



Service Manual

**COMPACT TYPE
GAS ANALYZER**

TYPE: ZFG

PREFACE

This service manual for the compact type gas analyzer (type ZFG) describes the factory mode for maintenance and inspection, method of adjustment to be performed after parts replacement, and measures to be taken in case of occurrence of troubles.

The manual does not describe basic operations of the gas analyzer. Be sure to read the manual carefully before performing maintenance and inspection.

This service manual gives you useful hints to take immediate remedy for after-sales service.

- First read the instruction manual and service manual carefully until an adequate understanding is acquired, and then proceed to installation, operation and maintenance of the gas analyzer. Wrong handling may cause an accident or injury.
- The specifications of this gas analyzer will be changed without prior notice for further product improvement.
- Modification of this gas analyzer is strictly prohibited unless a written approval is obtained from the manufacturer. Fuji Electric will not bear any responsibility for a trouble caused by such a modification.

Manufacturer: Fuji Electric Co., Ltd.
Type: Described in the nameplate on main frame
Date of manufacture: Described in the nameplate on main frame
Product nationality: Japan

Request

- It is prohibited to transfer part or all of this manual without Fuji's permission in written format.
- Description in this manual will be changed without prior notice for further improvement.

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CAUTION ON SAFETY

First of all, read this “Caution on safety” carefully, and then use the gas analyzer in the correct way.

The cautionary descriptions listed here contain important information about safety, so they should always be observed. Those safety precautions are ranked in 2 levels, “DANGER” and “CAUTION.”



DANGER

Wrong handling may cause a dangerous situation, in which there is a risk of death or heavy injury.



CAUTION

Wrong handling may invite a dangerous situation, in which there is a possibility of medium-level trouble or slight injury or only physical damage is predictable.

Caution on installation and transport of gas analyzer



DANGER

- This unit is not explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accidents.



CAUTION

- Install the gas analyzer in a place that satisfies the conditions described in the “Instruction Manual.” Otherwise electric shock, fire, or malfunction may result.
- During maintenance and check, care should be taken to keep the unit free from cable chips or other foreign objects. Otherwise, it may cause fire, trouble or malfunction of the unit.
- For lifting the gas analyzer, be sure to wear protective gloves. Bare hands may invite an injury.
- The gas analyzer is heavy. Two or more persons should carry the gas analyzer with sufficient care to avoid injury or damage to body.

Caution on piping



In piping, the following precautions should be observed. Wrong piping may cause gas leakage.

If the leaking gas contains a toxic component, there is a risk of serious accident being induced.

Also, if combustible gas is contained, there is a danger of explosion, fire or the like occurring.

- Connect pipes correctly referring to the instruction manual.
- Exhaust should be led outdoors so that it will not remain indoors.
- Exhaust from the gas analyzer should be relieved in the atmospheric air in order that an unnecessary pressure will not be applied to the gas analyzer. Otherwise, any pipe in the gas analyzer may be disconnected to cause gas leakage.
- For piping, use a pipe and a pressure reducing valve to which oil and grease are not adhering. If such a material is adhering, a fire or the like accident may be caused.

Caution on wiring



- Be sure to perform specified grounding work to avoid electric shock or malfunction.
- Be sure to use a power supply of correct rating. Connection of power supply of incorrect rating may cause fire.
- Wiring work must be performed with the main power set to OFF to prevent electric shocks.
- Wires should be the proper one meeting the ratings of this instrument. If using a wire which cannot endure the ratings, a fire may occur.

Caution on use



- For correct handling of calibration gas or other reference gases, carefully read their instruction manuals beforehand.



- Do not operate the gas analyzer continuously with the cover opened. Otherwise dust may enter, causing a failure.
- Do not open the cover and touch inside while the gas analyzer is operated. Otherwise burns or electric shock may result.

Caution on maintenance and check



DANGER

- Before performing work with the cover opened, be sure to turn off the power and purge fully not only the gas analyzer but also measurement gas lines with air and N₂ gas. Be careful not to stain the inside of piping with oil or grease. Otherwise gas leak may occur, thus causing poisoning, fire, or explosion.



CAUTION

- Be sure to remove metallic objects such as a wristwatch or a ring. Never perform work with wet hands to avoid electric shock.
- If the fuse is blown, eliminate the cause, and then replace it with the one of the same capacity and type as before. Otherwise, shock hazard or fault may be caused.

Others

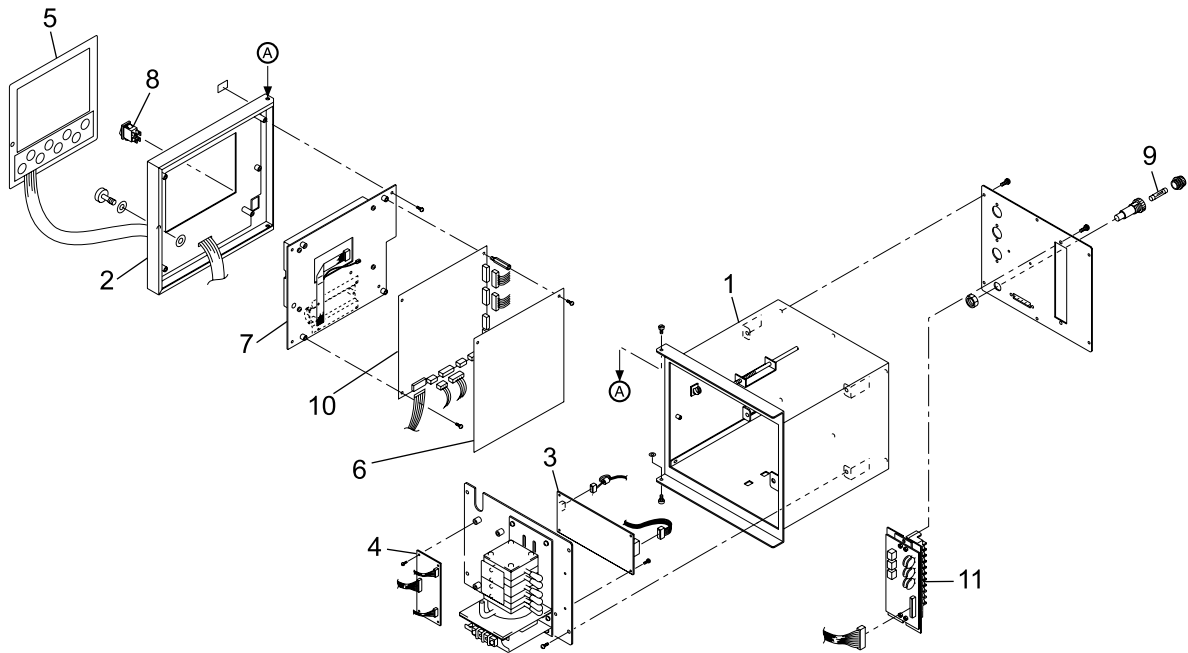


CAUTION

- If the cause of any fault cannot be determined despite reference to the instruction manual, be sure to contact your dealer or Fuji Electric's technician in charge of adjustment. If the instrument is disassembled carelessly, you may have a shock hazard or injury.
- Do not use replacement parts not specified by the manufacturer. Otherwise sufficient performance of the gas analyzer may not be obtained, or accidents or failure may result.
- Dispose the parts removed for maintenance as noncombustible waste.

1. NAME OF MAIN DEVICES AND SERVICE PARTS

1.1 Case and electrical parts

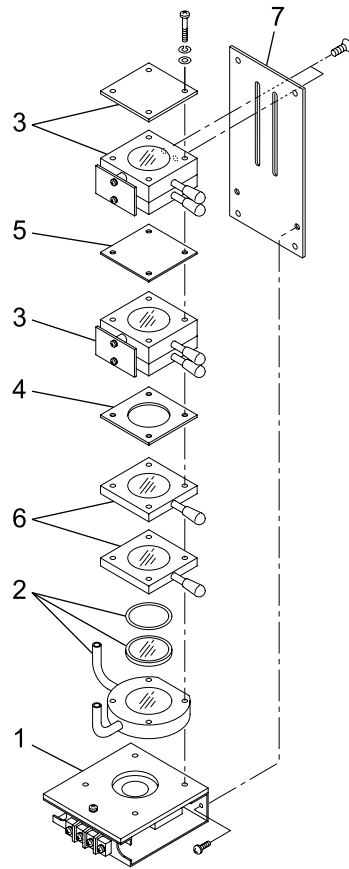


| No. | Parts order No. | Parts name | Recommended replacement cycle | Note |
|-----|-----------------|---|--------------------------------------|---|
| 1 | ZZPZFG1-A010 | Case assembly | — | Front and back panels not included |
| 2 | ZZPZFG1-A250 | Front panel assembly | — | Screws not included |
| 3 | ZZPZFG1-A120 | Power supply | — | See Page 10 for replacement procedure. |
| 4 | ZZPZFG1-A150 | Amplifier printed board | — | See Page 6 for replacement procedure. |
| 5 | ZZPZFG1-A200 | Sheet key | 500,000 times/1 contact | See Page 5 for replacement procedure. |
| 6 | ZZPZFG1-A400 | Protective cover for main printed board | — | — |
| 7 | ZZPZFG1-A270 | LCD unit | About 5 years (continuous operation) | See Page 3 for replacement procedure. |
| 8 | ZZPZFG1-A210 | Power switch | Contact: 10,000 times (ON/OFF) | — |
| 9 | ZZPZFG1-A550 | Fuse | — | See Instruction Manual for replacement procedure. |
| 10 | ZZPZFG1-A360 | Main printed board | — | See Page 8 for replacement procedure. |
| 11 | ZZPZFG1-A480 | Output terminal assembly | — | — |

Note 1: Specify “Parts order No.” on the list when ordering the parts.

Note 2: The replacement cycle varies depending on use conditions.

1.2 Measurement unit



| No. | Parts order No. | Parts name | Recommended replacement cycle | Note |
|-----|----------------------|-------------------|---------------------------------|--|
| 1 | ZZPZFG1-B010 | Light source unit | About 7 years ^{Note 3} | Motor/chopper included See Page 12 for replacement procedure. |
| 2 | ZZPZFG1-B020 to B024 | Cell unit | O-ring: About 2 years | Window/O-ring included See Page 14 for replacement procedure. |
| 3 | ZZPZFG1-B030 to B039 | Detector unit | About 7 years ^{Note 3} | Order No. varies depending on range component. See Page 16 for replacement procedure. |
| 4 | ZZPZFG1-B040 | Sapphire filter | — | — |
| 5 | ZZPZFG1-B050 | Teflon filter | — | — |
| 6 | ZZPZFG1-B060 to B064 | Gas filter | About 7 years ^{Note 3} | See Page 19 for replacement procedure. |
| 7 | ZZPZFG1-B070 | Heatsink | — | — |

Note 1: Specify “Parts order No.” on the list when ordering the parts.

Note 2: The replacement cycle varies depending on use conditions.

Note 3: Gas is sealed in the light source unit/gas filter/detector.

Be sure to replace them following the recommended replacement cycle irrespective of the use frequency.

Note 4: Optical system component varies depending on the measured component and setting range.

2. MAINTENANCE, INSPECTION, AND ADJUSTMENT AFTER REPAIR AND REPLACEMENT

2.1 Liquid crystal display unit

Recommended period of replacement: 5 years

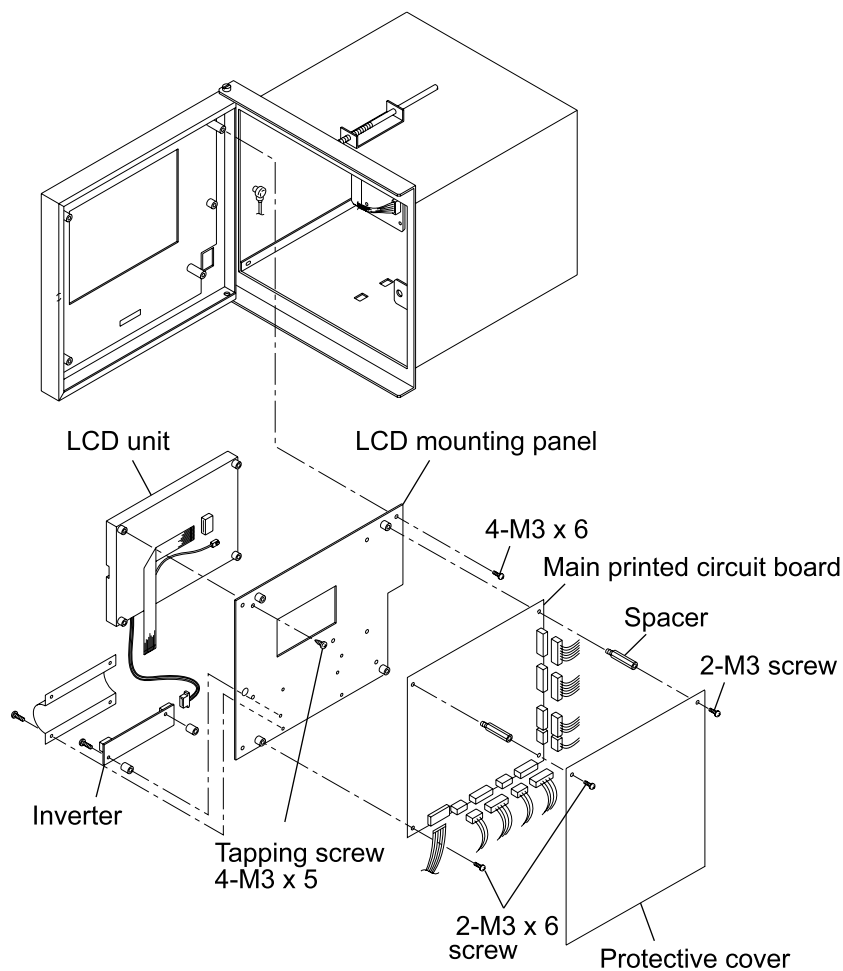
Error mode : End of service life of backlight Deterioration of LCD

Phenomena : Image is not displayed. Image is not clear or blinks.

Check : (1) Press any key and check that the backlight comes on.
(2) Set <Menu mode> and <5. Setting about monitor> and <Back light setting> to OFF.
(3) Check the connection of the connector of the LCD unit (Main printed circuit board CN1, CN2).
Also check the power supply voltage. (See “2.4 Main printed circuit board” of this manual.)

Measures : (1) Remove and then insert the connector to restore the performance of the contactor.
(2) Replace the display unit.

- Replacement : (1) Remove the cable connected to the main printed circuit board off the connectors (CN1 to CN8, and CN10).
- (2) Remove the fastening screw (2-M3×6 screws) and detach the protective cover and spacer.
- (3) Remove the fastening screw (2-M3×6 screws) from LCD mounting plate, and detach the main printed circuit board.
- (4) Remove the cable from the inverter.
- Remove the tapping screws (4-M3×5), and replace the LCD unit with a new one.



Caution on replacement

- (1) Be sure to turn off the power before removing and inserting the connector to avoid damage to the display drive IC, etc.

2.2 Sheet key (Membrane switch)

Recommended period of replacement: 500,000 operations/contact

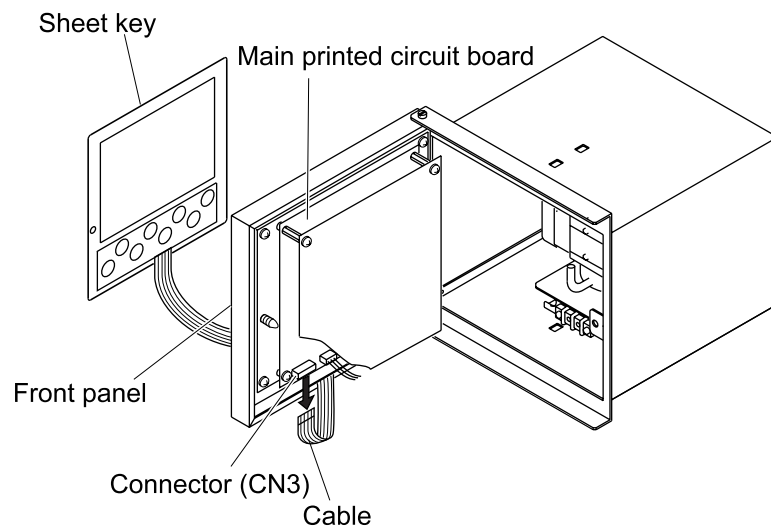
Error mode : Wear of key contact

Phenomena : Key operation cannot be performed.

Check : Check that the cable of the membrane switch is securely connected to the connector (main printed circuit board CN3).

Measures : (1) Remove and then insert the connector to restore the performance of the contactor.
(2) Replace the membrane switch.

Replacement : (1) Remove the cable connected to the main printed circuit board off the connector (CN3).
(2) Remove the LCD unit, referring to “2.1 Liquid crystal display unit”.
(3) The sheet key is fastened to the front panel with two-sided tape. Peel off the sheet and attach a new sheet key.



Caution on replacement

- (1) Be sure to turn off the power before removing the connector to avoid damage to the IC, etc.
- (2) Wipe the adhesive paste off the surface completely before attaching a new switch to avoid peeling due to dust.
- (3) Connect the cable through the square hole on the front panel.
- (4) The connector of the main printed circuit board (CN3) is provided with a stopper.
Slide the both sides of the switch slightly toward you. Do not pull it forcibly to avoid damage.
Insert the cable securely and fasten it with the stopper to mount the switch.

2.3 Amplifier printed circuit board

Recommended period of replacement: None

Error mode : Failure of electronic parts

Phenomena : Indication failure

Check : (1) Check and adjust the voltage according to the description of the following table.

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|----------------------|---------------------|---------------------|--|
| Power supply voltage | Between P15 and GND | — | + 15.000 V DC \pm 0.5 V DC |
| | Between N15 and GND | — | - 15.000 V DC \pm 0.5 V DC |
| Detector voltage | Between DV1 and SG1 | VR2 | Voltage reading of the detector for the 1st or the 3rd component \pm 0.1V |
| | Between DV2 and SG2 | VR4 | Voltage reading of the detector for the 2nd or the 4th component \pm 0.1 V |

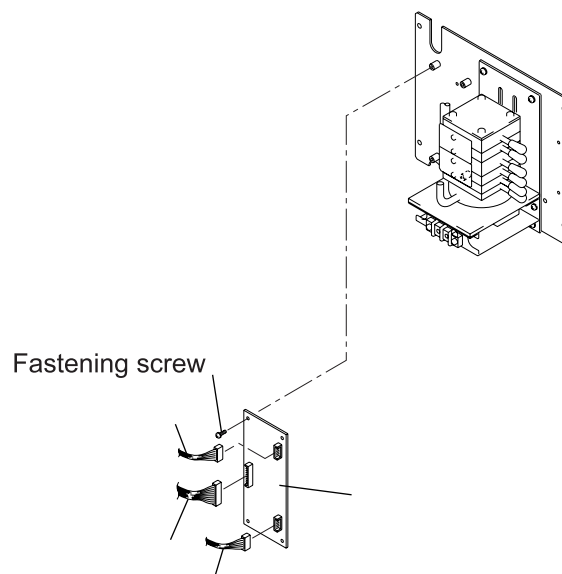
(2) Adjust detector signals.

Feed zero gas and adjust the signals.

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|-----------------|---------------------|---------------------|-----------------------------|
| Detector signal | Between TP2 and SG1 | VR1 | + 2.000 V DC \pm 0.1 V DC |
| | Between TP6 and SG2 | VR3 | + 2.000 V DC \pm 0.1 V DC |

Measures : (1) Remove and then insert the connector to restore the performance of the contactor.
(2) Replace the amplifier printed circuit board.

Replacement : (1) Remove the cables connected to the printed circuit boards (CN1, CN2, and CN3).
(2) Remove the fastening screws (4-M3 \times 6) and replace the amplifier printed circuit board with a new one.



Adjustment after replacement:

- (1) Insert connector CN3 only. (Do not insert CN1 or CN2.)
- (2) Insert the jumper pins (JP1 and JP2) into the same position as the old printed circuit board.
- (3) Turn on the power and check and adjust “power supply voltage” and “detector voltage.”
- (4) Turn off the power and insert connectors CN1 and CN2.
- (5) Turn on the power again, and adjust “detector signals.”
- (6) Perform zero and span calibrations to complete the work.

| Caution on replacement |
|--|
| <ol style="list-style-type: none">(1) Be sure to turn off the power before removing and inserting the connector to avoid damage to the detector.(2) Be careful not to cause short circuit with other parts while checking and adjusting the voltage.(3) Be sure to warm up the instrument fully before adjusting detector signals. |

2.4 Main printed circuit board

Recommended period of replacement: None

Error mode : Failure of electronic parts

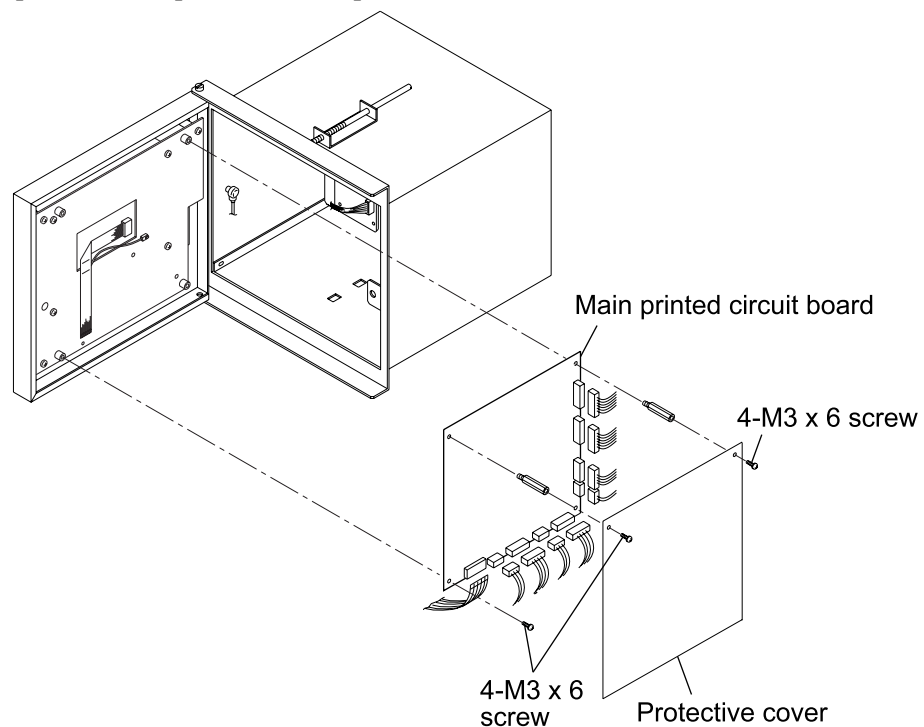
Phenomena : Control of each device malfunctions. Display error occurs.

Check : Check and adjust the power supply voltage.

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|----------------------|---------------------|---------------------|------------------------------|
| Power supply voltage | Between A15P and VG | — | + 15.000 V DC \pm 0.5 V DC |
| | Between A15N and VG | — | - 15.000 V DC \pm 0.5 V DC |
| | Between VCC and GND | — | + 5.000 V DC \pm 0.5 V DC |
| | Between VD and VG | — | + 5.000 V DC \pm 0.5 V DC |
| | Between N12 and VG | — | - 12.000 V DC \pm 0.5 V DC |
| | Between VDD and GND | — | + 5.000 V DC \pm 0.5 V DC |

Measures : (1) Remove and then insert the connector to restore the performance of the contactor.
(2) Replace the main printed circuit board.

Replacement : (1) Remove the cables connected to the printed circuit boards (CN1 to CN8, and CN10).
(2) Remove the fastening screws (4-M3 \times 6) and detach the protective cover and spacer, then replace the main printed circuit board with a new one.



Data input and adjustment after replacement:

- (1) Enter all the setting data for <Menu mode>/<Maintenance mode> manually.
(See the instruction manual for details of each mode.)
- (2) Enter the data for <Factory mode> manually. (See <Description of factory mode> in Chapter 3 of this manual.)
- (3) Perform offset adjustment.
 - 1) Turn off the power and remove CN1 and CN2 of the amplifier printed circuit board (detector signal open).
 - 2) Turn on the power, and make <Factory mode> and <5. Zero offset> settings.
 - 3) Turn off the power again, and connect CN1 and CN2 on the amplifier printed circuit board.
- (4) Perform zero and span calibrations to complete the work.

| Caution on replacement |
|--|
| <ol style="list-style-type: none">1) Be sure to turn off the power before removing and inserting the connector to prevent damage to electronic parts.2) Be careful not to cause short circuit with other parts while checking the voltage.3) We recommend you to order a main printed circuit board with data already entered. Specify "Date of manufacture," "Serial No." and "Type" when placing your order. |

2.5 Power supply

Recommended period of replacement: None

Error mode : Specified power supply voltage is not output.

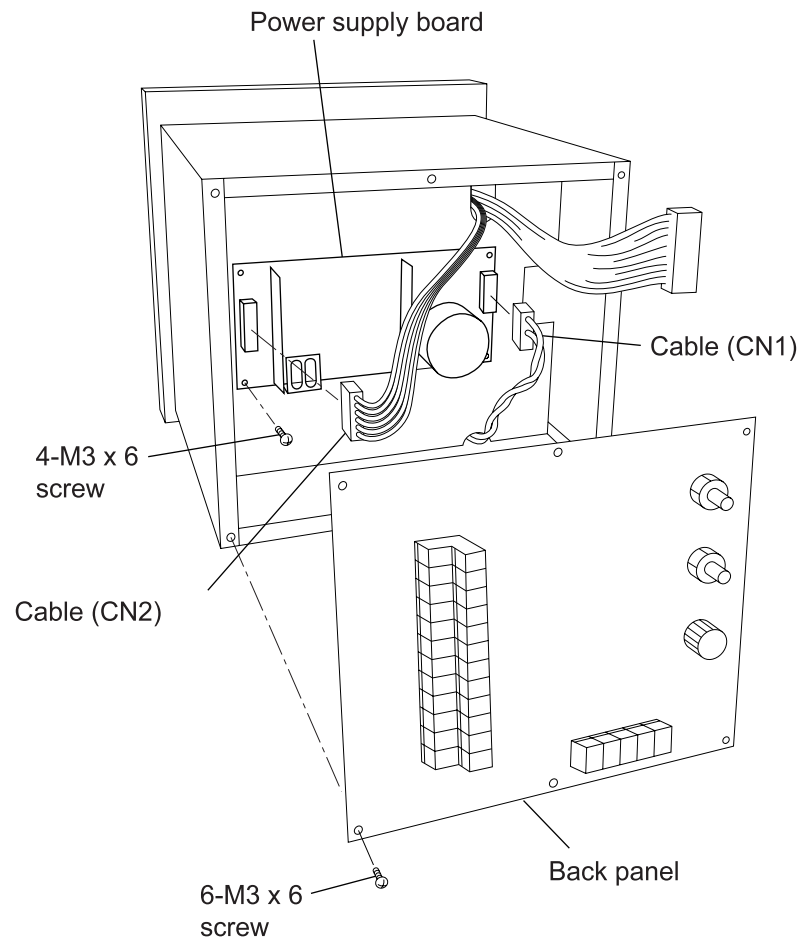
Phenomena : Image is not displayed. Display is not clear. Analog output is not produced.

Check : (1) Check the power supply voltage. (See “2.4 Main printed circuit board” of this manual.)
(2) Check the connection of the power supply connector.
(3) Check that the fuse is not blown.

| Pin | Symbol | Voltage |
|-----|--------|---------|
| 1 | V3 | -15V |
| 2 | G2 | GND2 |
| 3 | G2 | GND2 |
| 4 | V2 | +15V |
| 5 | G1 | GND1 |
| 6 | V1 | +5V |

Measures : (1) Remove and then insert the connector to restore the performance of the contactor.
(2) Replace the power supply.

- Replacement : (1) Remove the back panel (6-M3 × 6).
- (2) Remove the cables connected to the power supply (CN1 and CN2).
- (3) Remove the fastening screws from the power supply board (4-M3×6 screws) and replace the power supply with a new one.



Caution on replacement

- (1) Be sure to turn off the power before removing and inserting the connector to avoid damage to the parts.

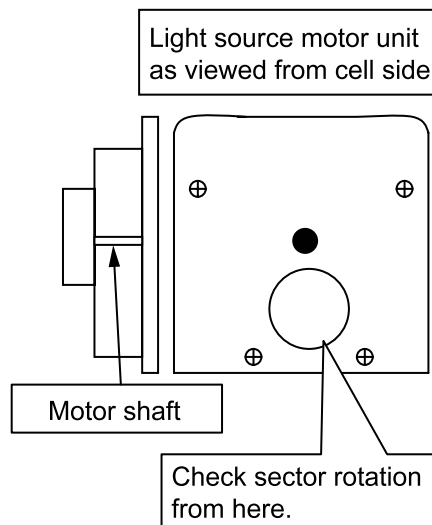
2.6 Light source unit

Recommended period of replacement: 7 years

Error mode : (1) Motor rotation stop
(2) Short circuit and disconnection of the light source electrically heated wire.
(3) Sealed gas leakage in light source

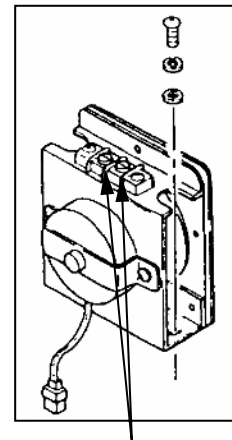
Phenomena : Unstable reading, scale out, and occurrence of Error-1

Check : (1) Motor:
• Turn on the power and visually check that the shaft rotates.
(Remove the light source unit, and you can check the rotation of the chopper through the window.)
• Check that abnormal sound is not emitted.
(2) Light source unit
• Remove the power supply cable of the light source unit, and check that the resistance value falls within the $37\Omega \pm 2\Omega$ range.
There is a break if the reading appears infinite.
With the decrease of the resistance value, the reading drifts in the minus direction.
(3) If the reading becomes unstable because of the gas in the atmosphere, sealed gas may be leaking.



1) Checking chopper rotation

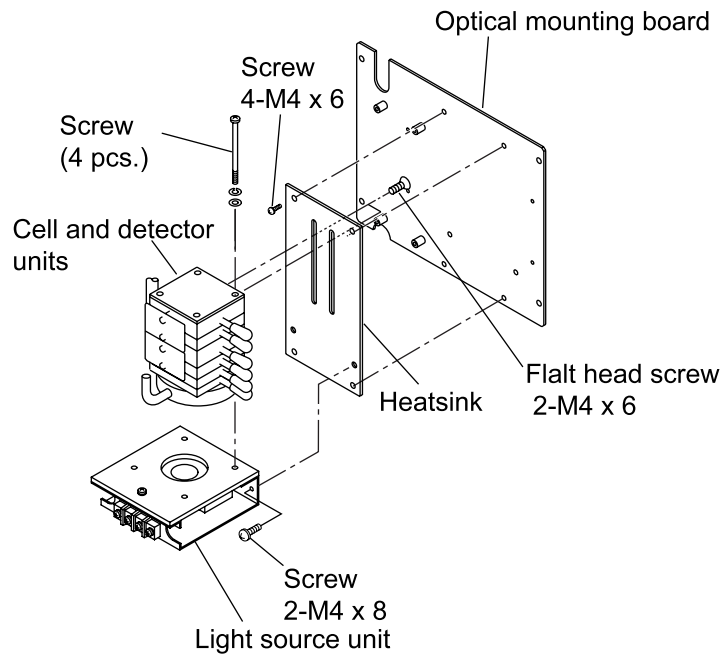
<Motor unit for light source>



2) Measuring resistance value of light source

Measures : Replace the light source unit.

- Replacement : (1) Remove the screw fastening the unit to the optical system baseboard (4-M4×6 screws).
- (2) Remove the cell and detector unit from the heatsink (2-M4×6 + lot head screws).
- (3) Remove the fastening screws (4pcs.) from the cell and detector unit.
- (4) Remove the light source unit from the heatsink (2-M4×8 screws).



Adjustment after replacement:

Adjust the signals from the detector on the amplifier printed circuit board.

- (1) Feed zero gas.

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|-----------------|---------------------|---------------------|-------------------------|
| Detector signal | Between TP2 and SG1 | VR1 | + 2.000 V DC ± 0.1 V DC |
| | Between TP6 and SG2 | VR3 | + 2.000 V DC ± 0.1 V DC |

- (2) Perform zero and span calibrations to complete the work.

| Caution on adjustment | |
|--|--|
| ▪ Be sure to warm up the instrument fully before adjusting detector signals. | |

2.7 Cell, cell window, and O-ring

Service life : Usable unless contaminated or corroded.

Recommended period of replacement: 2 years with O-ring

(1) Error mode : Contamination of cell, mixture of foreign matter, and contamination of cell window

Phenomena : Scale-out indication, drift and calibration error occurred to gas analyzer

Check : Disassemble the cell to assure that the inside is clean.

(2) Error mode : Crack in cell window

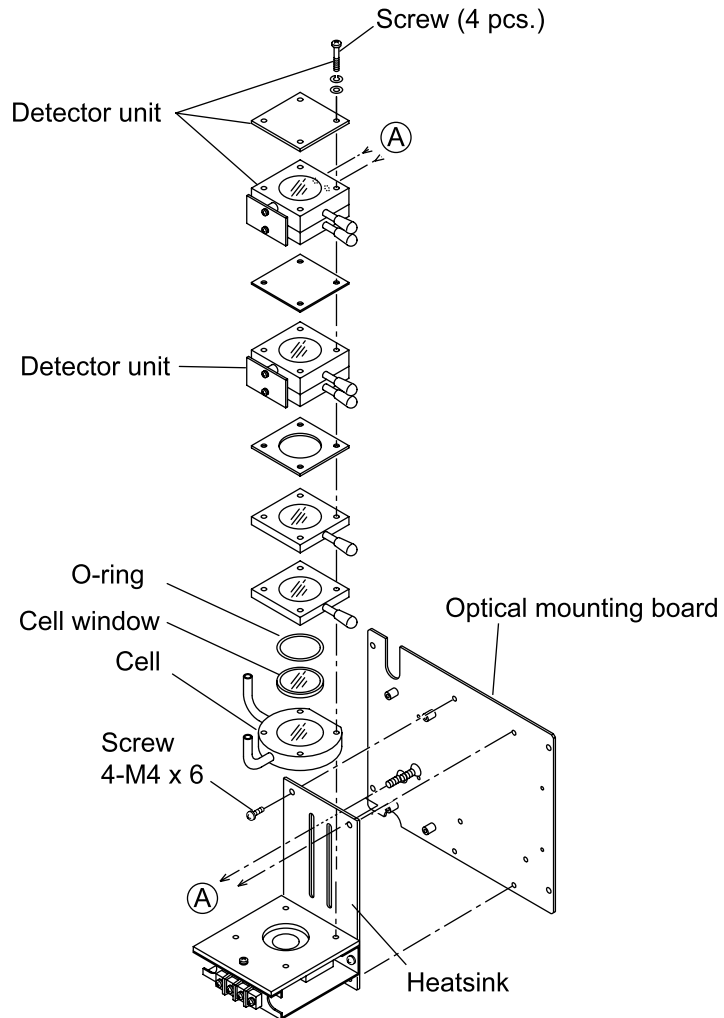
Phenomena : No change in indication, slow response, calibration error, and indication fluctuation

Check : Visually check the cell window for damage.

Measures : Cell Clean the inside of the cell (refer to the instruction manual for details). Replace if the inside is exposed to excessive contamination or corrosion.

Cell window Clean the cell window. Replace if the inside is exposed to excessive contamination.

- Replacement : (1) Remove the screw fastening the unit from the optical mounting board (4-M4 ×6 screws).
- (2) Remove the cell and detector unit from the heatsink (2-M4 ×6 flat head screws).
- (3) Remove four fastening screws from the detector unit.
- (4) Clean the cell, cell windows, and O-ring.
- Replace if they are exposed to excessive contamination or damage.



Adjustment after clean and replacement:

Adjust detector signals.

- (1) Feed zero gas and make an adjustment.

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|-----------------|---------------------|---------------------|------------------------|
| Detector signal | Between TP2 and SG1 | VR1 | +2.000 V DC ± 0.1 V DC |
| | Between TP6 and SG2 | VR3 | +2.000 V DC ± 0.1 V DC |

- (2) Perform zero and span calibrations to complete the work.

Caution on adjustment

- Be sure to warm up the instrument fully before adjusting detector signals.

2.8 Detector

Recommended period of replacement: 7 years

(1) Error mode : Damage to mass-flow detector

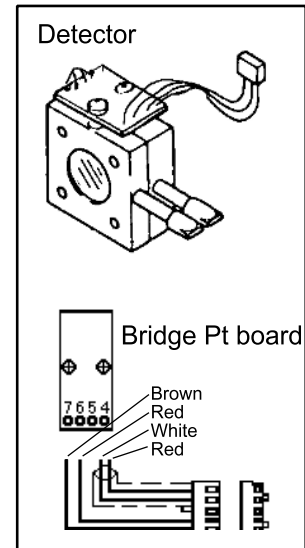
Phenomena : Scale-out indication of the gas analyzer

Check : Turn OFF the power of the gas analyzer and disconnect the connector connected from the detector to amplifier printed circuit board. (Amplifier printed circuit board CN1, CN2).

Measure resistance between 4 – 7 and 5 – 7 of the bridge printed circuit board on the detector. The measure values must be between 25Ω and 60Ω.

If the resistance value is fluctuated beyond the specified range, the detector element may be damaged.

Note: Do not use measurement instrument that allows a current of 2 mA or more to be supplied when measuring resistance, otherwise the element can be damaged.



(2) Error mode : Sensitivity deterioration due to sealed gas leak

Phenomena : Calibration error and fluctuation in indication

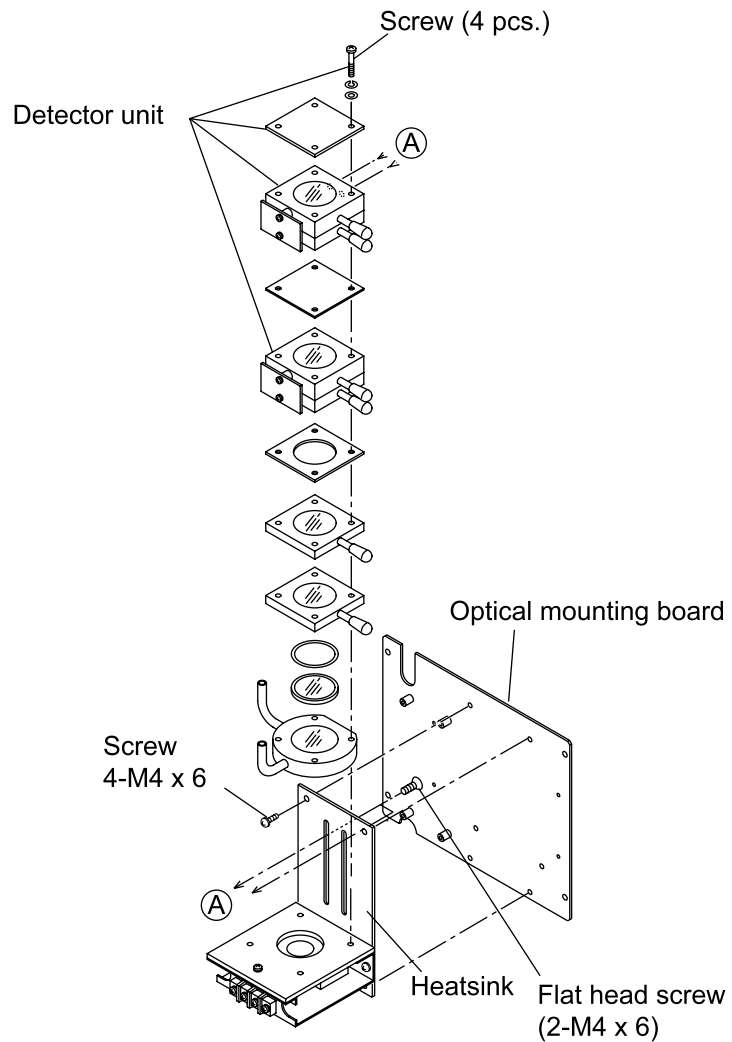
Check : Check indication value at zero point

..... Check the indication value for each component on the <Sensor Input Value> screen in the <Maintenance mode>.

If the light source is in normal condition and the cell is free of contamination, the counter value indicates 38000 to 42000 when zero gas is supplied. If the counter value is below the range, sensitivity can be degraded.

Measures : Replace the detector.

- Replacement : (1) Remove the screw fastening the unit from optical mounting board (4-M4×6 screws).
- (2) Remove the cell and detector unit from the heatsink (2-M4×6 flat head screws).
- (3) Remove four fastening screw from the detector unit.
- (4) Connect the cable solder-mounted on the detector bridge Pt board to the replaced detector (Refer to Page 16).



Adjustment after replacement:

Adjust the amplifier printed circuit board.

(1) Adjusting the power supply voltage of the detector:

Insert connector CN3 only. (Do not insert CN1 and CN2.)

Turn on the power and adjust the “detector voltage” shown below.

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|------------------|---------------------|---------------------|---|
| Detector voltage | Between DV1 and SG1 | VR2 | Voltage reading of the detector for the 1st component ± 0.1 V |
| | Between DV2 and SG2 | VR4 | Voltage reading of the detector for the 2nd component ± 0.1 V |

(2) Adjusting detector signals:

Feed zero gas.

Turn off the power and insert connectors CN1 and CN2.

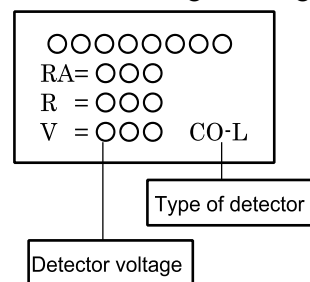
Turn on the power again, and adjust the “detector signals.”

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|-----------------|---------------------|---------------------|----------------------------|
| Detector signal | Between TP2 and SG1 | VR1 | +2.000 V DC ± 0.1 V DC |
| | Between TP6 and SG2 | VR3 | +2.000 V DC ± 0.1 V DC |

(3) Perform zero and span calibrations to complete the work.

Note: Adjust the detector voltage on the printed circuit board and plug the connector into the detector. Do not insert the connector before voltage regulation, or the element may be damaged.

Detector voltage reading



Caution on adjustment

- Be sure to warm up the instrument fully before adjusting detector signals.

2.9 Gas filter

Recommended period of replacement: 7 years

Error mode : Sealed gas leak

Phenomena : Increase of interference of other gases, linear deficiency, and drifting of reading in minus direction

Check : Perform zero/span calibration, feed the gas at the rate around the center of the range, and check the linearity.

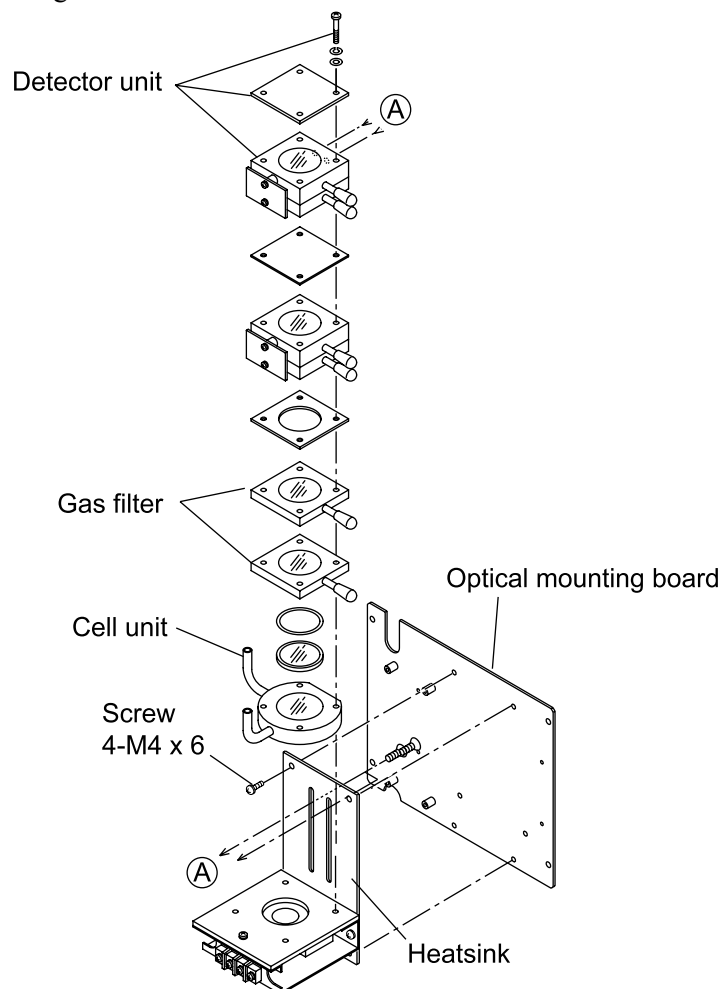
Measures : Replace the gas filter.

Replacement : (1) Remove the screw fastening the unit from the optical mounting board (4-M4 ×6 screws).

(2) Remove the cell and detector unit from the heatsink (2-M4 ×6 flat head screws).

(3) Remove four fastening screws from the cell unit and the detector unit.

(4) Replace the gas filter.



Adjustment after replacement:

Adjust the detector signals of the amplifier printed circuit board.

(1) Feed zero gas.

Turn on the power and adjust “detector signals.”

| Item | Check terminal | Knob for adjustment | Regulation voltage |
|-----------------|---------------------|---------------------|----------------------------|
| Detector signal | Between TP2 and SG1 | VR1 | +2.000 V DC \pm 0.1 V DC |
| | Between TP6 and SG2 | VR3 | +2.000 V DC \pm 0.1 V DC |

(2) Perform zero and span calibrations to complete the work.

| Caution on adjustment |
|--|
| ▪ Be sure to warm up the instrument fully before adjusting detector signals. |




3. FACTORY MODE

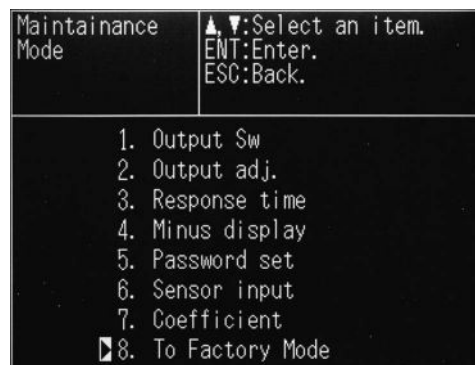
3.1 How to go to Factory Mode

Caution


Factory adjustment is made in this mode.



Be careful not to enter wrong settings to avoid malfunction of the analyzer.

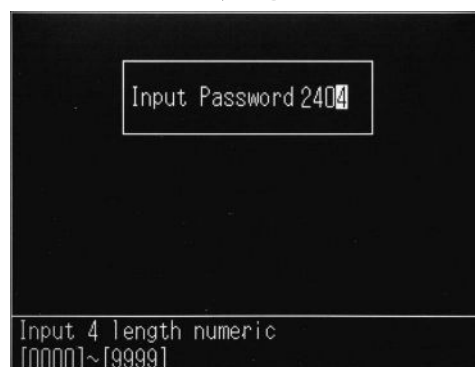
Point the cursor to “8. To Factory Mode” by using the  or  key on the Maintenance Mode screen and enter the  key. Then, the password input screen appears.




Enter the password, “2404.”

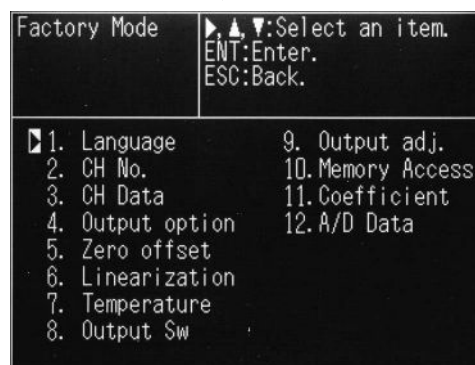
Select a digit using the  key.

Change the value using the  or  key.






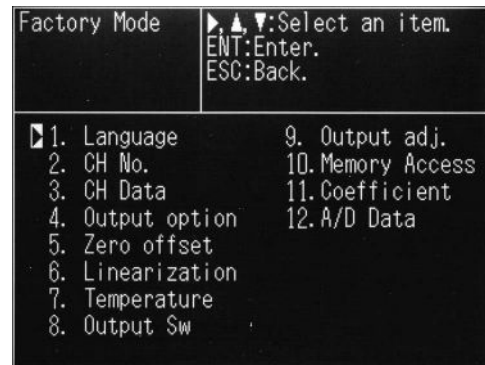
After password entry has been completed, press the  key, and the Factory Mode initial screen appears.


The cursor is placed at “1. Language” as default.




3.2 How to go to each item in Factory Mode


On the factory mode screen that appears, move the cursor to the item to be set using the , , or  key.



To get access to each setting screen, press the  key.

To return from each setting screen to the initial screen, press the  key.

Into each parameter screen


When escaping from the Factory Mode screen to the Maintenance Mode screen, press the  key.



3.3 Setting item in Factory Mode


3.3.1 Language setting


Function: Switch the language for display between Japanese and English.

Operation: The language select screen is shown at right.

Press the  key to highlight the setting.


Select Japanese or English using the  and  keys.

Press the  key to confirm the setting.

Press the  to cancel the setting.

Setting contents: Japanese, English

Initial value: [English]

Note: The display is switched between Japanese and English as soon as the  key is pressed.

Factory mode initial screen
The cursor is in 1.



3.3.2 Number of channels (Measured component setting)

Function: Set the components for each channel to be displayed on the measurement screen. The setting determines the number of components to be measured.

Operation: The screen for setting the number of channels is shown at right.

Move the cursor to the component to be measured using the \triangle and ∇ keys.

Press the ENT key to highlight the name of components selected.

Select a component name using the \triangle and ∇ keys.

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

Note: Make the setting sequentially beginning from first component. Be sure to select "None" for the optical systems without the sensor. Do not select "None" for all of them. Otherwise A/D conversion failure may result.

Select "ON" or "OFF" for CP calculation value.

Initial value : First component =CO₂

Second component =CO

CP calculation value = OFF (None)

Factory mode initial screen
The cursor is in 2.



| | |
|------------------------|--|
| Factory Mode CH No. | ▲▼:Select an element. ENT:Enter. ESC:Back. |
| ▣ First element | CO ₂ |
| Second element | CO |
| CP | OFF |
| | |



| | |
|------------------------|--|
| Factory Mode CH No. | ▲▼:Select an element. ENT:Enter. ESC:Cancel. |
| First element | CO ₂ |
| Second element | CO |
| CP | OFF |
| | |

3.3.3 Channel parameter (setting of range and unit)

Function: Set the number of ranges, unit of concentration, decimal point position of the range, and the range value of each component.

Operation: The CH data setting screen is shown at right.

Select the channel to be set using the \triangle and ∇ keys.

Press the ENT key to enter the mode.

Select the item to be set using the \triangle and ∇ keys.

Press the ENT key to highlight the setting selected.

Move the digit using the \rightarrow key and make the setting for each digit.

Select the setting using the \triangle and ∇ keys.

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

Setting contents:

Number of ranges:

Number of measurement ranges; 1, 2 (2 max.)

Unit: Unit of measurement range; ppm or vol%, mg/m³ or g/m³ (Units ppm and vol% or mg/m³ and g/m³ cannot be selected at the same time. It is allowed that ppm is selected for range 1, while vol% is selected for range 2. Combination of ppm and mg/m³ is not allowed.)

Decimal point position:

Decimal point position of measured concentration

Range setting: Range value setting

Setting up to the first decimal place (such as 0.5 vol%) is allowed.

Note 1: The full scale of the linearization table setting should be the maximum range of the setting range.

Note 2: The ratio of range of range 1 to range 2 is 1 to 5 at the maximum.

Factory mode initial screen
The cursor is in 3.



```

Factory Mode      ▲▼:Select a channel.
CH Data          ENT:Enter.
                  ESC:Back.

▶CH1 CO2
  CH2 CO
    
```



```

Factory Mode      ▲▼:Select an item.
CH Data          ENT:Enter.
CH1 CO2         ESC:Cancel.

▶Number of Range  2
Unit             Range1 vol%
                Range2 ppm
Decimal          Range1 0.000
Point           Range2 0.000
Range            Range1 0001.0
Value           Range2 0002.0
    
```



```



Factory Mode      ▲▼:Input Value.
CH Data          ▶:Select a digit.
CH1 CO2         ENT:Enter.
                  ESC:Cancel.


Number of Range  2
Unit             Range1 vol%
                Range2 ppm
Decimal          Range1 0.000
Point           Range2 0.000
Range            Range1 0001.0
Value           Range2 0002.0
    
```


3.3.4 Output option

Function: Set each output of the remote hold and the range identification.

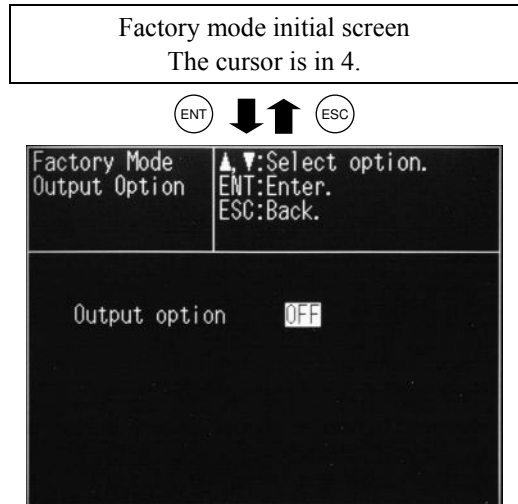
Operation: The output option setting screen is shown at right.

Select "OFF" or "ON" for output option using the  and  keys.

Press the  key to confirm the setting.

Press the  key to cancel the setting.

Initial value : [OFF]



3.3.5 Zero offset

Function: Store the offset value of the A/D converter.

Operation: The zero offset screen is shown at right. Be sure to remove the input signal cable of the detector from the amplifier board before making the adjustment.

Select the channel to be set using the \triangle and ∇ keys.

Press the ENT key to highlight the name of component selected.

Press the ENT key again, and offset adjustment is performed automatically and the value is selected.

Press the ESC key to cancel the adjustment.

Select ALL CH to perform simultaneously adjustment for all the inputs.

Setting contents: Initial value [20000]

Factory mode initial screen
The cursor is in 5.



| Factory Mode Adjustment Zero Offset | | \triangle ∇ :Select a channel. ENT:Enter. ESC:Back. |
|-------------------------------------|-----------------|--|
| CH | element | offset value |
| ∇ CH1 | CO ₂ | 51854 |
| CH2 | CO | 20000 |
| ALL CH | ALL | |



| Factory Mode Adjustment Zero Offset | | ENT:Enter. ESC:Cancel. |
|-------------------------------------|-----------------------|---------------------------|
| CH | element | offset value |
| CH1 | CO₂ | 51854 |
| CH2 | CO | 20000 |
| ALL CH | ALL | |



| Factory Mode Adjustment Zero Offset | | \triangle ∇ :Select a channel. ENT:Enter. ESC:Back. |
|-------------------------------------|-----------------|--|
| CH | element | offset value |
| ∇ CH1 | CO ₂ | 37575 |
| CH2 | CO | 20000 |
| ALL CH | ALL | |

3.3.6 Linearizer

Function: Set the linearize table calculated using the calibration curve measurement data.

This allows linearity correction to be made.

Operation: The linearize table setting screen is shown at right.

Select the CH to be set using the \triangleleft and \triangleright keys.

Press the ENT key to enter the table setting screen.

Select the set point using the ENT , \triangleleft and \triangleright keys.

Press the ENT key to highlight the setting.

Move the digit using the ENT key and make the setting for each digit.

Change the setting using the \triangleleft and \triangleright keys.

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

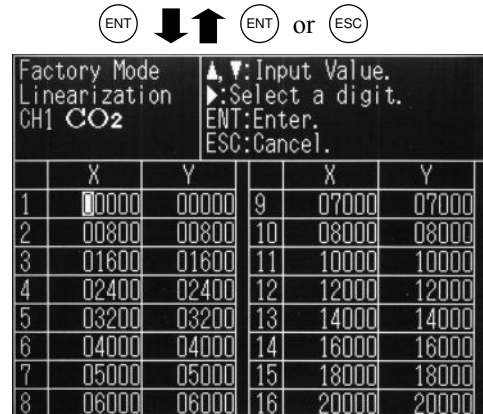
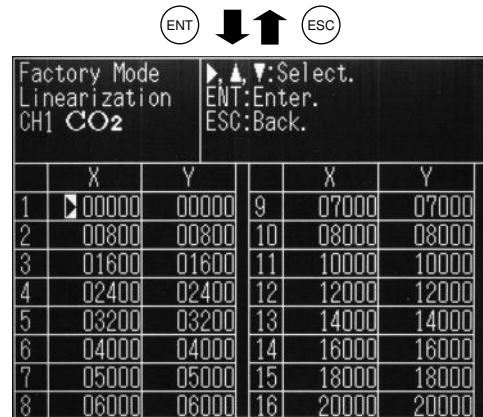
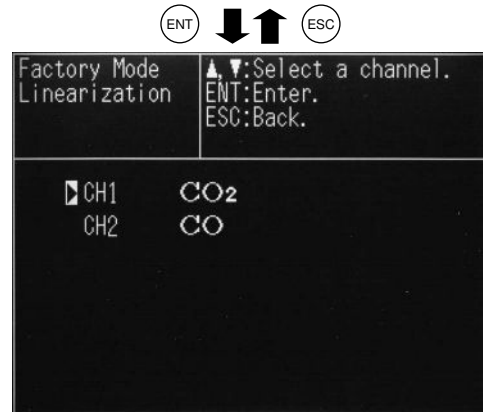
Setting contents: The linearization function uses 16 broken line approximation for calculation. Enter the value of each break point calculated from the calibration curve for setting.

X and Y represent the X and Y axes, and points 1 to 16 correspond to each break point.

The first break point and the 16th break point correspond to the zero and values of the maximum range, “00000” and “20000” respectively.

Initial value: In the order of correction points from 1 to 16 both for X and Y axes [0, 800, 1600, 2400, 3200, 4000, 5000, 6000, 7000, 8000, 10000, 12000, 14000, 16000, 18000, 20000] (Non-linear state)

Factory mode initial screen
The cursor is in 6.



3.3.7 Temperature compensation

Function: Set the temperature compensation coefficient and temperature counts calculated from the temperature characteristic test data.

This allows temperature compensation to be performed.

Operation: The temperature compensation setting screen is shown at right.

Select the item to be set using the \triangle and ∇ keys.

Press the ENT key to enter the mode.

Temperature table:

Set the count of the temperature sensor for each temperature.

Zero temperature compensation table:

Set the temperature compensation coefficient at zero point for each temperature.

Span temperature compensation table:

Set the temperature compensation coefficient at span point for each temperature.

▪ **When temperature compensation table is selected**

Select the count using the \rightarrow , \triangle , and ∇ keys.

Press the ENT key to highlight the setting.

Move the digit using the \rightarrow key, and make the setting for each digit.

Change the setting using the \triangle and ∇ keys.

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

Setting contents:

The X-axis represents temperature ($^{\circ}\text{C}$).

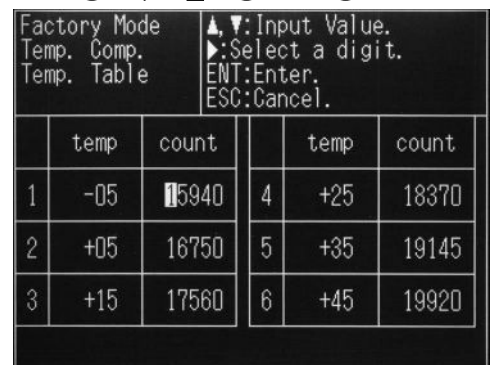
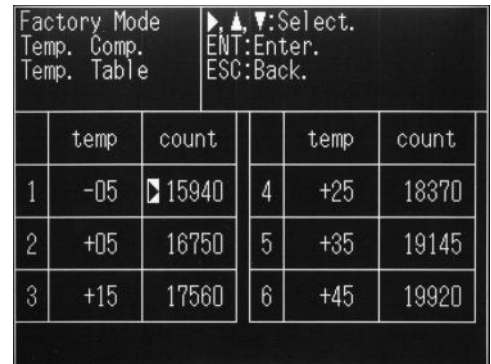
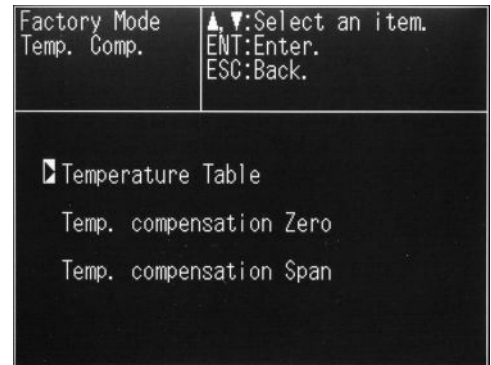
The Y-axis represents temperature count (A/D conversion value of the temperature sensor).

Initial value:

X-axis: In the order from 1 to 6 [-05, +05, +15, +25, +35, +45]

Y-axis: In the order from 1 to 6 [15940, 16750, 17560, 18370, 19145, 19920]

Factory mode initial screen
The cursor is in 7.



▪ When zero temperature compensation table is selected

Select a channel to be set using the \triangleleft and \triangleright keys.

Press the ENT key to enter the mode.

Select an item to be set using the F , A , and R keys.

Press the ENT key to highlight the setting.

Move the digit using the P key, and make the setting for each digit.

Change the setting using the \triangleleft and \triangleright keys.

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

Setting contents:

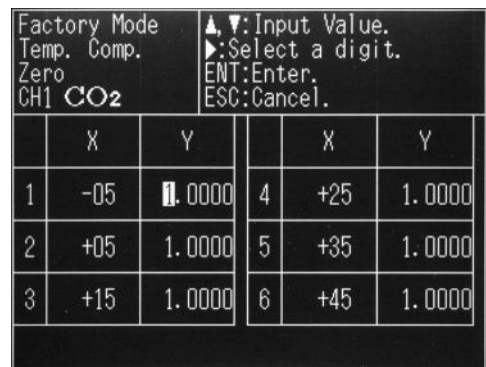
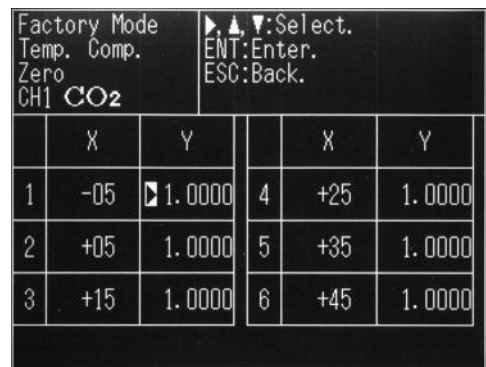
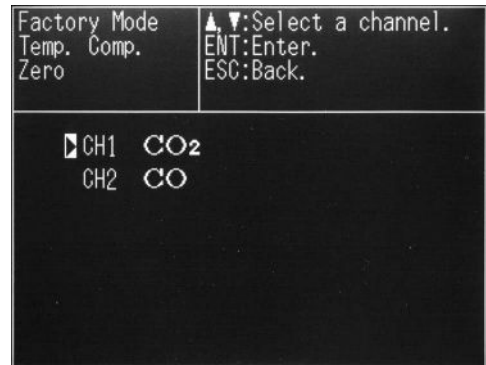
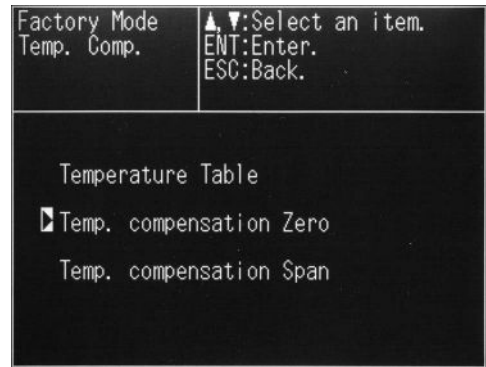
Enter temperature (°C) for X-axis according to the temperature table (change not allowed).

Enter zero temperature compensation coefficient value for Y-axis.

Initial value:

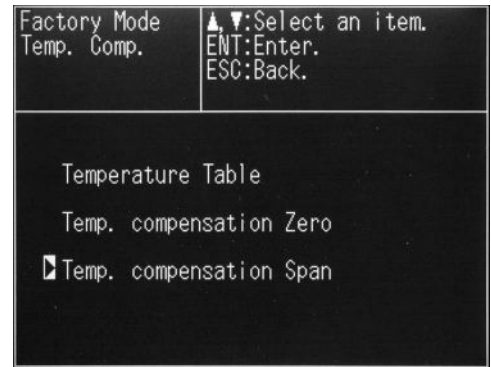
X-axis: [-05, +05, +15, +25, +35, +45]

Y-axis: [1.0000] for all

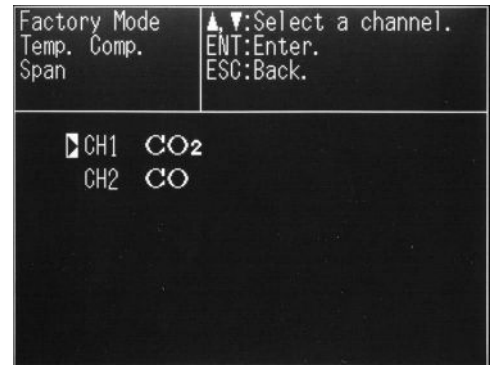


▪ **When span temperature compensation table is selected**

Select a channel to be set using the \triangle and ∇ keys.
Press the ENT key to enter the mode.



Select an item to be set using the \rightarrow , \triangle , and \leftarrow keys.
Press the ENT key to highlight the setting.



Move the digit using the \rightarrow key, and make the setting for each digit.

Change the setting using the \triangle and ∇ keys.

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

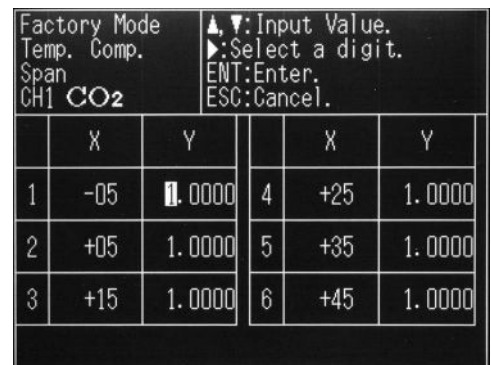
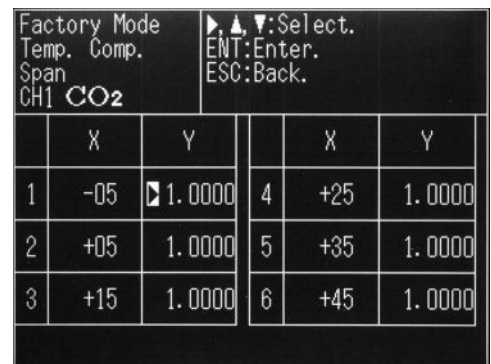
Setting contents:

Enter span temperature compensation coefficient.

Initial value:

X-axis: [-05, +05, +15, +25, +35, +45]

Y-axis: [1.0000] for all






3.3.8 Output selection



Function: Select 4-20mA DC, 0-1V DC, 0-100mV DC or 0-10mV DC for analog output value.


Note: Select the output and then switch the output jumper pin on the main board.


Operation: The analog output selection screen is shown at right.

Select the output to be set (OUT 1 to 3) using the  and  keys.

Press the  key to highlight the setting.

Change the setting using the  and  keys.

Press the  key to confirm the setting.

Press the  key to cancel the setting.

Setting contents:

The outputs (OUT) 1 to 3 correspond to CH1 to CH3 respectively.

Initial value:

[4 - 20 mA] for all of OUT1 to OUT3

Factory mode initial screen
The cursor is in 8.

| Factory Mode Output SW | | Jumper select. ▲▼:Select an item. ENT:Enter. ESC:Back. |
|---------------------------|--------|---|
| OUT | OUTPUT | Jamper |
| 1 | 4-20mA | JP1 1-2 |
| 2 | 4-20mA | JP2 1-2 |
| 3 | 4-20mA | JP3 1-2 |

    or 

| Factory Mode Output SW | | Jumper select. ▲▼:Select output ENT:Enter. ESC:Cancel. |
|---------------------------|--------|---|
| OUT | OUTPUT | Jamper |
| 1 | 4-20mA | JP1 1-2 |
| 2 | 4-20mA | JP2 1-2 |
| 3 | 4-20mA | JP3 1-2 |

3.3.9 Output adjustment

Function: Adjust the zero point and span point of the analog output.

Operation: The Analog Output Adjustment screen is as shown at right.

Select the output to be adjusted (OUT 1 to 3) using the \leftarrow , \rightarrow , and \uparrow keys, and connect the digital voltmeter to the output terminal.

* See “3.3.8 Output selection” for the correspondence between OUT No. and output.

Press the ENT key to highlight the setting.

Adjust the value using the \leftarrow , \rightarrow and \uparrow keys, seeing the value on the digital voltmeter.

Adjust the output as follows:

- When 4-20mA DC, zero: 4 mA \pm 0.05 mA DC
Span: 20 mA \pm 0.05 mA DC
- When 0-1V DC, zero: 0 V \pm 0.005V DC
Span: 1 V \pm 0.005 V DC
- When 0-100mV DC, zero: 0 mV \pm 0.5mV DC
Span: 100 mV \pm 0.5 mV DC
- When 0-10mV DC, zero: 0 mV \pm 0.05mV DC
Span: 10mV \pm 0.05 mV DC

Press the ENT key to confirm the setting.

Press the ESC key to cancel the setting.

Setting contents:

The outputs (OUT) 1 to 3 correspond to CH1 to CH3 respectively.

The settings are digital values transmitted to the D/A converter.

Initial value: OUT1 to 3

- Current output: [Zero = 0800]
[Span = 3850]
- Voltage output: [Zero = 0540]
[Span = 3440]

Factory mode initial screen
The cursor is in 9.



| Factory Mode Output Adj. | | \leftarrow , \rightarrow , \uparrow : Select output ENT : Enter. ESC : Back. | |
|-----------------------------|----------------------------|--|--|
| OUT | ZERO | SPAN | |
| 1 | \blacktriangleright 0800 | 3850 | |
| 2 | 0800 | 3850 | |
| 3 | 0800 | 3850 | |



| Factory Mode Output Adj. | | \uparrow , \downarrow : Select out adjust. \leftarrow : Select a digit. ENT : Enter. ESC : Cancel. | |
|-----------------------------|------|---|--|
| OUT | ZERO | SPAN | |
| 1 | 0800 | 3850 | |
| 2 | 0800 | 3850 | |
| 3 | 0800 | 3850 | |

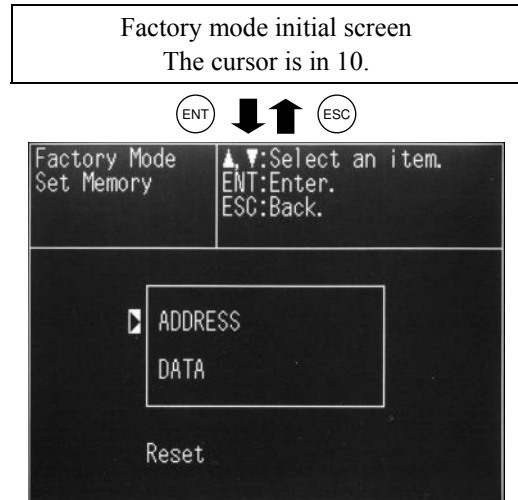
3.3.10 Memory rewrite

Function: Directly read and write EEPROM and RAM data to the specified address.


Perform soft reset.

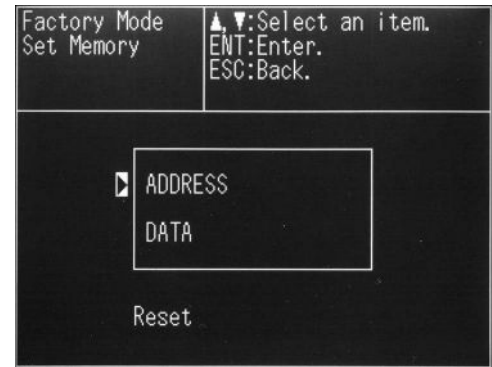
Note: An address map is required to write values here. Do not perform memory rewrite, because malfunction results if improper value is written.


Operation: The set memory screen is shown at right.





▪ Memory read/write

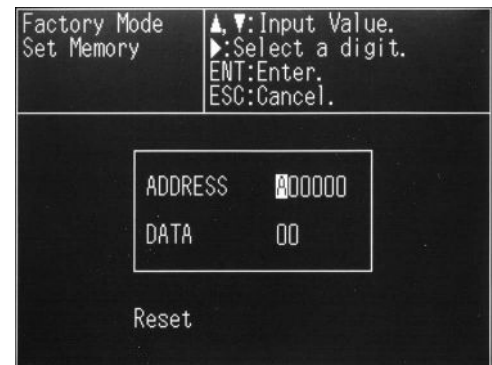
Move the cursor to the address to be written pressing the  key.





Move the digit using the  key, and make the setting for each digit.



Enter the value using the  and  keys.


Data is displayed as the value to be written by specified address.




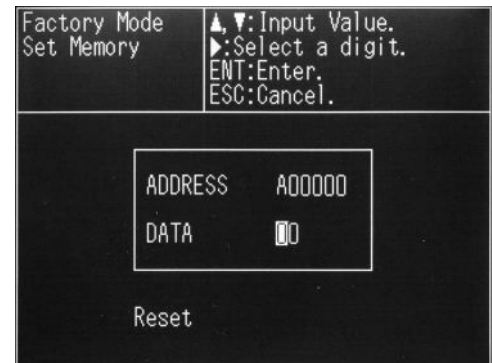
Press the  key, and the cursor moves to the value to be written.

Move the digit using the  key and make the setting for each digit.


Enter the value using the  and  keys.

Press the  key to confirm the setting.


Press the  key to cancel the setting.




▪ Soft reset

Move the cursor to “Reset” and then press the  key.

“Reset” is highlighted.

Press the  key again, and reset is carried out and the program is started from the beginning.

The measurement screen appears again.

Press the  key to cancel the reset.

3.3.11 Coefficient confirmation

Function: Displays zero offset and calibration coefficient.

Operation: The initial coefficient confirmation screen is shown at right.

Select the item to be set using the \triangle and ∇ keys.

Press the ENT key to enter each display screen.

- When offset is selected

Display contents:

OffsetOffset value of infrared ray detector

Press the ESC key to return to the initial coefficient confirmation screen.

- When calibration coefficient is selected

Display contents:

Display is made by range.

Zero.....Zero calibration coefficient

SpanSpan calibration coefficient

Press the ESC key to return to the initial coefficient confirmation screen.

Note: You can check the coefficient but cannot change it in this mode.

Factory mode initial screen
The cursor is in 11.



| | |
|-----------------------------|--|
| Factory Mode Coefficient | ▲,▼:Select an item. ENT:Enter. ESC:Back. |
| ▾Offset Calibration | |




| | | | |
|---------------------------------------|--------------------------------|--|--|
| Factory Mode Coefficient offset | Display to check. ESC:Back. | | |
| | offset | | |
| CH1 | 37575 | | |
| CH2 | 20000 | | |

| | | | |
|-----------------------------|--------------------------------|---------|---------|
| Factory Mode Calibration | Display to check. ESC:Back. | | |
| CH | RANGE | ZERO | SPAN |
| CH1 | 1.0vol% | 01.0000 | 01.0000 |
| CO ₂ | 2.0ppm | 01.0000 | 01.0000 |
| CH2 | 1.0vol% | 01.0005 | 01.0000 |
| CO | 2.0vol% | 01.0005 | 01.0000 |

3.3.12 A/D data

Function: Measures the counter readings immediately after A/D conversion.

Operation: The A/D data screen is shown at right.

Press the  key to return to the initial A/D data screen.

Note: You can check the count of input signals but cannot change the value in this mode.

Factory mode initial screen
The cursor is in 12.



| | |
|--------------------------|--------------------------------|
| Factory Mode A/D Data | Display to check. ESC:Back. |
| First element | 37099 |
| Second element | 39973 |
| temperature | 18258 |
| | |
| | |
| | |

4. ERROR JUDGEMENT CRITERIA FOR ERROR CODES

* This section covers the error judgement criteria for error codes.

For the contents of errors, refer to Instruction Manual.

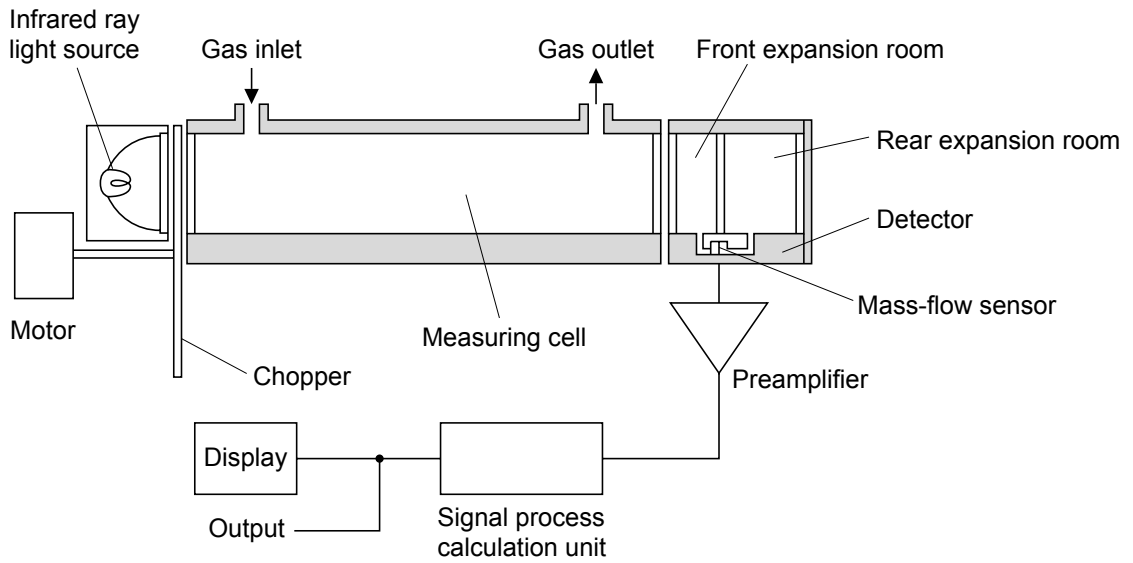
| Error No. | Contents | Criteria |
|-----------|--|--|
| Error 1 | Motor rotation detector signal is faulty. | Detector signals generated due to motor chopping are converted into rectangular waves and rectangular waves are monitored. If waves are not generated or irregular, an error occurs. |
| Error 3 | A/D conversion signal is faulty | When input value is too much, error occurs. (The upper limit depends on the specification) The circuit is faulty |
| Error 4 | Zero calibration is not within the allowable range. | Infrared component: $0.7 \leq \text{zero calibration coefficient} \leq 4.0$ |
| Error 5 | An amount of zero calibration is over 50% of full scale. | This error occurs in the following condition. $50\% \text{ of FS} < \{(\text{Zero calibration concentration set value}) - (\text{current display})\}$ |
| Error 6 | Span calibration is not within the allowable range. | When span calibration coefficient is not within the following range, error occurs. Infrared component: $0.5 \leq \text{span calibration coefficient} \leq 6$ |
| Error 7 | An amount of span calibration is over 50% of full scale. | This error occurs in the following condition. $50\% \text{ of FS} < \{(\text{Span calibration concentration set value}) - (\text{current display})\}$ |

Main portions to be checked during error

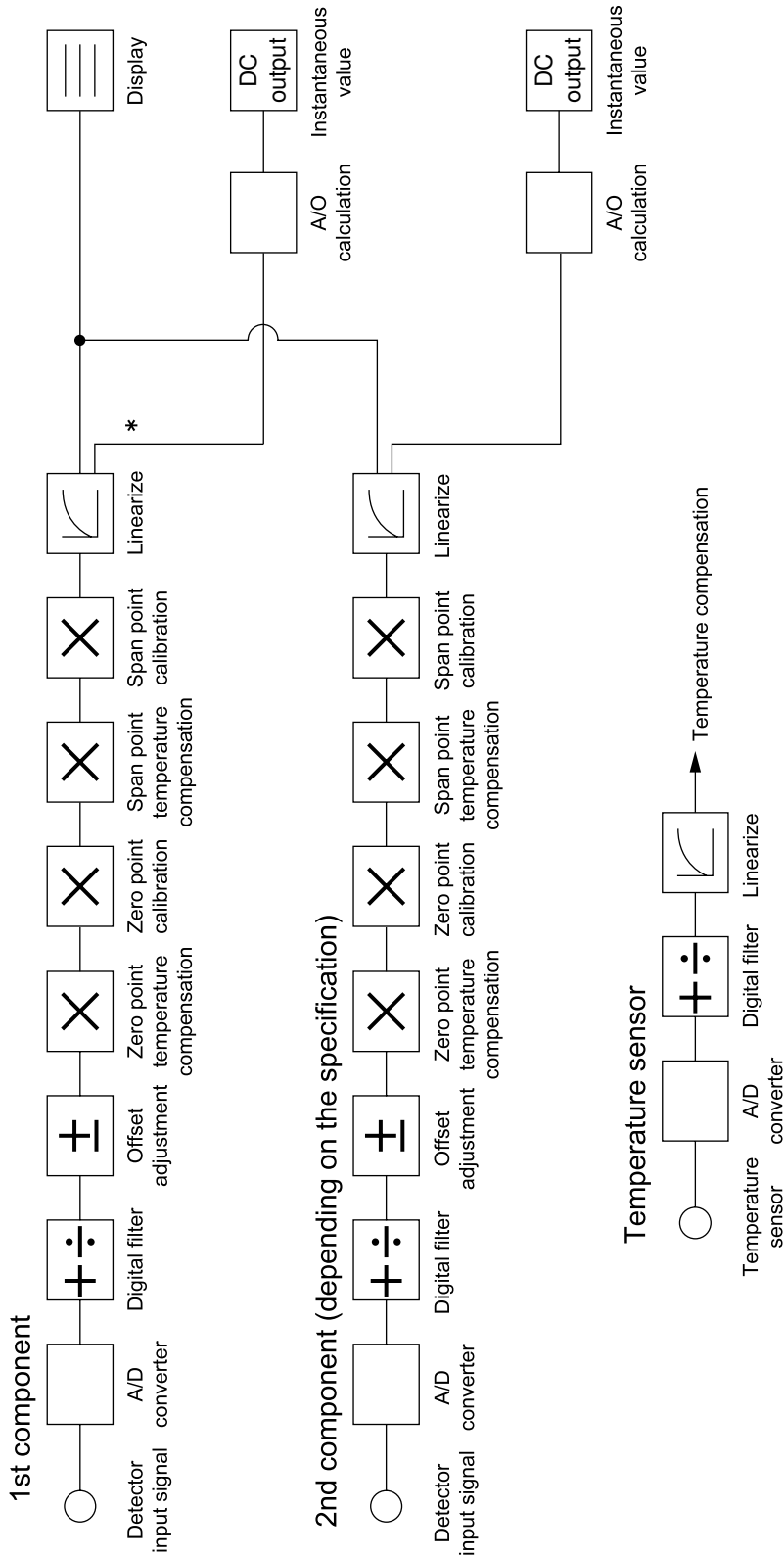
| Error No. | Main portions to be checked |
|-----------|---|
| Error 1 | Sector motor rotation, detector signal on amplifier printed circuit board. Rectangular waves between GND and MPD2 on main printed circuit board (10Hz, 5Vp-p) |
| Error 4 | See this service manual "3.3.11 Coefficient confirmation". |
| Error 5 | See this service manual "3.3.11 Coefficient confirmation" and the detector signal voltage in "2.3 Amplifier printed circuit board". |
| Error 6 | See this service manual "3.3.11 Coefficient confirmation". |
| Error 7 | See this service manual "3.3.11 Coefficient confirmation" and the detector signal voltage in "2.3 Amplifier printed circuit board". |

5. MEASURING PRINCIPLE DIAGRAM

Infrared ray type measuring principle diagram (CO₂, CO, and CH₄)

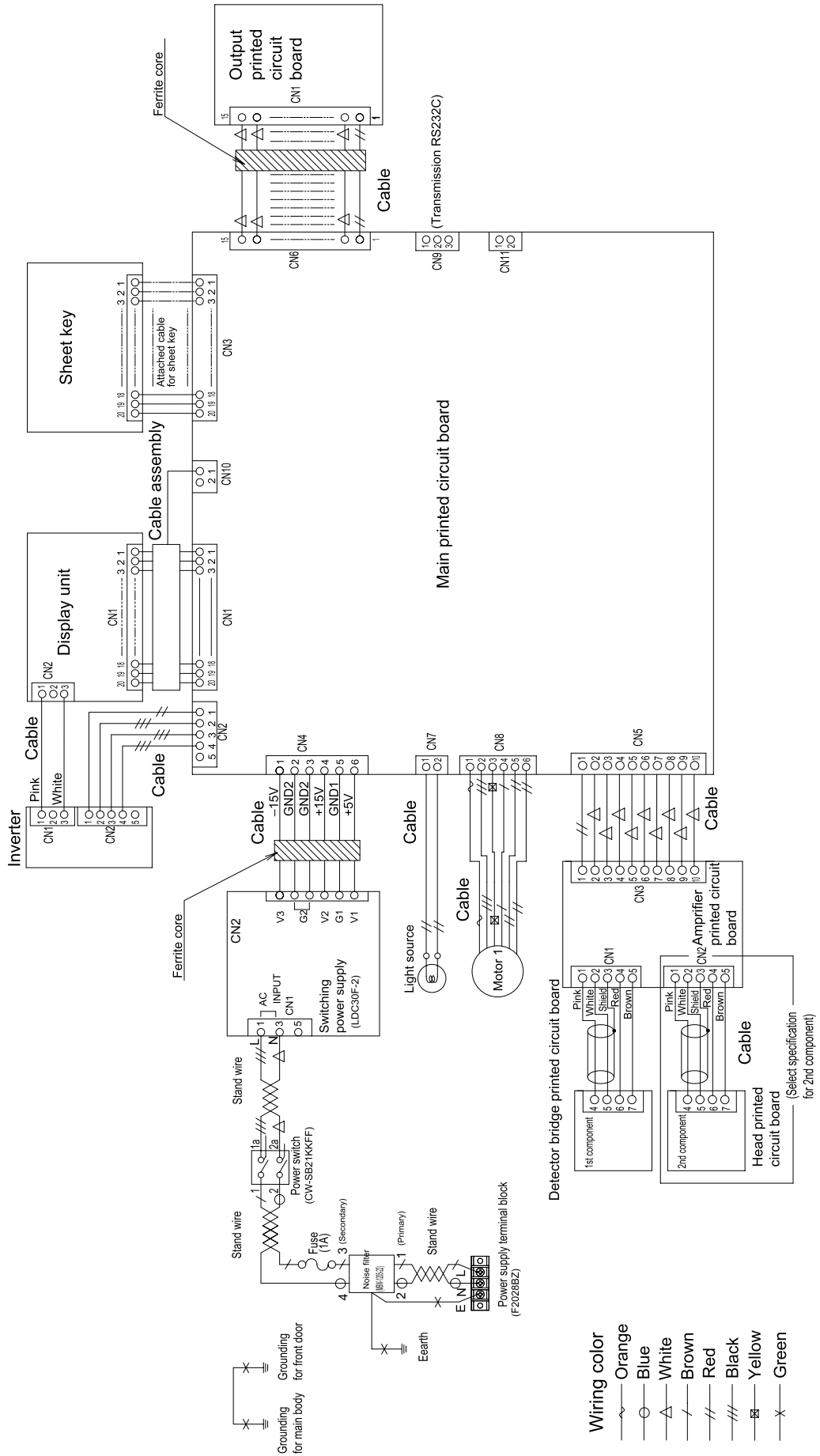


6. SOFT FLOW CHART

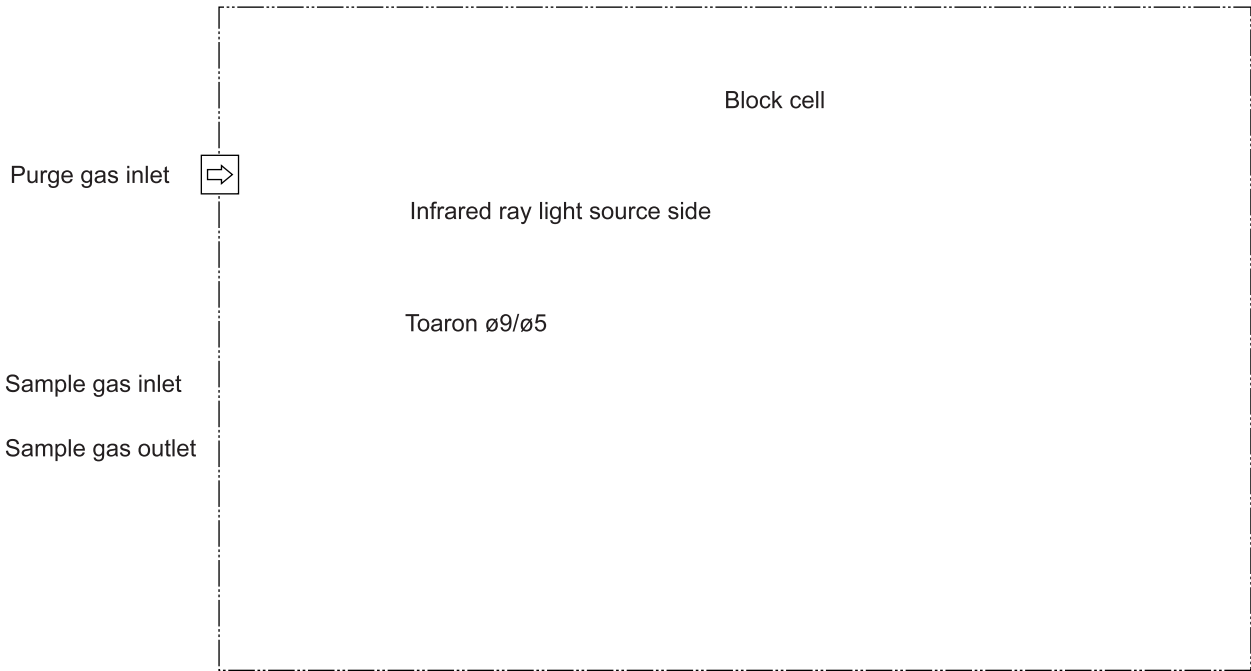


Note 1) Asterisk mark * indicates "Hold point."

7. INTERNAL WIRING DIAGRAM

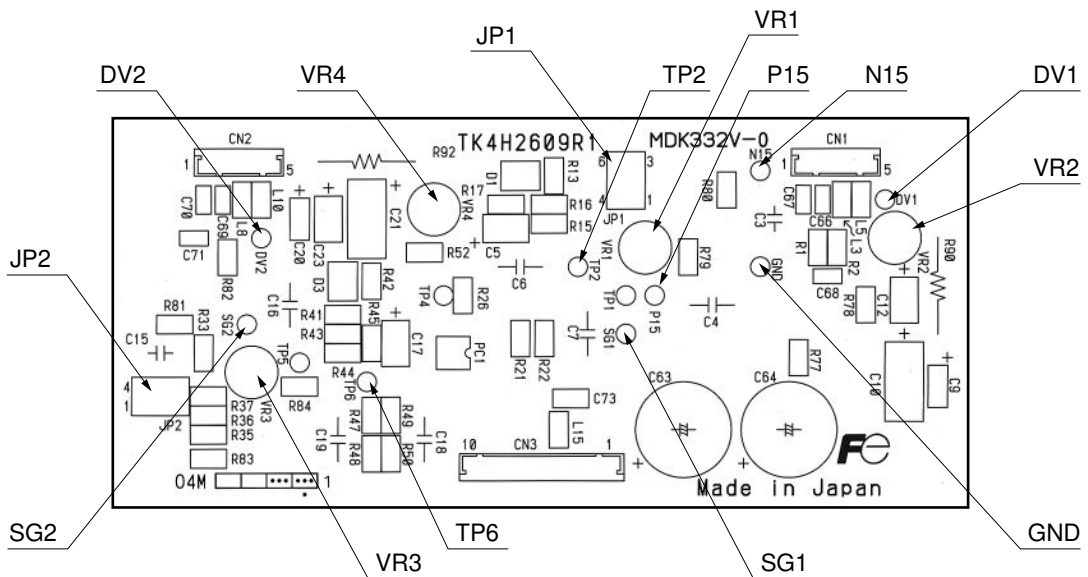


8. INTERNAL PIPING

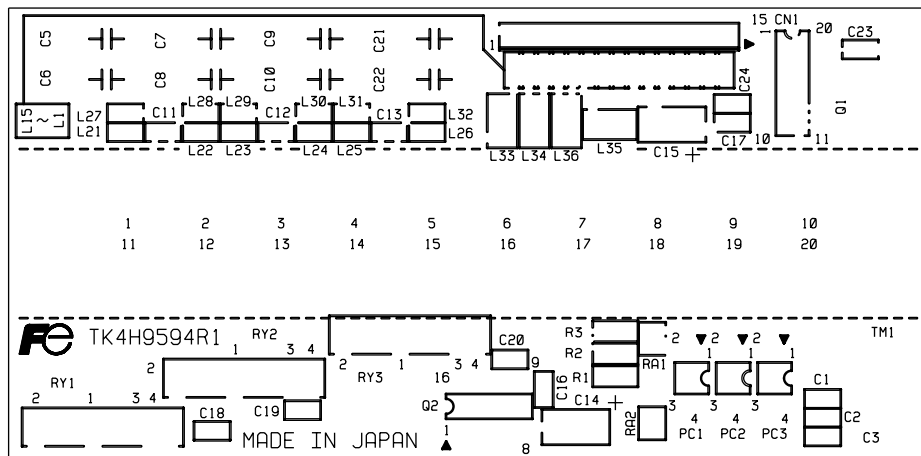


9. PRINTED CIRCUIT BOARD DIAGRAM

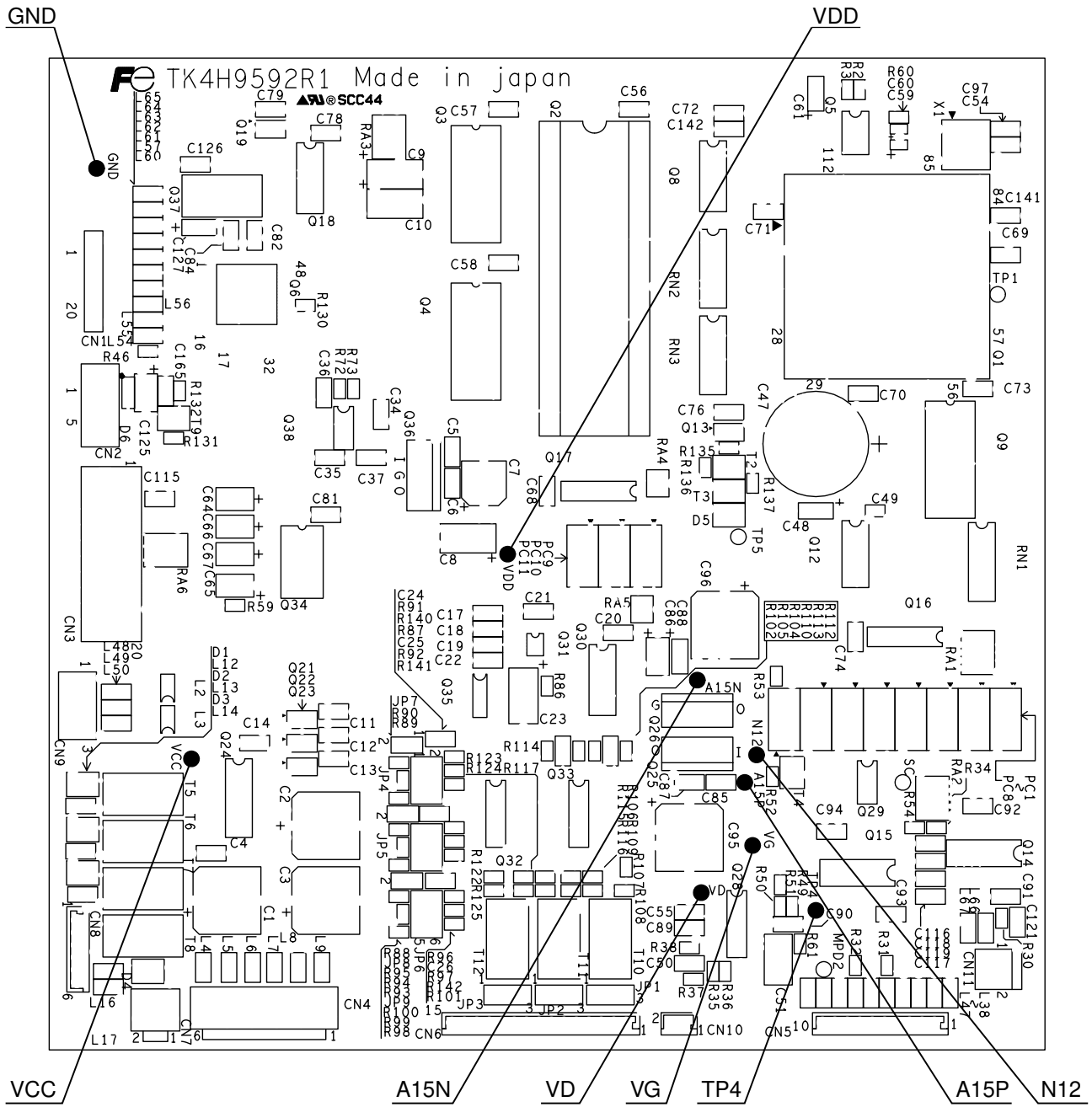
9.1 Amplifier printed circuit board



9.2 Output printed circuit board



9.3 Main printed circuit board



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