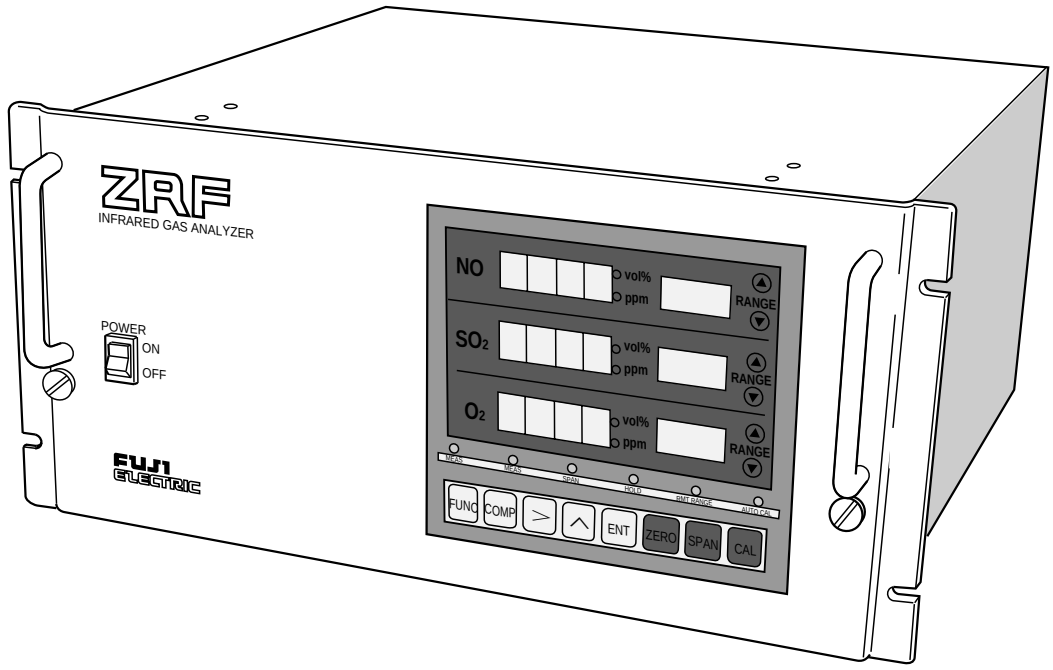
Instruction Manual

NON-DISPERSION TYPE INFRARED GAS ANALYZER

TYPE: ZRF



Fuji Electric Systems Co., Ltd.

INZ-TN510237-E

PREFACE

Congratulations on your purchase of Fuji Electric's Infrared Gas Analyzer (Type: ZRF).

This service manual provides descriptions on the maintenance, inspection, repair and adjustment procedures of the non-dispersion type infrared gas analyzer (ZRF).

It is recommended to refer to the related instruction manual and parts list when reading this service manual.

- Before using, be sure to read the related instruction manual carefully to ensure correct maintenance, inspection and repair of the infrared gas analyzer. Note that incorrect handling may lead to trouble or personal injury.
- The specifications of this infrared gas analyzer are subject to change for improvement without prior notice.
- Do not attempt to modify the infrared gas analyzer without permission. Fuji Electric is not responsible for any trouble caused by modification without permission.

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

NOTICE

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

Issued in Dec., 1997

SAFETY PRECAUTION

First of all, read this "Safety Precaution" carefully, and then use the 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 2 levels; "DANGER" and "CAUTION".

Warning & Symbol	Meaning
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 an explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accidents.
CAUTION:	• For installation, observe the rule on it given in the instruction manual and select a place where the weight of gas analyzer can be endured. Installation at an unsuited place may cause turnover or fall and there is a risk of injury. • For lifting the gas analyzer, be sure to wear protective gloves. Bare hands may invite an injury. . • Before transport, fix the casing so that it will not open. Otherwise, the casing may be separated and fall to cause an injury. • The gas analyzer is heavy. It should be transported carefully by two or more persons if manually required. Otherwise, body may be damaged or injured. • During installation work, care should be taken to keep the unit free from entry of cable chips or other foreign objects. Otherwise, it may cause fire, trouble or malfunction of the unit.

Caution on piping

DANGER:

On 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 gas should be led outdoors so that it will not remain in the sampling device and indoors.
- Exhaust from the analyzer should be relieved in the atmospheric air in order that an unnecessary pressure will not be applied to the analyzer. Otherwise, any pipe in the 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

CAUTION:

- Wiring is allowed only when all power supplies are turned off. This is required for preventing a shock hazard.
- Enforce construction of class-3 grounding wire by all means. If the specified grounding construction is neglected, a shock regard or fault may be caused.
- 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.
- Use power source that matches the rating of the unit. Use of power source out of rating may cause fire.

Caution on use

DANGER:

- When handling the standard gas such as calibration gas, read the instruction manual of the standard gas carefully and use the gas correctly.

CAUTION:

- Avoid continuous operation with the casing drawn out.
- During operation, avoid opening the casing and touching the internal parts. Otherwise, you may suffer a burn or shock hazard.

Caution on maintenance and check

DANGER:

- When doors are open during maintenance or inspection for adjusting the optical system, etc., be sure to purge sufficiently the inside of the gas analyzer as well as the measuring gas line with nitrogen or air, in order to prevent poisoning, fire or explosion due to gas leaks.

CAUTION:

- Before working, take off a wrist watch, finger ring or the like metallic accessories. And never touch the instrument with a wet hand, Otherwise, you will have a shock hazard.
- 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.
- Do not use a replacement part other than specified by the instrument maker. Otherwise, adequate performance will not be provided. Besides, an accident or fault may be caused.
- Replacement parts such as a maintenance part should be disposed of as incombustibles.

Others

CAUTION:

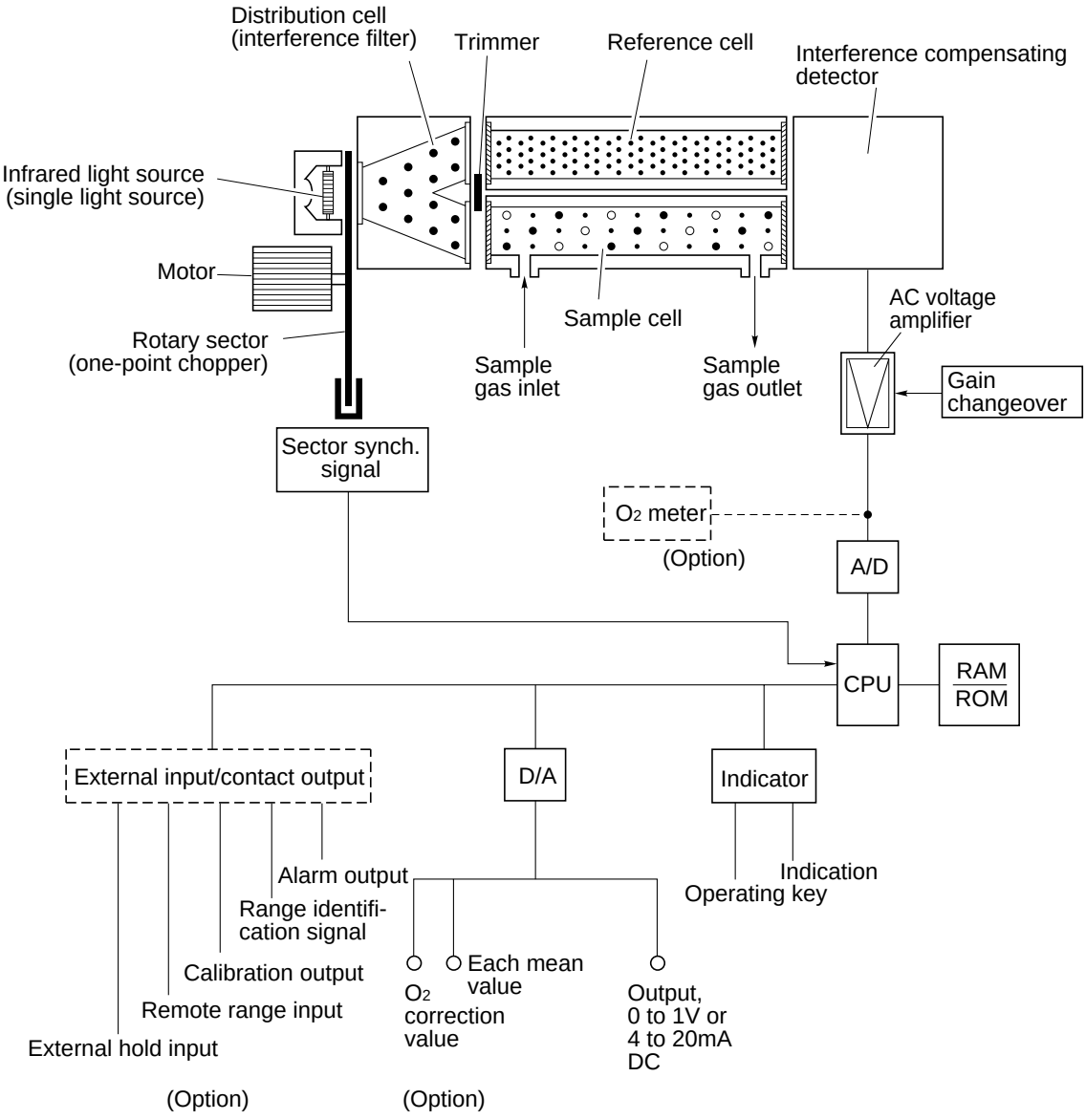
- If the cause of any fault cannot be determined despite reference to the instruction manual, be sure to contact your dealer or Fuji Electric's technician in charge of adjustment. If the instrument is disassembled carelessly, you may have a shock hazard or injury.

CONTENTS

1. OPERATION PRINCIPLE

1.1 Standard type

The infrared rays radiated from the infrared light source is divided into two parts by the distributing cell to be incident upon the sample cell and reference cell, respectively. Interference gas is sealed in the distributing cell to lessen the influence of the interference gas contained in the sample gas. The infrared ray is absorbed by the sample gas in the sample cell, and the transmitted light quantity is reduced by the absorbed quantity. Meanwhile, such a gas that does not absorb the infrared ray is sealed in the reference cell, so the infrared ray is transmitted without being absorbed. The rotary chopper provided between the infrared light source and distributing cell turns on a cycle of approx. 9Hz. Therefore, a larger quantity of infrared ray and a smaller quantity of infrared ray are incident to the detector simultaneously on a cycle of approx. 9Hz. A Fuji unique mass flow type detector is employed as this detector. This detector converts the difference between these light quantities into a resistance variation, and generates an AC signal of approx. 9Hz. Furthermore, this detector functions as an interference compensation detector which lessens the influence of the interference gas contained in the sample gas by a special method.



Operation principle diagram (standard type)

1.2 Sample switching type

The following description is given on the infrared carbon monoxide analyzer. However, this analyzer makes the similar action in case of other components.

The sample switching type infrared analyzer is based on a basic operation principle that the carbon monoxide has a unique infrared ray absorption spectrum. The monoxide is measured by a flow route changeover and flow differential system with the sample gas through a carbon monoxide/carbon dioxide converter set to zero gas.

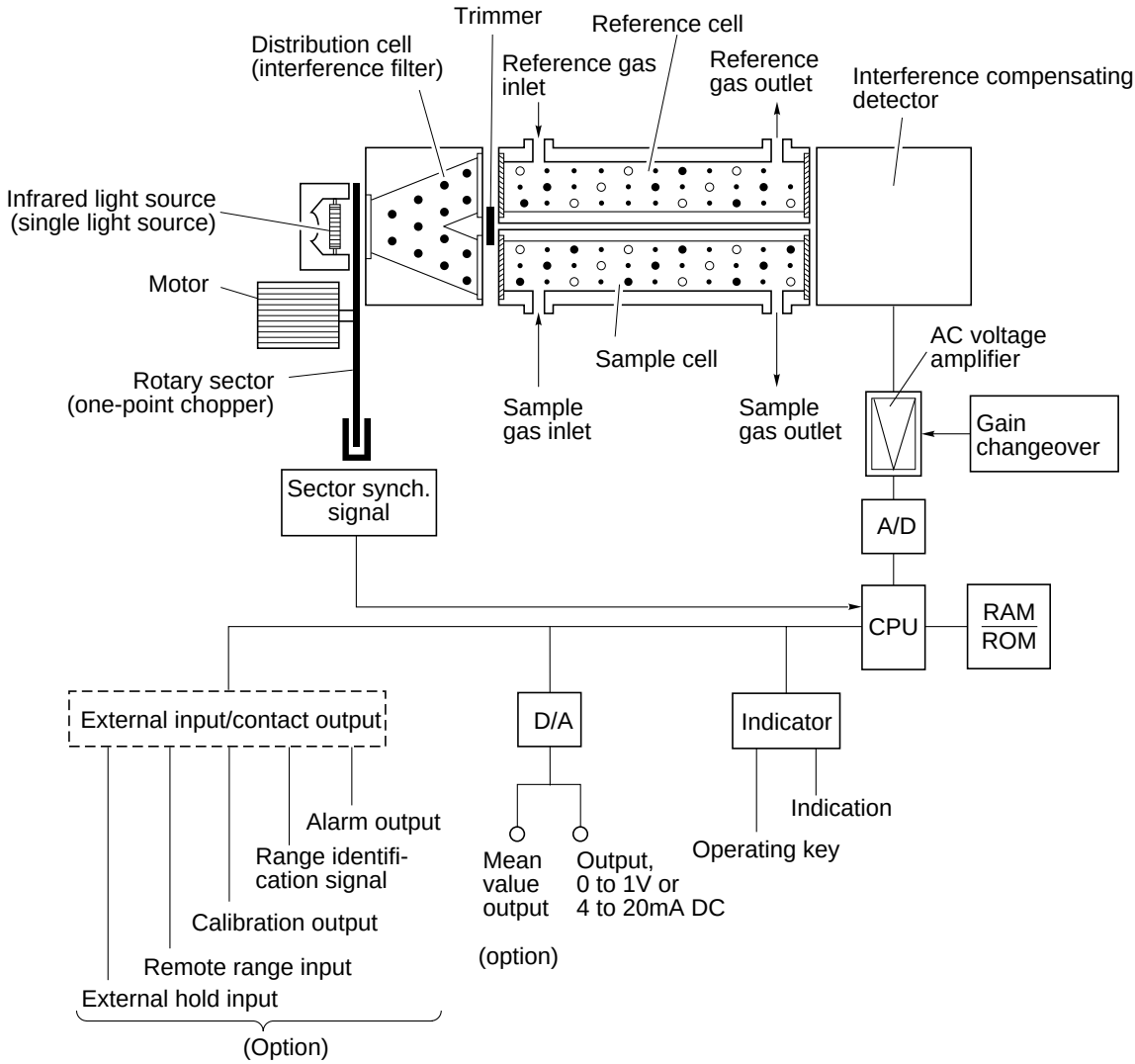
One of the sample gases processed by the pre-processor gets in the sample cell of the analyzer, while the other is converted into a gas containing no carbon monoxide through the CO/CO_2 converter, and it is put in the reference cell. The flow routes of these gases are changed over to each other by a solenoid valve every 50 seconds, using the solenoid valve drive signal sent from the main printed circuit board.

The sample cell and reference cell are provided with infrared-ray transmitting windows at both ends. The sample gases are exposed to the infrared rays which are transmitted through these windows, and absorb the infrared rays according to the measurement component.

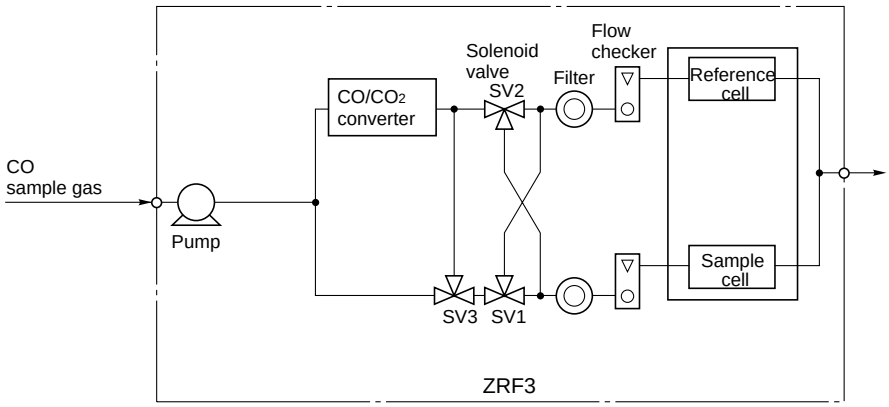
The sample gas through the CO/CO_2 converter does not absorb the infrared ray of the wave-length peculiar to the carbon monoxide, while the sample gas containing the carbon monoxide put in the sample cell absorbs the infrared ray.

The infrared rays transmitted through these two cells are incident upon the reference side detector vessel and sample side detector vessel, respectively. The pressure of the detector vessel on the larger light quantity side (the side of the sample gas through the CO/CO_2 converter) becomes higher than that of the other detector vessel. Therefore, the gas flows from the reference side to the sample side at the moment of making the infrared ray incident upon the detector vessels, but it flows reversely at the moment of interrupting the infrared rays.

This flow is converted into an AC voltage by the mass flow sensor. This AC voltage is subjected to A/D conversion and digital processing.



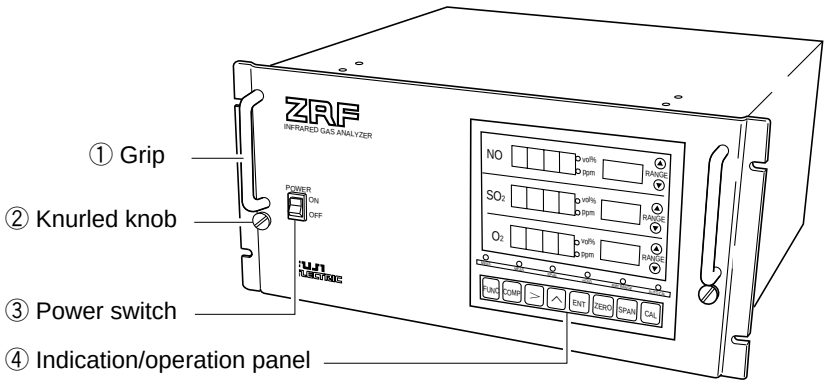
Operation principle diagram (sample switching type)



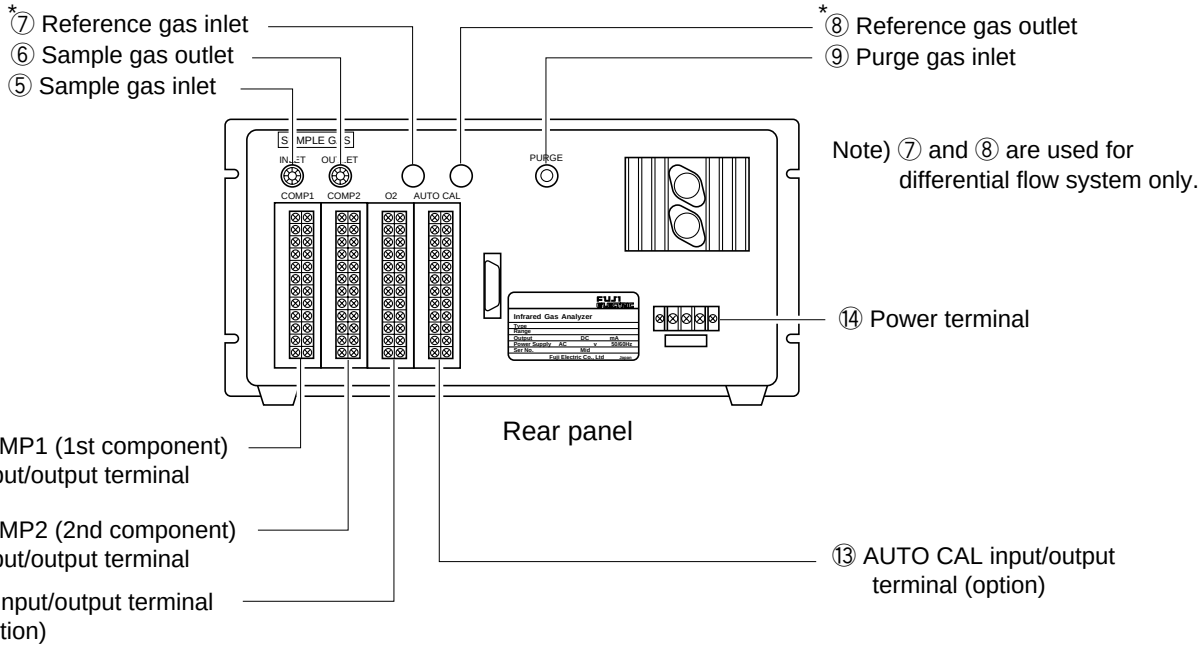
Sampling system block diagram (for ZRF3)

2. NAME AND DESCRIPTION OF EACH COMPONENT

2.1 Name and description of each component on case



Front panel

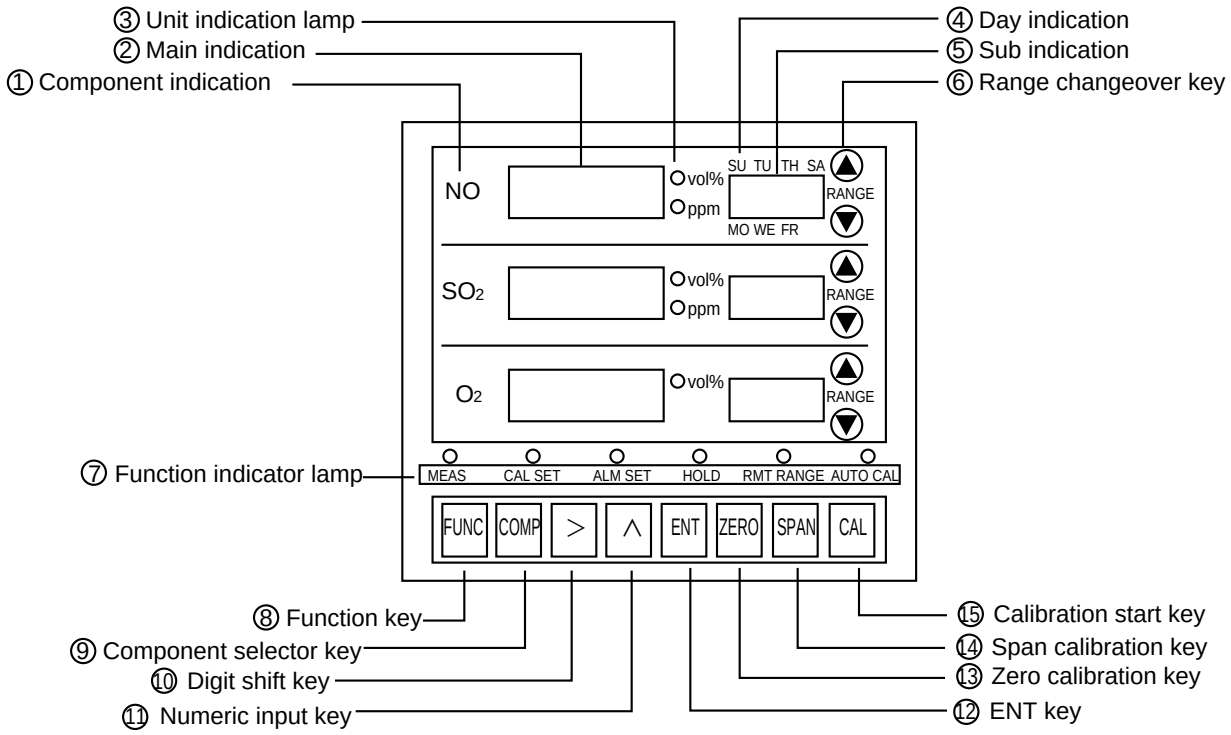


Note) ⑦ and ⑧ are used for differential flow system only.

Rear panel

Part name	Description
① Grip	Used to pull out the interior (base).
② Knurled knob	Used to fasten the instrument and case.
③ Power switch	Turn ON to supply power to the internal components (excluding the pump). After 3 or 4 seconds the LED indicator lights up.
④ Indication/operation panel	Indicates gas concentration, measuring range, etc., and contains keys necessary for routine operation and settings. Refer to section 4 for operating method.
⑤ Sample gas inlet	Connect gas to be measured here.
⑥ Sample gas outlet	Connect pipe for discharging measured gas here.
⑦ Reference gas inlet	Connect reference gas here in case of differential flow system.
⑧ Reference gas outlet	Connect pipe here for discharging reference gas.
⑨ Purge gas inlet	Connect pipe for purge gas here.
⑩ COMP1 (1st component) input/output terminal	Used for 1st component of standard type and sample switching type or flow differential type.
⑪ COMP2 (2nd component) input/output terminal	Input/output terminal for 2nd component of two-component analyzer.
⑫ O_2 input/output terminal (option)	Input/output terminal for O_2 analyzer.
⑬ AUTO CAL input/output terminal (option)	Input/output terminal for auto calibration function.
⑭ Power terminals	Supply power to the analyzer.

2.2 Name and description of components on indication/operation panel



(Three components of NO, SO_2 and O_2 are indicated in this figure.)

Part name	Description
① Component indication	Indicates kind of gas measured.
② Main indication	Indicates measured concentration. Also indicates various setpoints for alarm function, auto calibration function (option), etc.
③ Unit indication lamp	Indicates unit of measured gas concentration.
④ Day indication	Indicates current day or day of starting by means of bar in auto calibration (option) setting mode. Indication SU MO TU WE TH FR SA Day Sun Mon Tue Wed Thu Fri Sat
⑤ Sub indication	Indicates measuring range, error code, various setpoints, etc.
⑥ Range changeover key	Used when changing the range. High range is set when pressing △ and low range is set when pressing ▽.
⑦ Function indicator lamp	Relevant lamp lights up when following functions are set. MEAS : Lights up in measuring status. CAL SET : Flashes in calibration concentration setting mode. ALM SET : Flashes in alarm setting mode. HOLD : Flashes in hold setting mode or lights steadily while hold function is activated. RMT RANGE : Flashes in remote range setting mode or lights steadily while remote range function is activated. AUTO CAL : Flashes in auto calibration setting mode or lights steadily while auto calibration function is activated.
⑧ Function key	Setting mode is changed at each press of this key. (Refer to section 4.)
⑨ Component selector key	Set component is changed for each setting mode or span calibration.
⑩ Digit shift key	Shift is made from highest toward lowest digit at each press of this key.
⑪ Numeric input key	Selected digit is incremented at each press of this key.
⑫ ENT key	By pressing this key after setting, the set contents are memorized and become valid.
⑬ Zero calibration key	Used for zero point calibration. (Lamp flashes in zero calibration mode.)
⑭ Span calibration key	Used for span calibration. (Lamp flashes in span calibration mode.)
⑮ Calibration start key	Start key for manual calibration. Zero is calibrated by pressing ZERO and CAL keys.(CAL lamp lights steadily during calibration.) Span is calibrated by pressing SPAN and CAL keys. (CAL lamp lights steadily during calibration.)

3. PIPING AND WIRING

3.1 Piping method

DANGER

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

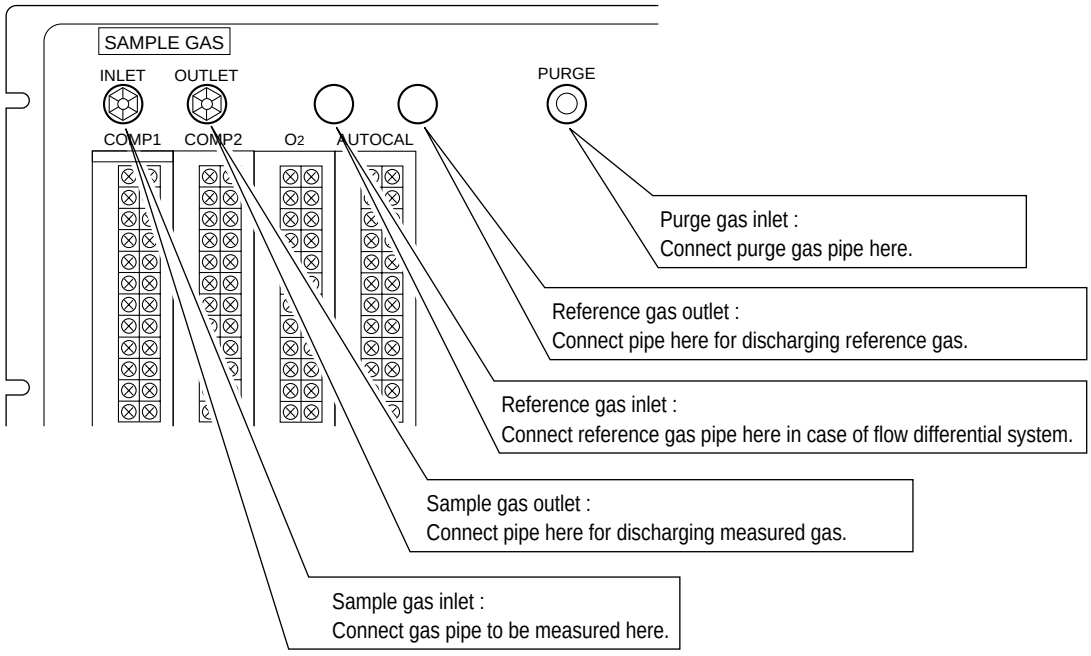
- Connect pipes correctly referring to the instruction manual.
- Exhaust gas should be led outdoors so that it will not remain in the sampling device and indoors.
- Exhaust from the analyzer should be relieved in the atmospheric air in order that an unnecessary pressure will not be applied to the analyzer. Otherwise, any pipe in the 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.

(1) Piping procedure

Connect pipes to the gas inlets and outlets located at the rear top of the analyzer.

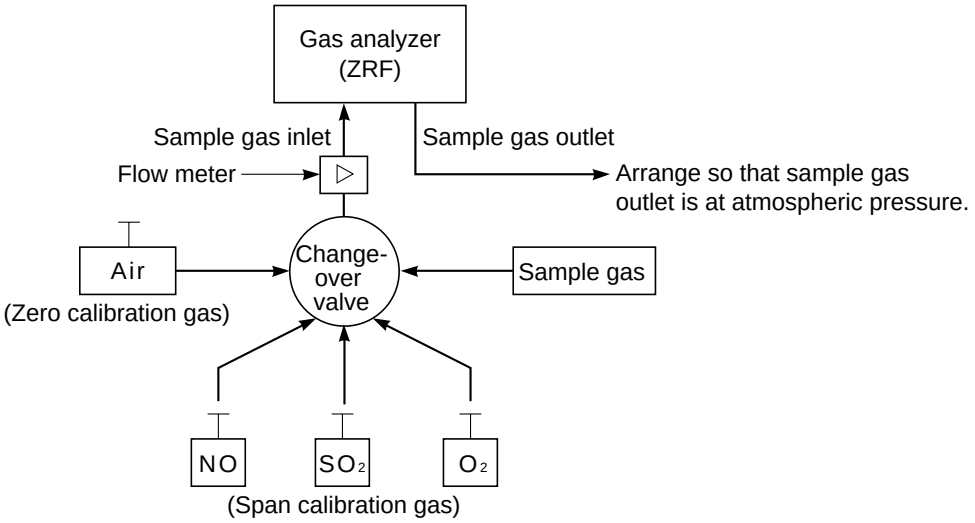
Use anticorrosive tubes made of Teflon, stainless steel, polyethylene or the like for connecting the analyzer and sampling system. Avoid using rubber or soft vinyl tubes even if there is no worry about corrosion. Improper piping material may cause inaccurate indication due to adsorption of gas.

The pipe connections are Rc1/4 (PT1/4) or NPT1/4 internal thread. And the pipes should be kept as short as possible to quicken the response. A suitable inner diameter is about 4mm. Note that dust entering the analyzer may cause a malfunction, so be sure to use clean pipes and joints.



(2) Piping diagram

Shown next is an example of the configuration for measuring three components. (When using Zirconia O_2 analyzer)



3.2 Sampling

3.2.1 Sample gas condition

(1) Remove all dust included in sample gas by means of a filter. Use a filter capable of eliminating dust particles of 0.3μ at the final stage.

(2) The dew point of sample gas must be lower than the ambient temperature to prevent accumulation of drain inside the analyzer. If water vapor is included in the sample gas, then feed the gas through a dehumidifier to lower the dew point to around 0°C.

(3) If SO_3 mist is included in sample gas, then use a mist filter, cooler etc. to exclude the mist. The same applies if other kinds of mist are included.

(4) Note that if strongly corrosive gas such as Cl_2, F_2 or HC ℓ is included in sample gas in a large amount, it will shorten the service life of the analyzer.

(5) The sample gas temperature should range from 0 to 50°C. Be careful not to introduce a high temperature gas directly into the analyzer.

3.2.2 Sample gas flow rate

The sample gas flow rate should be as follows.

Provide a flowmeter as shown in the preceding diagram to measure the flow rate.

Standard type	0.5 ℓ ±0.25 ℓ /minute
Sample switching type	(1 ℓ +1 ℓ)±0.1 ℓ /minute (sample gas+reference gas)
Flow differential type	(0.5 ℓ + 0.5 ℓ)±0.25 ℓ /minute (sample gas +reference gas)

3.2.3 Preparation of standard gas

Prepare standard gas for zero point and span point calibration.

Zero gas	N_2 gas
Span gas	Gas with concentration of 80% or more of full scale for each component

When using a Zirconia O_2 analyzer, use air for zero gas.

Zero gas	Air (O_2 analyser span gas in measuring method) Note)
Span gas	1 to 2% O_2 (O_2 analyser span gas in measuring method) Gas with concentration of 80% or more of full scale for other than Zirconia O_2 analyzer.

Note: When calibrating the low and high ranges of Zirconia type O_2 analyzer, use 9 to 10% O_2/N_2 for the low range, and air for the high range.

3.2.4 Analyzer interior purging

Although purging of the analyzer interior is normally unnecessary, it should be considered in the following cases.

(1) When combustible gas is included in the measured gas

(2) When corrosive gas is included in the atmosphere at the installation site.

(3) When the same gas as the measured components is included in the atmosphere at the installation site.

In such cases, purge the analyzer interior with instrumentation air or N_2. The flow rate for purging should be about 1 ℓ /minute.

And dust or mist should be completely eliminated from the gas for purging.

3.2.5 Pressure at sample gas outlet

Arrange so that the sample gas outlet is at atmospheric pressure.

3.3 Wiring method

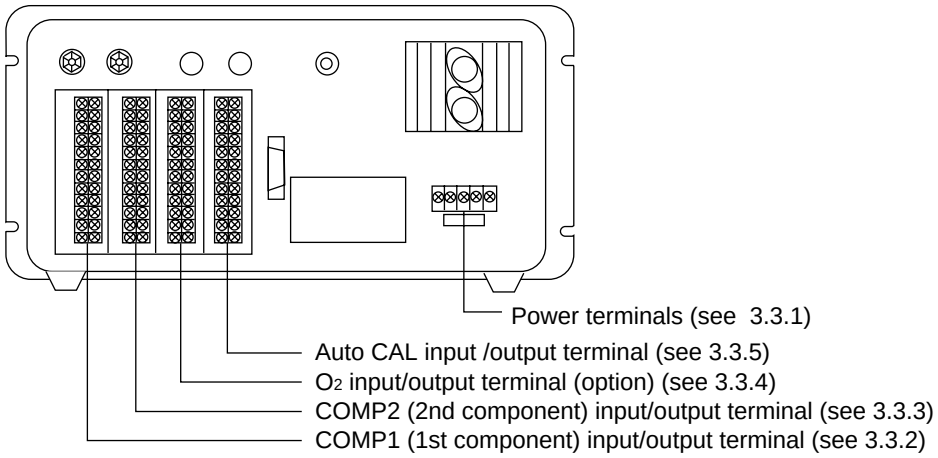
CAUTIONS

- Wiring is allowed only when all power supplies are turned off. This is required for preventing a shock hazard.
- Enforce construction of class-3 grounding wire by all means. If the specified grounding construction is neglected, a shock regard or fault may be caused.
- 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.
- Use power source that matches the rating of the unit. Use of power source out of rating may cause fire.

The external terminals are provided on the rear of the instrument.

Carry out wiring to each terminal according to the figure. Terminal screws are M3 (but power terminals are M4).

Use shielded wires for the output signals to suppress the influence of external noise.



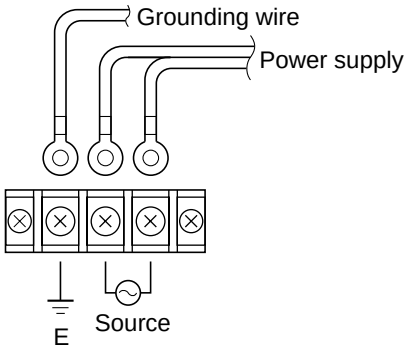
3.3.1 Power terminals

The power terminals are arranged as shown in the figure.

Connect the specified power supply to the terminals and connect a grounding wire to the ground terminal.

The grounding should be made securely.

Use solderless terminals (for M4) for connection to the terminals.

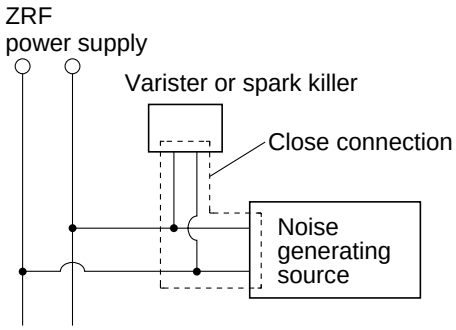


When the noise generating source is located nearby

Avoid installing this analyzer near an electrical apparatus which produces power source noise. (Such as high frequency furnace, electric welder, etc.) If use of the analyzer near such an apparatus is unavoidable, then keep the power lines separate to avoid noise.

If noise from a relay, solenoid valve or the like enters the power source, then attach a varistor or a spark killer to the noise source as shown in the figure.

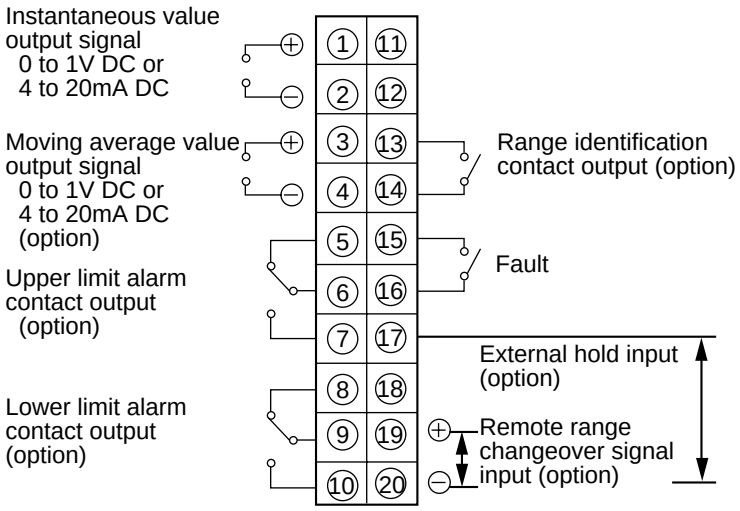
Note that attaching the varistor or spark killer away from the noise source will be ineffective.



3.3.2 COMP 1 (1st component) input/output terminal

This output terminal is used with the standard single-component type, sample switching type or flow differential type.

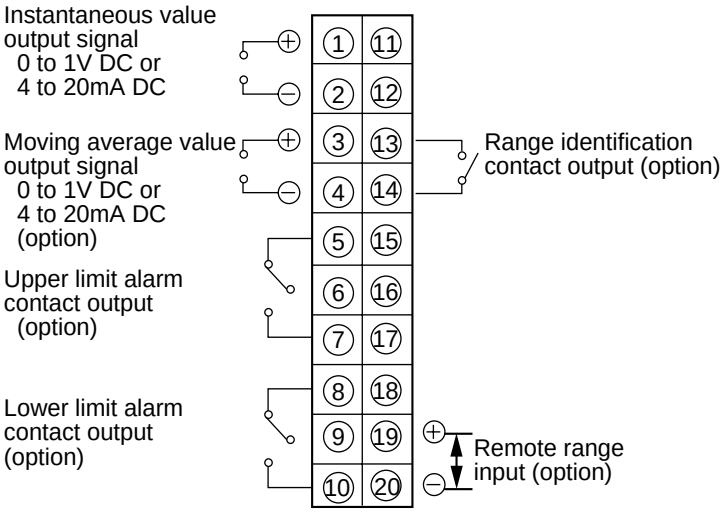
The wiring method is as follows.



3.3.3 COMP2 (2nd component) input/output terminal

This output terminal is for the 2nd component of the standard type.

The wiring method is as follows



COMP1, COMP 2 input/output terminal block

<Instantaneous value output>

Instantaneous value of 0 to 1V DC or 4 to 20mA DC is outputted.

<Moving average output> (option)

Specified 1 or 4hours moving average value of 0 to 1V DC or 4 to 20mA DC is outputted.

<Upper limit alarm contact output> (option)

When signal exceeds upper limit, terminals ⑤ and ⑥ turn from ON to OFF and ⑥ and ⑦ turn from OFF to ON.

1c contact 250V AC, 2A (resistive load)

<Lower limit alarm contact output> (option)

When signal is below lower limit, terminals ⑧ and ⑨ turn from ON to OFF and ⑨ and ⑩ turn from OFF to ON.

1c contact 250V AC, 2A (resistive load)

<Range identification contact output> (option)

Terminals ⑬ and ⑭ are conductive when 1st range is selected: ⑬ and ⑭ are open when 2nd range is selected.

1a contact 250V AC, 2A (resistive load)

<Remote range input> (option)

1st range is selected when 5V DC is inputted to terminals 1 and ⑳ ; 2nd range is selected when there is no input to terminals ⑲ and ⑳ .

<External hold input> (Input to COMP1 terminal) (option)

Hold setting component is outputted and held with 5V DC inputted between ⑰ and ⑳ .

<Fault> (Input to COMP1 terminal)

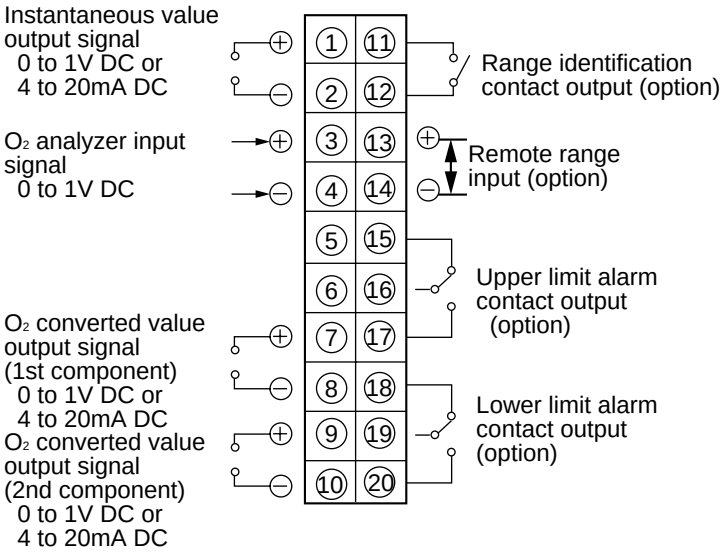
Contact output when analyzer incurs an abnormality.

1a contact 250V AC, 2A (resistive load)

3.3.4 O_2 input/output terminals (option)

This is the input/output terminal for the standard type O_2 analyzer.

The wiring method is as follows.



O_2 input/output terminal block

<Instantaneous value output>

Instantaneous value of 0 to 1V DC or 4 to 20mA DC is outputted.

<O_2 analyzer input signal>

O_2 analyzer signal of 0 to 1V DC linear is inputted.

<O_2 conversion output>

O_2 conversion instantaneous value is outputted with preset conversion reference value.

<Upper limit alarm contact output> (option)

When upper limit is exceeded, terminals ⑮ and ⑯ turn from ON to OFF and ⑯ and ⑰ turn from OFF to ON .

1c contact 250V AC, 2A (resistive load)

<Lower limit alarm contact output> (option)

When signal is below lower limit, terminals ⑱ and ⑲ turn from ON to OFF and ⑲ and ⑳ turn from OFF to ON .

1c contact 250V AC, 2A (resistive load)

<Range identification contact output> (option)

Terminals ⑪ and ⑫ are conductive when 1st range is selected: ⑪ and ⑫ are open when 2nd range is selected.

1a contact 250V AC, 2A (resistive load)

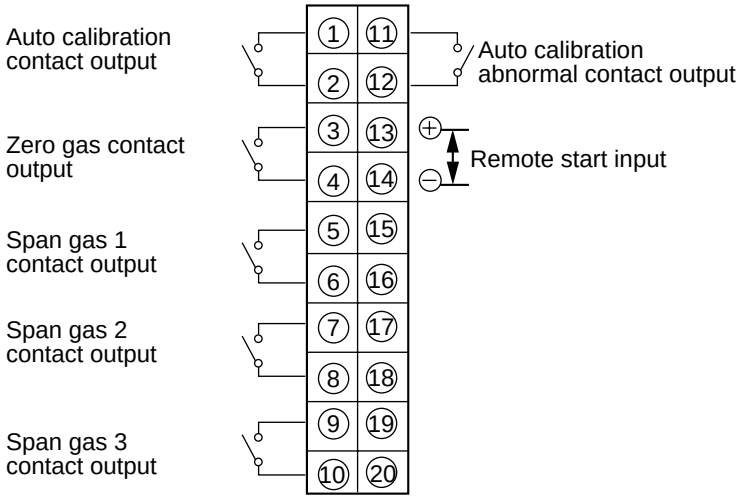
<Remote range input> (option)

1st range is selected when 5V DC is inputted to terminals ⑬ and ⑭ ; 2nd range is selected when there is no input to terminals ⑬ and ⑭ .

3.3.5 AUTO CAL input/output terminal (option)

This is the output terminal for the auto calibration function.

The wiring method is as follows.



AUTO CAL input/output terminal block (option)

<Contact output during auto calibration>

Contact between ① and ② is ON during auto calibration.

1a contact, 250V AC, 2A (resistive load)

<Zero gas contact output>

Contact output for driving solenoid valve for flowing zero gas.

1a contact 250V AC, 2A (resistive load)

<Span gas 1 contact output>

Contact output for driving solenoid valve for flowing 1st component span gas.

1a contact 250V AC, 2A (resistive load)

<Span gas 2 contact output>

Contact output for driving solenoid valve for flowing 2nd component span gas.

1a contact 250V AC, 2A (resistive load)

<Span gas 3 contact output>

Contact output for driving solenoid valve for flowing O_2 analyzer span gas.

1a contact 250V AC, 2A (resistive load)

<Auto calibration abnormal contact output>

Contact output when abnormality occurs during auto calibration.

<Remote start input>

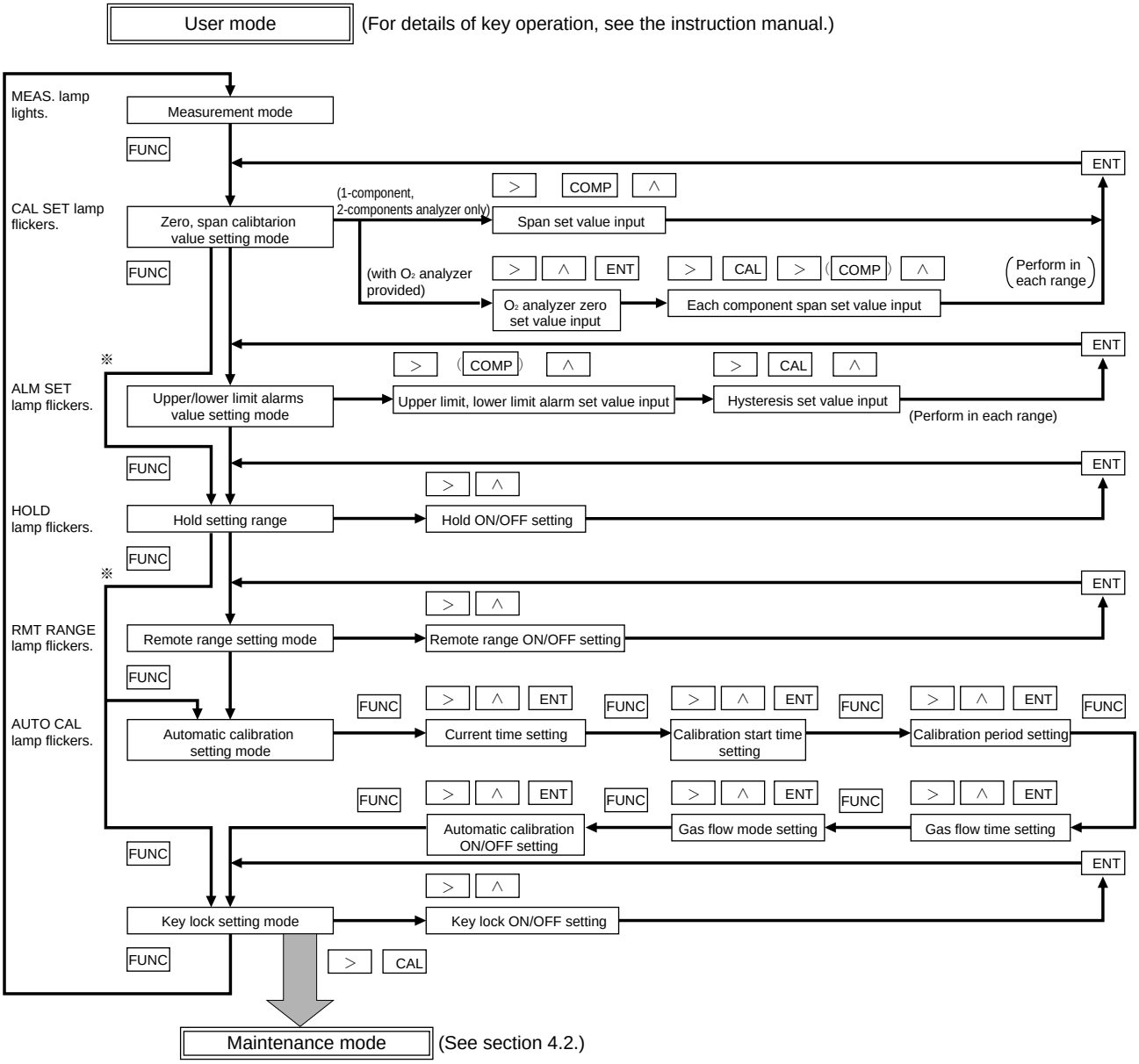
Input for starting auto calibration via external signal. Calibration started by inputting 5V DC between terminals ⑬ and ⑭ .

4. OPERATION OF INDICATION/OPERATION PANEL

The key operations permitted on this instrument are roughly classified into three types ; a user mode for measurement and setting by general user (see section 4.1 of the instruction manual), a maintenance mode for setting and adjustment in each maintenance (see section 4.2), and a parameter input mode for setting each characteristic value during parts replacement (see section 4.3).

The individual modes are described below sequentially.

4.1 User mode

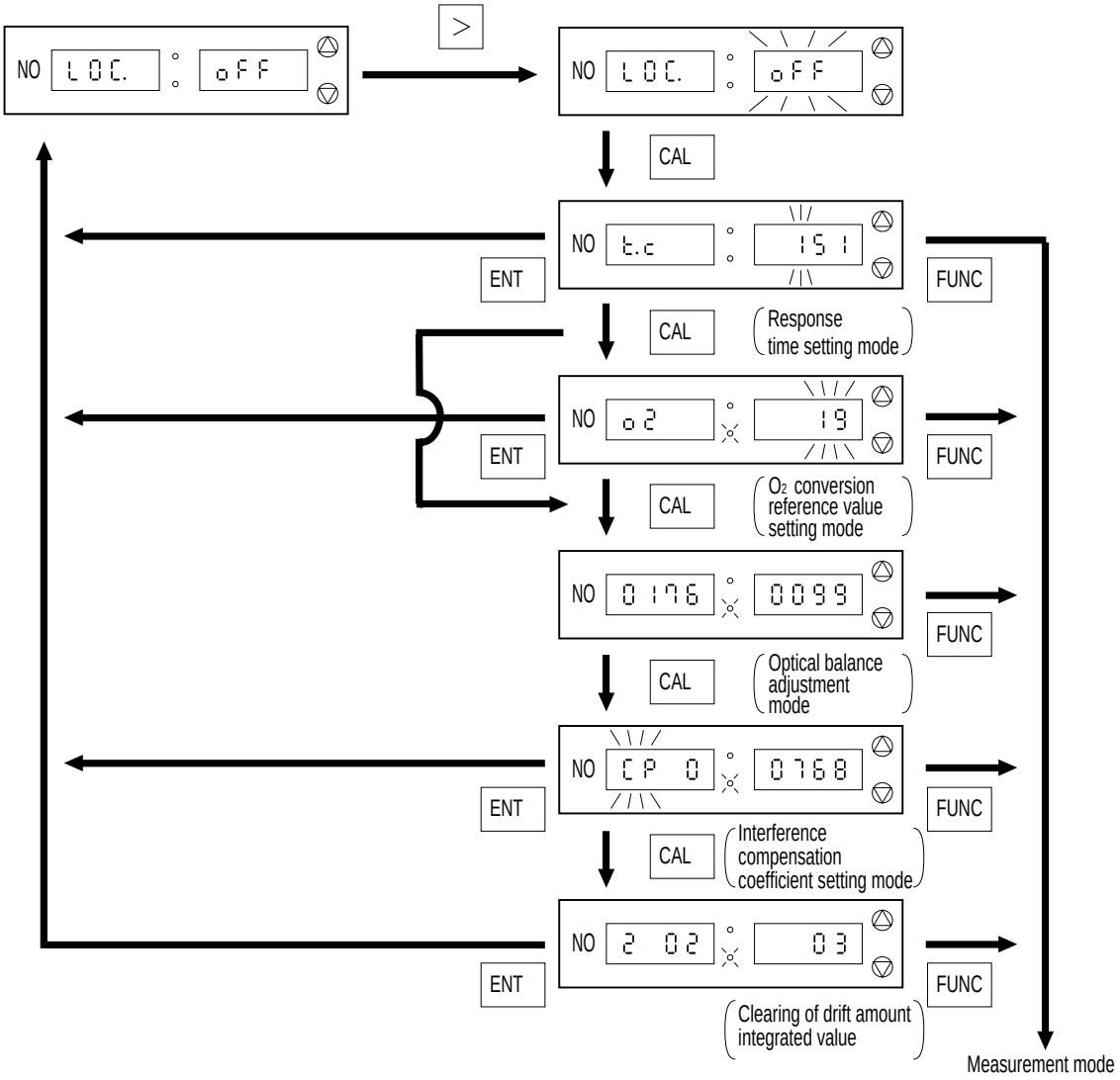


※ Changes, depending upon whether option is provided.

4.2 Maintenance mode

To set the maintenance mode, perform the following operation in the key lock mode.
The maintenance mode refers to setting and adjustment in the following five modes.

- Response time setting mode
- O_2 conversion reference value setting mode (option)
- Optical balance adjustment mode
- Interference compensation coefficient setting mode
- Indication and clearing of drift amount integrated value



Cautions on operation

1. When O_2 display, conversion function is not provided, O_2 conversion reference value setting mode is not available.

   By pressing CAL key in the response time setting mode, the display is changed for optional balance adjustment.

2. When any setting is finished, be sure to press ENT key.

   If another key is pressed without pressing ENT key, the numerical value which has been set is not registered.

3. After ENT key is pressed, "LOC." display lamp lights up.

4.2.1 Response time setting

Press CAL key while "LOC." display lamp is flickering, and "t.c" will be displayed. At this time, the sub display lamp flickers.

Press COMP key to select desired setting component.

Next, set the response time of the electric system.

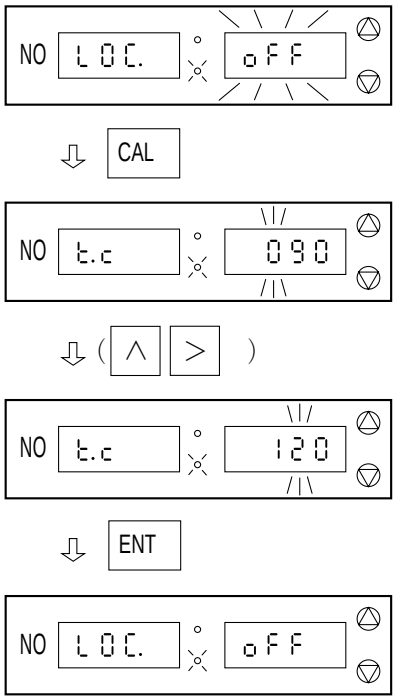
Numerical value (1 to 199, O_2: 1 to 49) is set from the top digit displayed by the flicker of sub display lamp.

90% response time (electric system) ≒ 0.22 × (1 to 199) sec.

Numerical value increases by pressing ∧ key.

Digits are selected by pressing > key.

After setting the response time, press ENT key.



4.2.2 O_2 conversion reference value setting

With the "LOC." indication flashing, press the CAL key and "o2" will be indicated.

The sub indication now flashes.

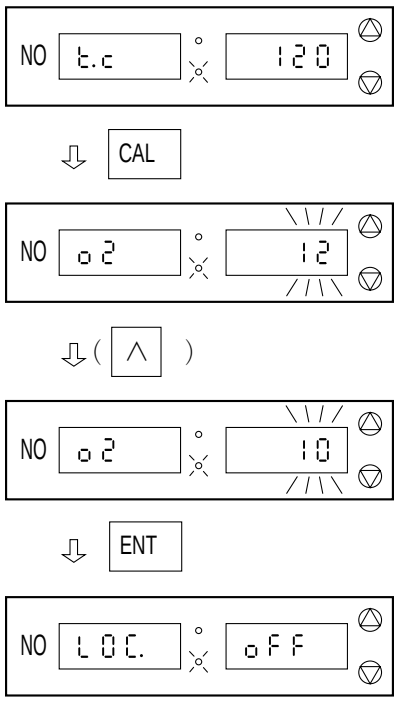
Set a reference value (0 to 19) %O_2.

Press the ∧ key and the numeric will be incremented.

Press ENT key after setting a reference value.

$$O_2 \text{ converted concentration} = \left(\frac{21 - \text{Set value}}{21 - O_2 \text{ concentration}} \right)^{\text{Note}} \times \text{NO concentration}$$

Note: The calculted value in the parenthesis is four max.



4.2.3 Optical balance adjustment

When the sample cell is reassembled after having been detached for cleaning or the like, this optical zero adjustment should be performed before use.

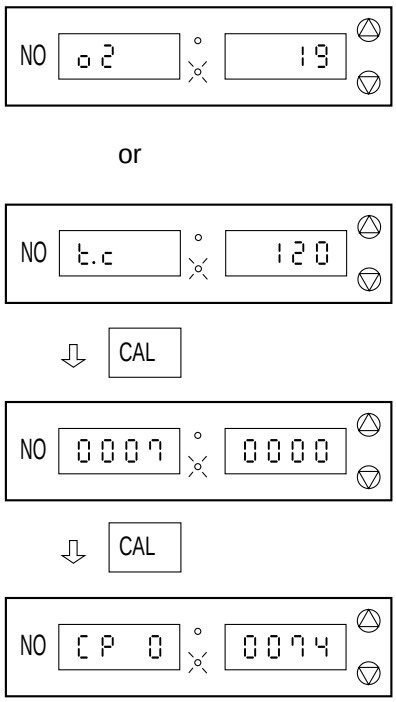
When this mode is assumed, the input signal from the measurement detector is displayed on the main indicator while the input signal from the interference compensating detector is displayed on the sub indicator.

The numerics vary in a range of -999 to 3200.

This adjustment is made so that the readings on both indicators approach zero. Refer to section 6.3 “Optical zero adjustment method” for details.

With the “t 0C.” indication flashing, press the CAL key and the input signal from the measurement detector will appear on the main indicator while the input signal from the interference compensating detector will appear on the sub indicator.

Press the CAL key after the optical balance adjustment.



CAUTIONS

A mistake in this adjustment will cause problems in measurement.

4.2.4 Interference compensation coefficient setting

This is used for adjusting the interference compensation when there is much interference. In this mode, adjust so that an indicated value is within 2% of gas concentration of full scale while flowing interference gas (0°C or 2°C saturated H_2O). Refer to section 6.4 "Interference compensation adjusting method" for details.

With the "LOC." indication flashing, press the CAL key and "CP" will be indicated. Main display lamp "CP" flickers.

(The compensation coefficient is the lower two digit on the main indicator and a value within -32768 to 32768 on the sub indicator.)

(The lower 2nd digit of main display is negative symbol.)

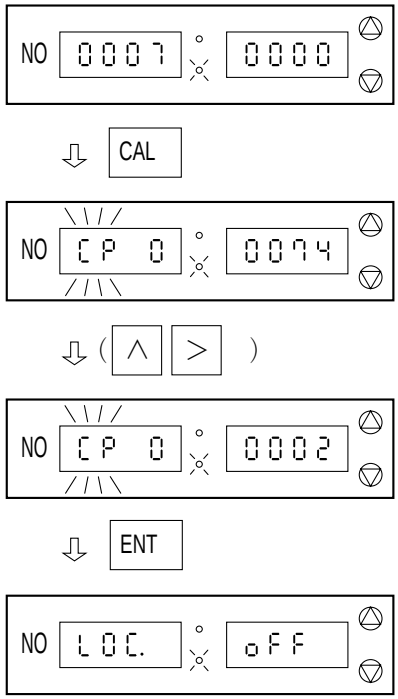
Press the COMP key to select the desired component.

Set the compensation coefficient.

Press the ∧ key and the numeric will be incremented.

Press the > key and the numeric will be decremented.

Press ENT key after setting the compensation coefficient.



Note) In case the sub indication is a "–" one, the device operates reversely.

CAUTIONS

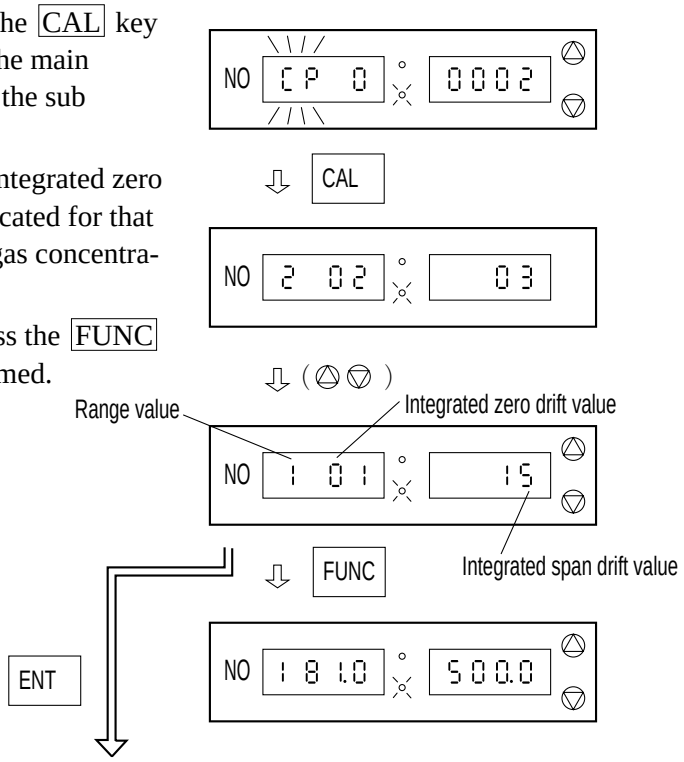
A mistake in this adjustment will cause problems in measurement.

4.2.5 Indication and clearing of integrated drift value

When the "LOC" indication flashing, press the CAL key and indicate the zero point drift amount on the main indicator and the span point drift amount on the sub indicator for each component.

Select the range with the △ ▽ keys and the integrated zero point and span point drift values will be indicated for that range. (The indication is a % indication of gas concentration of full scale.)

When the integrated drift value appears, press the FUNC key and the measurement mode will be resumed.



Zero clearing

Carry out zero clearing after cleaning the sample cell. When the integrated drift value appears on the indicator, press the ENT key and the integrated zero point and span point drift values will be cleared to zero for each component and each range. The indicator will then display "LOC".

4.3 Parameter input setting

When the detector or main printed circuit board is replaced, each characteristic data should be set in this mode.

Since the instrument may not be normally operated unless each parameter is properly set, utmost care should be exercised about this setting. For key operations other than this item, see the TD524500.

(1) Role of each mode

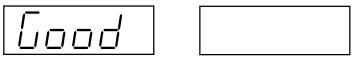
Mode No.	Item
1 to 5	Refer to TD524500.
6	Setting of interference compensation coefficient (Refer to 4.3.1)
7 to 13	Refer to TD524500.
14	(Zero, Span) adjustment of external output signal (Refer to 4.3.2)
15 to 16	Refer to TD524500.
17	Lamp test (Refer to 4.3.3)
18	Reset (Refer to 4.3.4)
19 to 21	Refer to TD524500.
22	Error function ON/OFF (changeover in adjustment) (Refer to 4.3.5)

CAUTIONS — **Never perform this operation!!**

Do not turn ON the power while pressing the △ and ▽ keys, as the parameter mode is completely cleared.

This instrument is provided with a function of all clearing the parameter mode. If the following operation is made, the Q21 (E^2PROM) on the main printed circuit board 1 must be replaced.

When the power supply is started up while pressing the △ + ▽ keys, the following display appears.



The program corresponding to this function (the version name printed on Q19 and Q20 on the main printed circuit board)

TK7F0633	~C	For standard type	In case of without option mean value or 1H
TK4F0479	~C		Incase of option mean value 4H
TK7C8148	~U	For sample switching	In case of without option mean value or 1H
TK7D8333	~G		Incase of option mean value 4H

(The all clear function is deleted in the programs after the above-mentioned programs.)

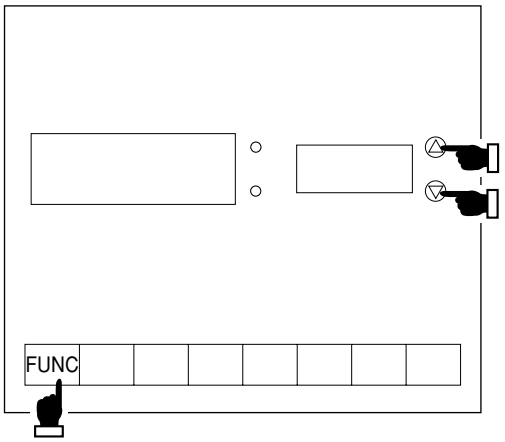
(2) How to set the parameter setting mode

The parameter mode consists of an adjustment mode 1 and adjustment mode 2.

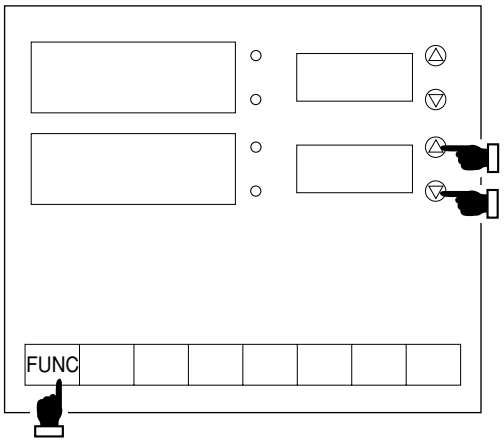
The operating method for the adjustment mode 2 (mode 6, 14, 17, 18, 22) is described in this manual. (For the adjustment mode 1, see the TD524500.)

This mode can be set from any position of the user mode by pressing the following three keys (☚) simultaneously.

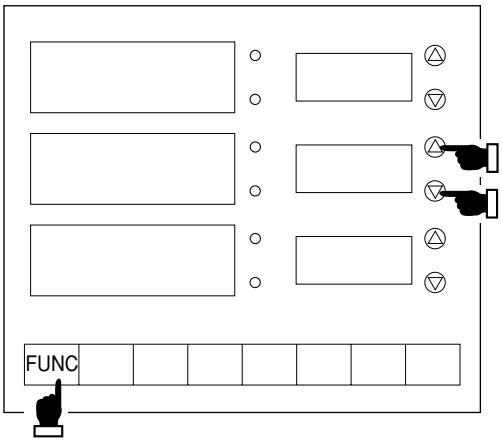
In case of one-component analyzer

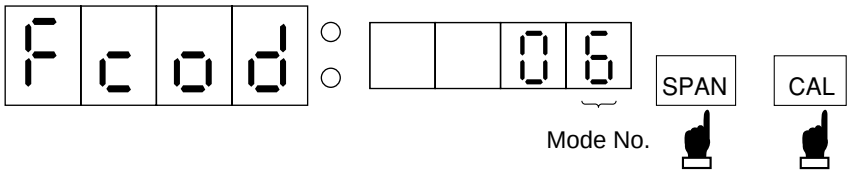


In case of two-component analyzer



In case of three-component analyzer





① When this mode is set, the indication shown to the left.

② Select the mode No. to be set, using the SPAN or CAL key.

SPAN key : No. up CAL key : No. down

Don't press any key other than the above keys.

4.3.1 Mode 6 (interference correction coefficient setting)

It this mode, the moisture interference correction coefficient can be set every component. This is a coefficient by which the component side signal is to be multipled. This setting should be done so that the influence of an interference gas may be lessened within the specification when it flow actually.

This mode is not used in actual adjustment, but interference adjustment is made, using the maintenance mode mentioned separately, and coefficient set there can be read by this mode. (Desired coefficient : 0.5 to 1.8)

After the parameter mode is set, press the ENT key, and the indication will be changed over.

Select in component to be set by the COMP key . (This procedure need not to be taken in case of the one-component.)

(The indication of the settable component flickers.)

Change the set value of the correction coefficient by the following keys.

SPAN key : The correction coefficient is incremented by 0.001.

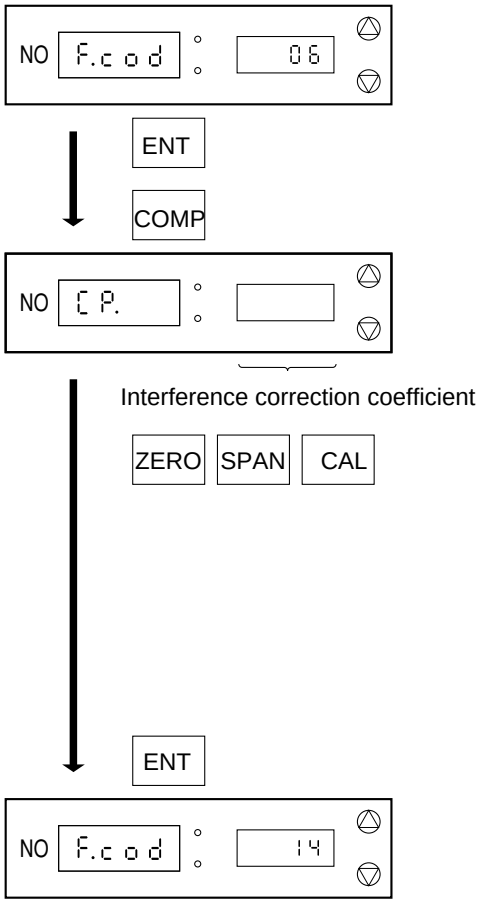
CAL key : The correction coefficient is decremented by 0.001.

SPAN key + ZERO key
: The correction coefficient is incremented by 0.050.

CAL key + ZERO key
: The correction coefficient is decremented by 0.050.

(Press them simultaneously.)

Press the ENT key, and the data will be stored.



4.3.2 Mode 14 (adjustment of output signal)

In this mode, the output signal value can be set and adjusted.

Press the ENT key, and the indication will be changed over.

Connect a digital voltmeter or ammeter to the terminal block of the output to be adjusted.

Adjust the output signal value at the zero point by the SPAN key or CAL key.
(The adjusted value should be within ±0.1% of the full scale output.)

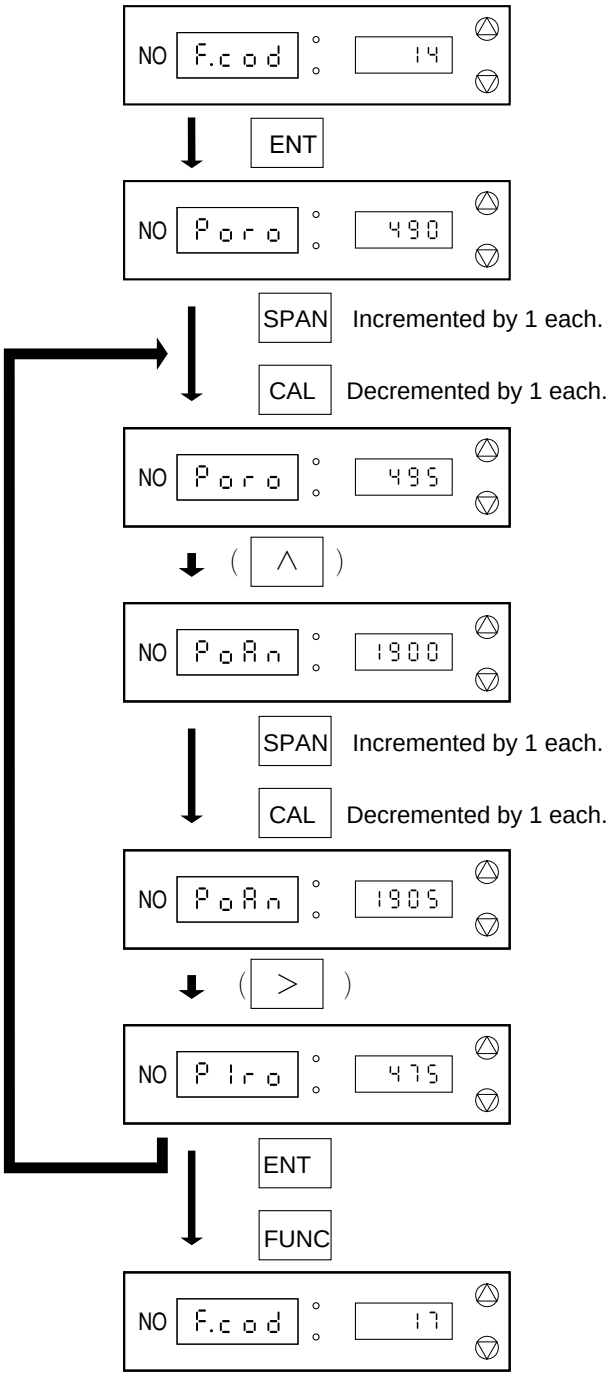
Press the ∧ key to change over the indication.

Next, adjust the output signal value at the span point by the SPAN key or CAL key.
(The adjusted value should be within ±0.1% of the full scale output.)

Press > key, and each output terminal No. will be changed over. Similarly, adjust the zero and span points of each output terminal No.

Press the ENT key to stored the data.

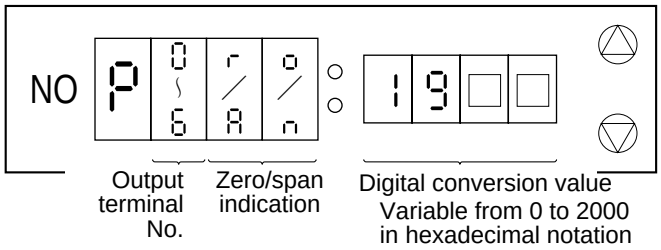
Next, press the FUNC key, and the indication will be changed over the mode 17.



The key functions to be used for adjustment are as follows.

When the SPAN key is pressed, the value is incremented by 1, and the output value is also increased.
When the CAL key is pressed, the value is decremented by 1, and the output value is also decreased.
When the ZERO key and SPAN key are pressed simultaneously, the output value is increased more speedily.
When the ZERO key and CAL key are pressed simultaneously, the output value is decreased more speedily.

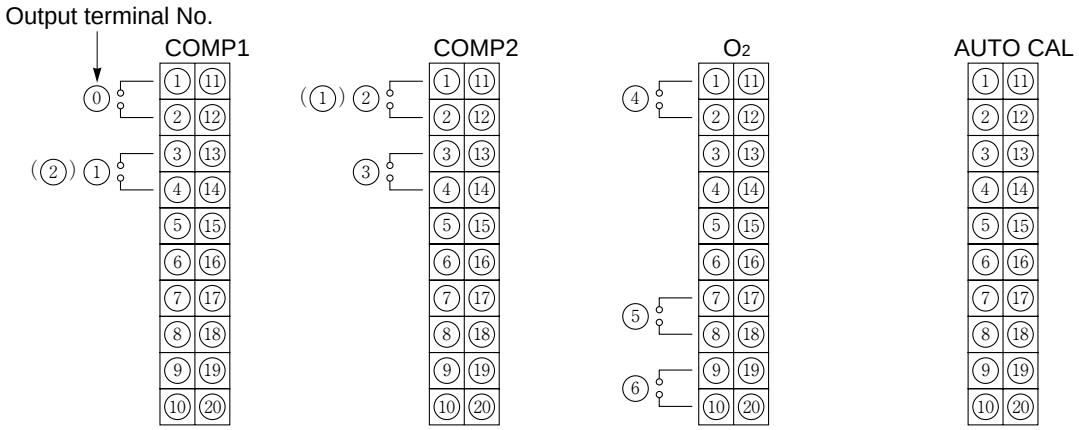
The contents of the indication are shown below.



Comparison between each component and output terminal No.

For the contents of each output, see section 3.3.2 to 3.3.5.

Figure in parentheses ( ) denotes the output terminal No. of the one-component or one-component + O_2 analyzer of flow differential type, sample switching type.

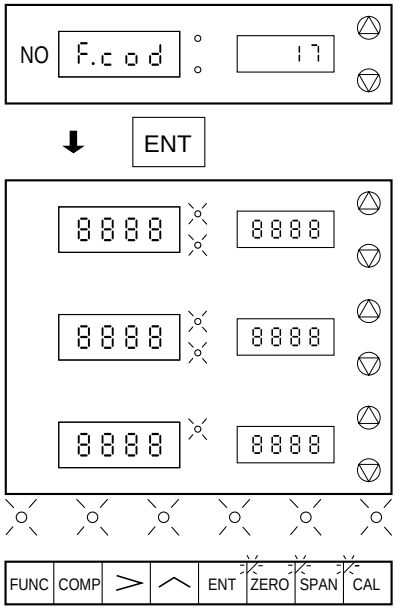


Note) When option function is not provided, the digital conversion value is displayed as 0000 at zero point and 1000 at span point.

4.3.3 Mode 17 (lamp test)

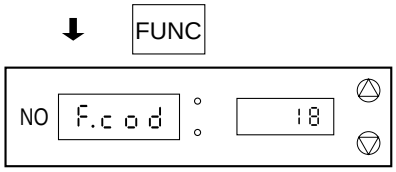
In this mode, each LED lamp is tested.

Press the ENT key, and all LED lamps will light.



(In case of three-components indication)

Press the FUNC key, and the indication will be changed over to mode 18.



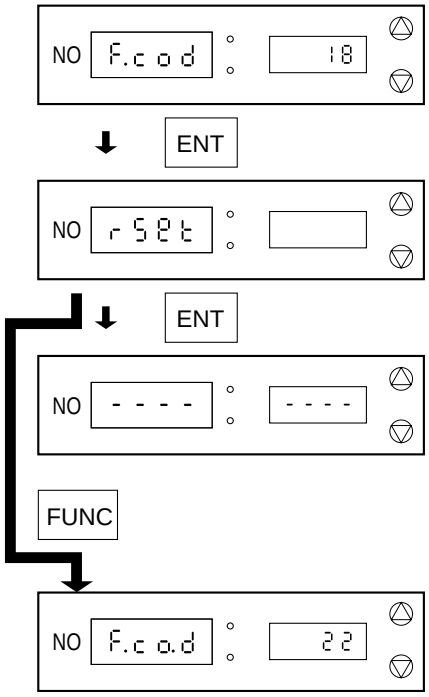
4.3.4 Mode 18 (reset)

This mode is used when the parameter mode is reset to the user mode.

Press the ENT key, and " rSEt " will be indicated.

Press the ENT key again, and the parameter mode will be reset to the measurement mode (user mode).

When no reset is executed, press the FUNC key, and the indication will be changed over to the mode 22.

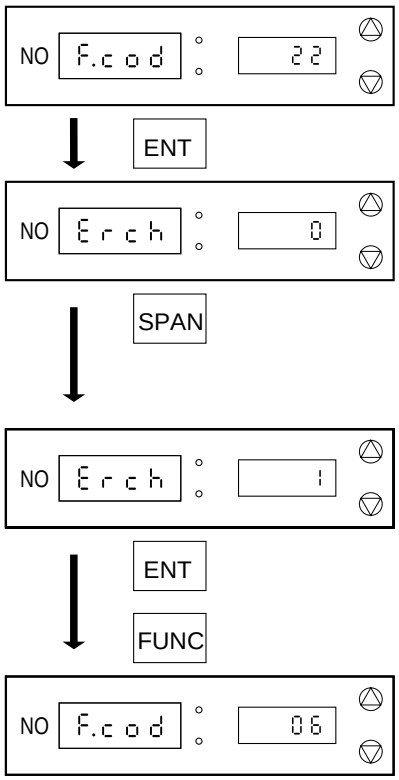


4.3.5 Mode 22 (ON/OFF error function)

This mode is used to reset the error restriction during adjustment.

However, E-0 to E-3 cannot be reset.

The data set in this mode becomes error ON (with function provided) without fail when the power supply is turned OFF.



Press the ENT key, and the indication is changed over to "Erch".

Press the SPAN key to select "0 " or " 1 ".

"0" and " 1 " are changed over to each other alternately every time the SPAN key is pressed.

Press the ENT key , and the data will be stored.

Press the FUNC key , and the indication will be changed over to the mode 6.

"0"	:	The error function is provided.
" 1 "	:	The error function is reset.

CAUTIONS

Programs after 96-01-31 (after program history No. TK7F0479G and TK7F0633G) have an additional function of zero display by masking the minus sign. In this mode, the masking function is cleared by setting "1".

5. INSPECTION

DANGER

- When doors are open during maintenance or inspection for adjusting the optical system, etc., be sure to purge sufficiently the inside of the gas analyzer as well as the measuring gas line with nitrogen or air, in order to prevent poisoning, fire or explosion due to gas leaks.

CAUTIONS

- Before working, take off a wrist watch, finger ring or the like metallic accessories. And never touch the instrument with a wet hand, Otherwise, you will have a shock hazard.
- 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.
- Do not use a replacement part other than specified by the instrument maker. Otherwise, adequate performance will not be provided. Besides, an accident or fault may be caused.
- Replacement parts such as a maintenance part should be disposed of as incombustibles.

Perform the daily check and routine check in accordance with the following checking table.

Checking Table

	Checking portion	Symptom	Cause	Remedy
Portions to be checked everyday	Recorder indication	Abnormal increase or decrease of indicated value	1) Dust is contained in sample cell. 2) Air is absorbed on the coarse of sampling piping	1) Clean sample cell, and at the same time, check sampling device, particularly, gas filter. 2) Find out leak from sampling line, and repair it.
	Flow rate of sample gas (Including flow rate of purge gas when internal purge is per-formed)	Deviated from standard flow rate of 0.5 ±0.25 ℓ / min.		Adjust by needle valve of flow rater.
	Check monitor filter (menbrane filter)	Greatly contami-nated.	Damage to primary filter, etc.	1) Replace primary filter. 2) Replace filter.
Portions to be checked weekly	Zero point of analyzer	Deviation of zero point		Zero point adjustment
	Span point of analyzer	Deviation of standard point		Span adjustment
	Replacement of monitor filter (membrane filter)	Irrespective of symptom		Replace filter.
Portions to be checked every three months	Cleaning of sample cell	Irrespective of symptom		Clean sample cell. (Use furnished sample cell cleaning cloth for cleaning.)
Portions to be checked yearly	Analyzer	Irrespective of symptom		Overhaul
	Output of analyzer	After overhaul		Instrument error test

6. MAINTENANCE

If dust or water drips get in the measurement cell, its interior is contaminated and a drift may occur. Since an error code is indicated if measurement or calibration is disabled, check if the measurement cell is contaminated. When its is contaminated, clean it in the procedure given in this chapter.

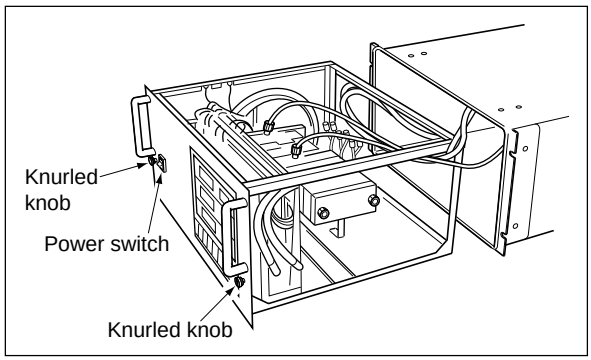
At the same time, check the sampling devices, particularly, the filter to prevent the cell interior from being contaminated by dust, mist or the like.

6.1 How to clean sample cell (pipe cell)

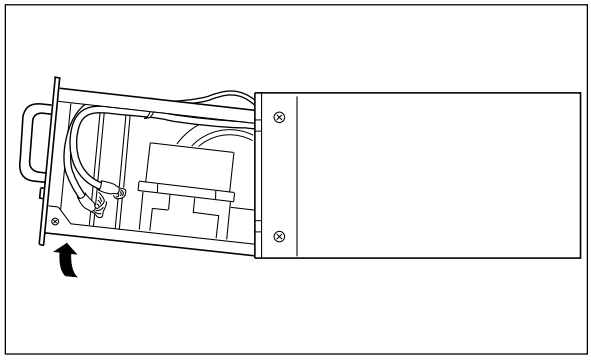
This unit is strictly adjusted prior to delivery from the factory, and special care should be taken when handling it.

(1) To purge the sample cell, turn off the power switch and stop the flow of sample gas and flow zero gas for a few minutes.

Loosen the knurled knobs (2 pieces) on the front panel and pull out the analyzer interior by means of the grips.



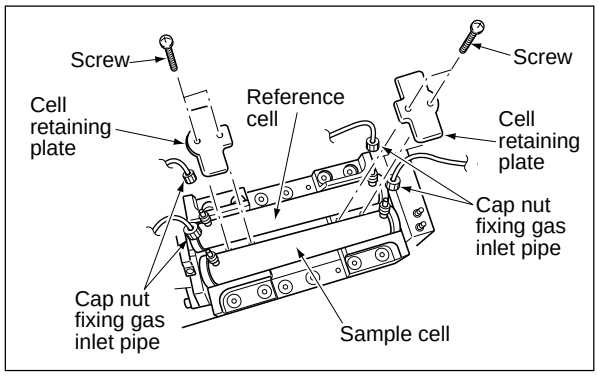
General maintenance and inspection are to be performed under the conditions shown above. If it becomes necessary to completely remove the main unit, lift up the front of it and pull it out toward you. At this time, it should be noted that the piping and wiring are exposed at the same time.



(2) Loosen the cap nuts fixing the gas inlet pipe, and detach the internal gas inlet pipe.

(3) Remove the screws from the left and right cell retaining places.

- In the case of the sample switching type, remove both the sample and reference cells.
- With the standard type, remove only the sample cell.



(4) For cleaning the infrared-ray transmitted window and cell interior, first remove heavy contamination with a soft brush or the like, then wipe lightly with a soft cloth.

Be especially careful when cleaning the window since it is easily scratched.

(5) When cleaning of the sample cell is finished, then reassemble the cell in its original position.

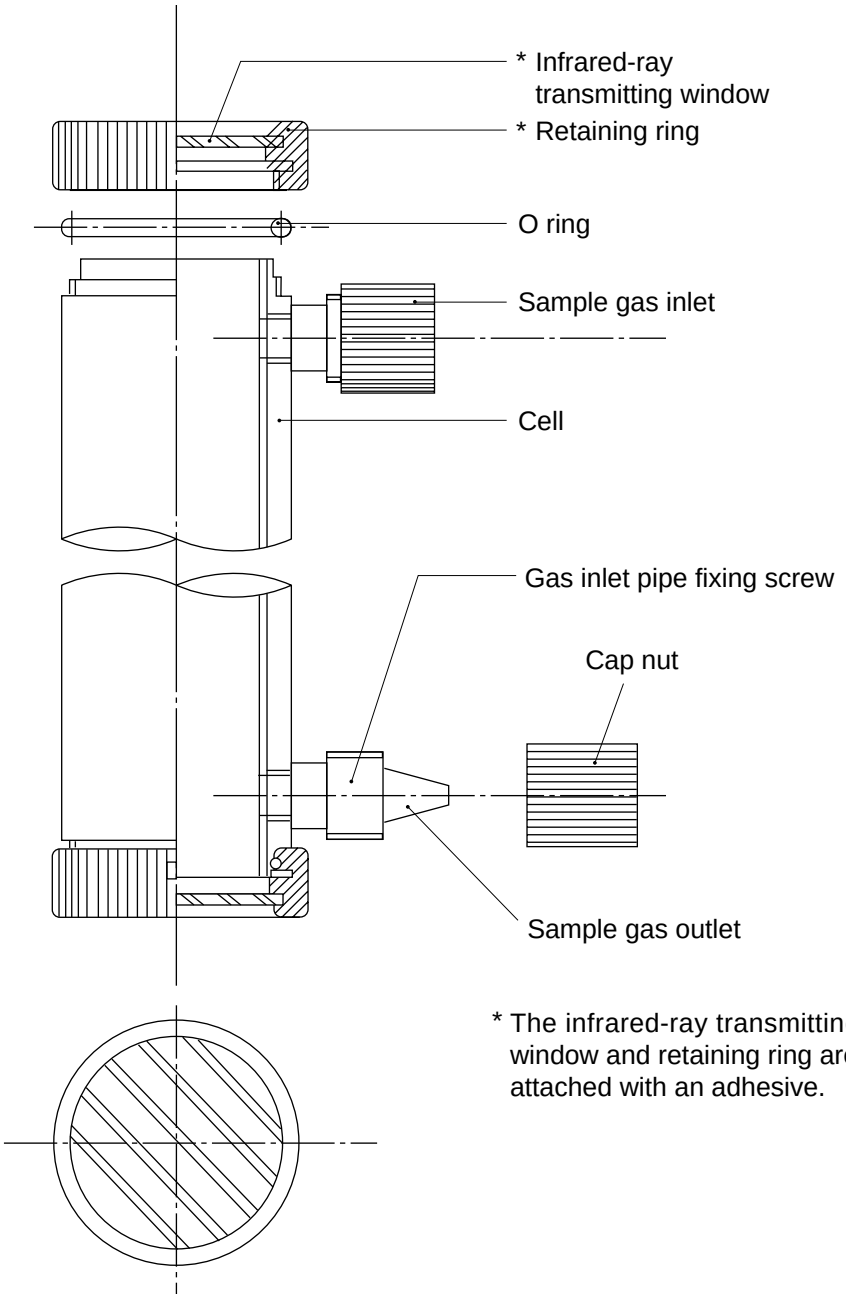
If the zero point has deviated considerably when operating again, select a low range and carry out optical zero adjustment (see section 6.3).

Also, the drift integrated value should be cleared (see section 4.2.5).

CAUTION

If the infrared-ray transmitting window is only lightly contaminated, it can be cleaned by wiping lightly with the soft cloth to which chrome oxide powder is added. But if heavily contaminated, the window must be replaced.

Be careful not to apply unreasonable force when cleaning.

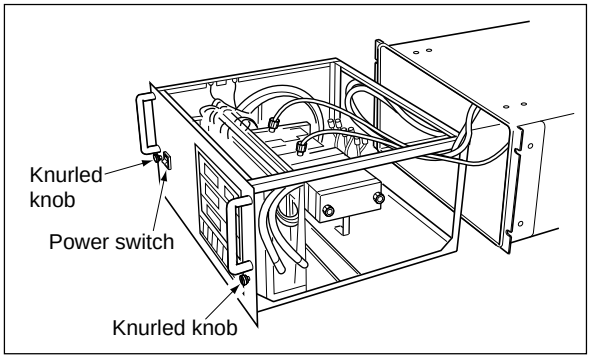


Sample cell structure

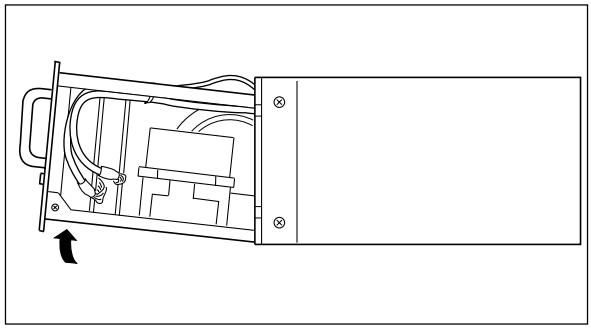
6.2 How to clean sample cell (block cell)

(1) Turn off the power switch, stop the flow of sample gas and flow zero gas for a few minutes.

Loosen the knurled knobs (2 pieces) on the front panel and pull out the analyzer interior by means of the grips.



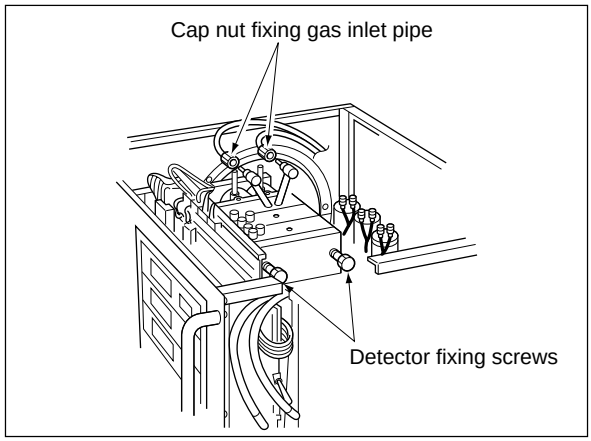
General maintenance and inspection are to be performed under the conditions shown above. If it becomes necessary to completely remove the main unit, lift up the front of it and pull it out toward you. At this time, it should be noted that the piping and wiring are exposed at the same time.



(2) Loosen the cap nuts fixing the gas inlet pipe and remove the internal gas inlet pipe.

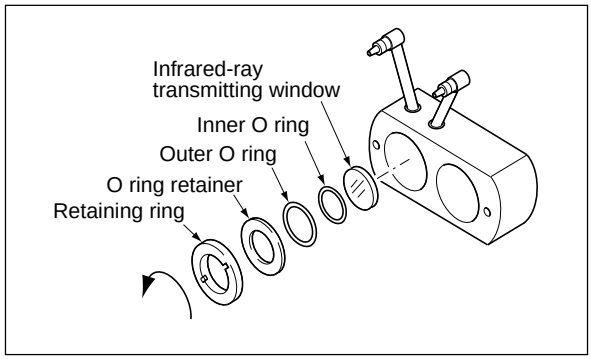
(3) Remove two detector

Note: Be careful since the distribution and block cells are fixed together with the detector.



(4) Using the furnished cell assembly tool, turn the retaining ring leftward and detach it from the cell.

Refer to the next page.



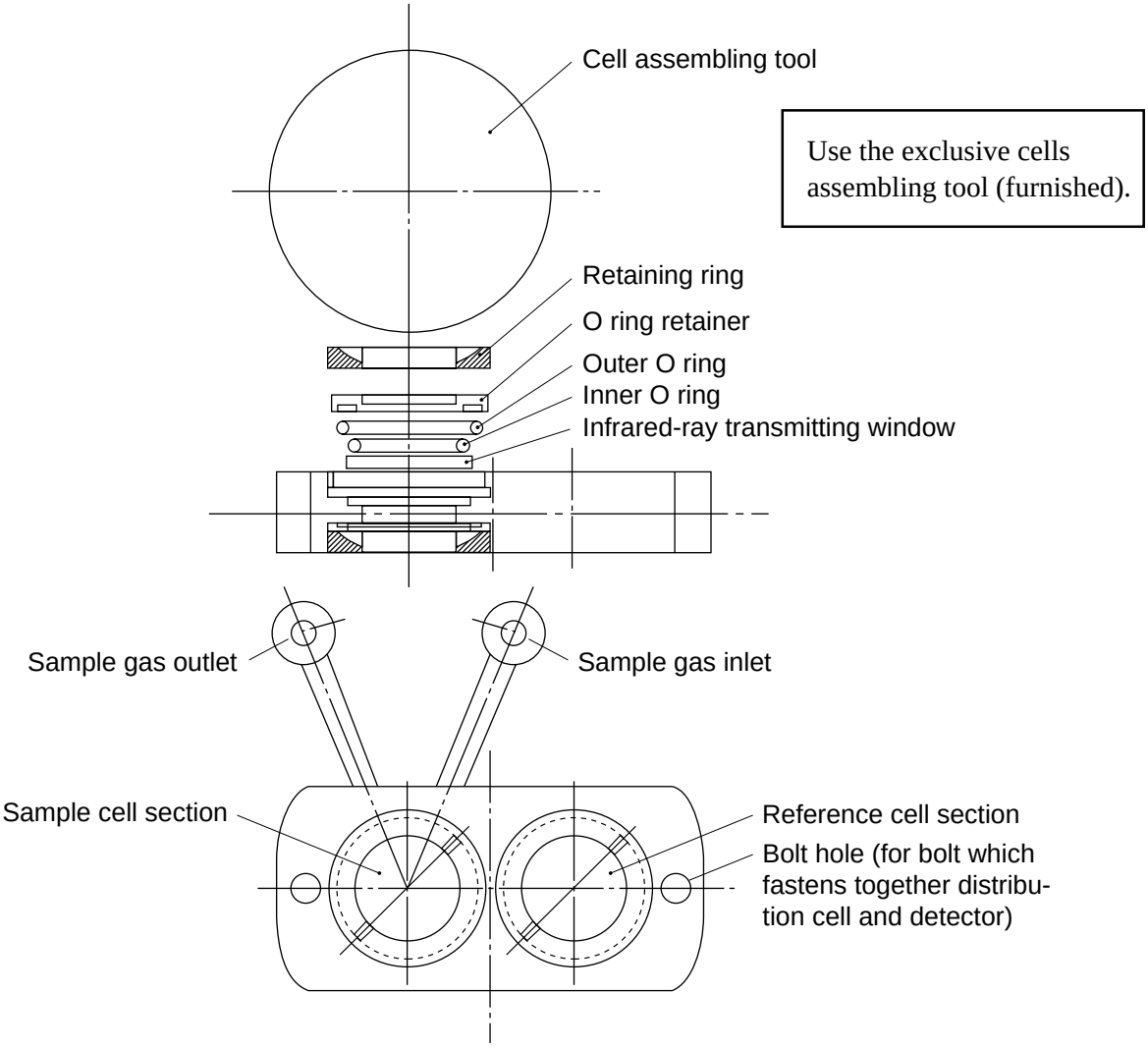
(5) For cleaning the infrared-ray transmitting window and cell interior, first remove heavy contamination with a soft brush or the like, then wipe lightly with a soft cloth.

Be especially careful when cleaning the window since it is easily scratched.

CAUTION

If the infrared-ray transmitting window is only lightly contaminated, it can be cleaned by wiping lightly with the soft cloth to which chrome oxide powder is added. But if heavily contaminated, then the window must be replaced.

Be careful not to apply unreasonable force when cleaning.



Sample cell structure (for cells with length of 32, 16, 8, 4, 2mm)

(The sample cell and reference cell are integral.)

Sample cell structure (block cell)

6.3 Optical zero adjustment method (optical balance method)

When the sample cell is reassembled after having been removed for cleaning or the like, this adjustment should be carried out before use. Following is the adjustment procedure.

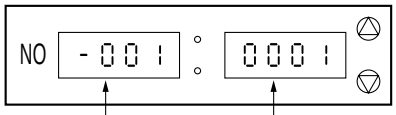
(1) First carry out electrical zero adjustment.

With the power turned off, detach the connectors CN2 and 3 (for 1st component) and CN4 and 5 (for 2nd component) leading from the detector which are connected with the main PCB (2).

Next, turn on the power and calibrate the zero point using ZERO and CAL keys.

(2) Turn off power, connect the connectors CN2 and 3 (1st component) and CN4 and 5 (2nd component), and turn on power again. Supply dry nitrogen from the sample gas inlet and wait until the indication stabilizes.

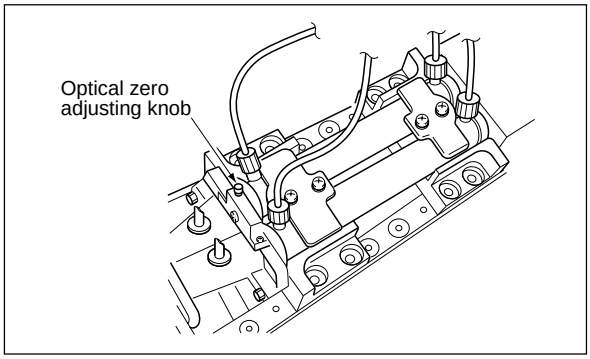
(3) Set up the optical zero adjustment mode as in section 4.2.3. The following indications will appear on the main and sub indicators of the analyzer front panel.



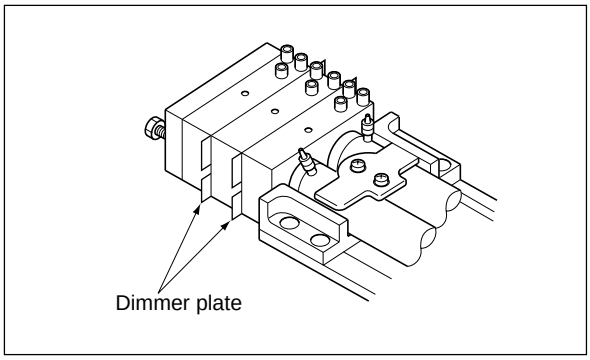
Main indicator: Input signal from measurement detector

Sub indicator: Input signal from interference compensating detector

(4) Operate the optical zero adjusting knob so that the numeric value on the main indicator approaches zero.



(5) Operate the dimmer plate so that the numeric value on the sub indicator approaches zero.



(6) Repeat steps (4) and (5) to bring the numeric values on the main and sub indicators as close to zero as possible.

⚠ CAUTIONS

A mistake in this adjustment will cause problems in measurement.

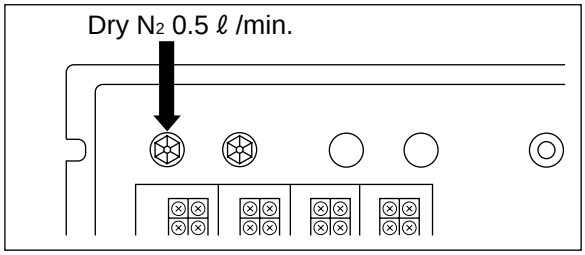
6.4 Interference compensation adjusting method

> Since this adjustment requires highly trained technique, please contact Fuji if it becomes necessary.

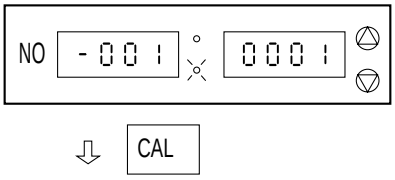
Adjust the interference compensation if the effect of interference is large (more than ±2%FS of full scale).

(1) After warming up the instrument, supply dry N_2 at a rate of 0.5 ℓ /minute from the sample gas inlet.

(With the flow differential system, supply dry nitrogen continually to the reference cell.)



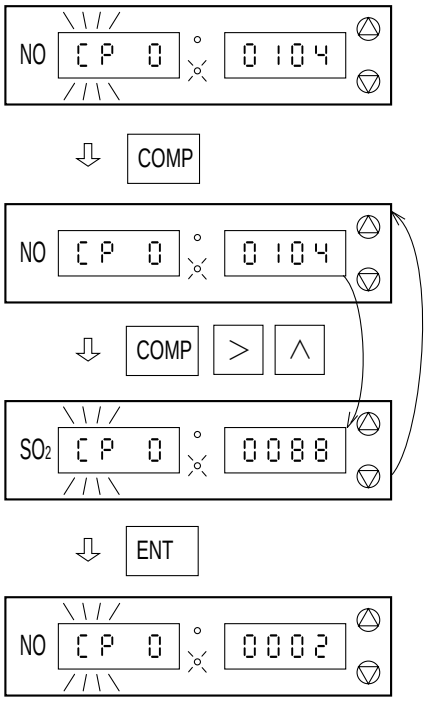
(2) After indication is stabilized, carry out zero calibration using the ZERO and CAL keys.



(3) Set up the interference compensation setting mode as in section 4.3.1.

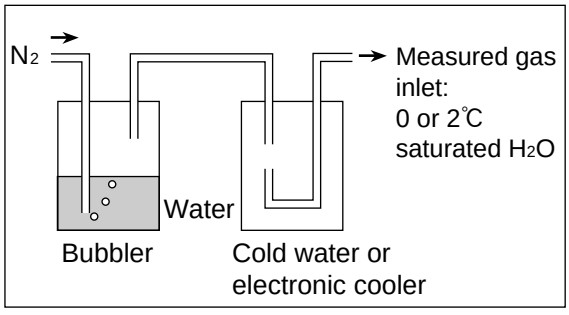
"C P" will appear in the upper two digits of the main indicator on the front panel while a total of 5 numerals will appear in the lower digit of the main indicator plus the four digits of the sub indicator.

(A negative sign appears in the second lowest digit of the main indicator.)



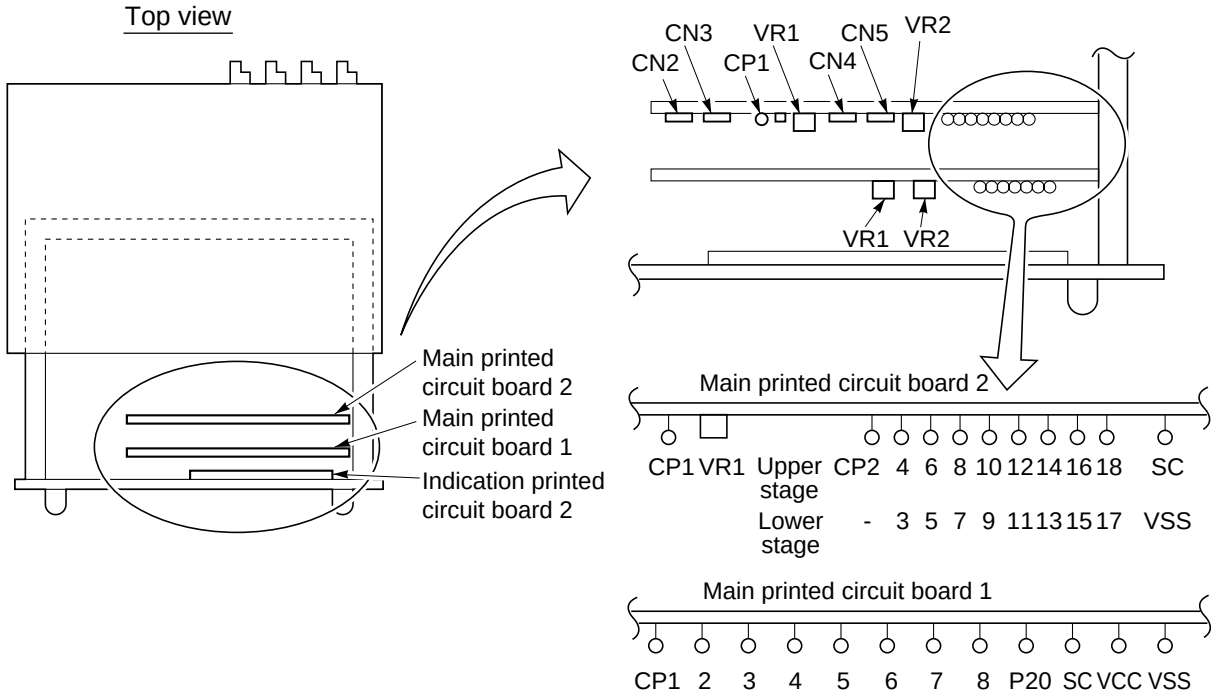
(4) Feed interference gas (saturated H_2O at 0°C or 2°C) as illustrated. When the indication is stabilized, press COMP key and select the component to be adjusted, then adjust it until the indicated value becomes almost 0 within 2% of the full scale, using > key and ^ key.

(5) After the adjustment is finished, press ENT key to record the data in memory.



6.5 Power source voltage adjustment

The check and adjustment variable resistor are shown in the following figure.



(1) Turn ON the power switch.

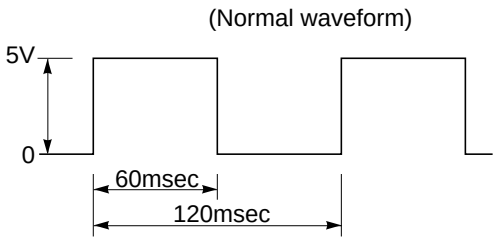
(2) Adjust VR1 until the voltage between the check terminals P20 and SC on the main printed circuit board 1 is 20.00 ±0.05V.

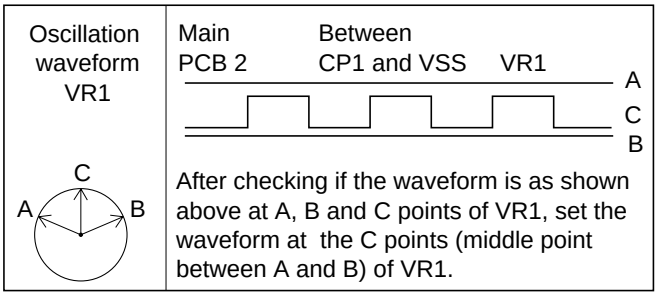
(3) Adjust VR2 until the voltage between the check terminals VCC and VSS on the main printed circuit board 1 is 5.00 ±0.05V.

(4) Adjust VR2 until the voltage between the check terminals CP2 and SC on the main printed circuit board 2 is 5.00 ±0.05V.

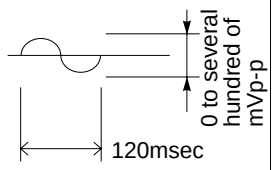
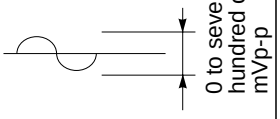
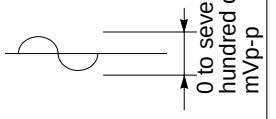
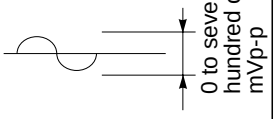
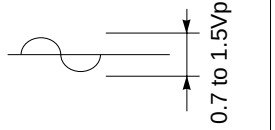
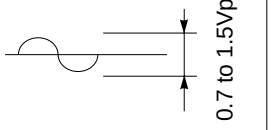
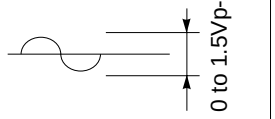
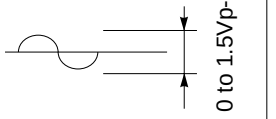
(5) Connect a synchroscope between the check terminals CP1 and VSS on the main printed circuit board 2, and adjust VR1 until the voltage having the following waveform is obtained.
If this signal is interrupted, E-3 error occurs, and the indication do not flicker during various setting operations.

Note) If the following waveform is not obtained, the capacity of C30, C31, C100 or C101 should be changed.





(6) Check the input signal waveform at each point by the synchroscope.
For the check terminals, use the individual terminals on the main printed circuit board 2.
(The peak-to-peak value of the signal voltage changes, depending upon the measured component, and range.)

	First component		Second component	
	CP7-SC	CP10-SC	CP9-SC	CP12-SC
Zero				
Span		Same level as in zero gas between CP10 and SC		Same level as in zero gas between CP12 and SC
H_2O 2℃ saturation		Same level as in H_2O between CP7 and SC		Same level as in H_2O between CP9 and SC

7. REPAIR

If the analyzer does not operate normally, the following causes are assumed, so proceed with checking according to the individual items. When making repair, never give shocks to the gas-seal pipes (2 pipes) provided at lower part of the detector, nor exert an unreasonable force to them.

7.1 Infrared light source unit

Fault : Disconnection or deterioration of the infrared light source, or leak of seal gas.

Check :
(1) Check if the infrared supply voltage is 20 ±0.2V DC between ① and ② on the sector cover terminal block. If not, check the power supply voltage on the main printed circuit board (see section 6.5).
(2) Disconnect the light source terminals from the sector cover terminal block, and check its resistance value. The resistance value should be approx. 18Ω. If this value deviates greatly, the light source may be deteriorated or disconnected. Replace the light source.

Replacement :
(1) Disconnect the light source terminals from the sector cover terminal block, and remove the light source unit mounting screws (2pcs), then light source will be able to be replaced. See Fig. 7-3.
After replacement is finished, make the optical zero adjustment in accordance with section 6.3.

7.2 Detector unit

Fault : Disconnection of the mass flow sensor, or leak of detector seal gas.

Check :
(1) Confirmation of detector supply voltage
Check the voltage between pins ① and ④ of each connector of CN2 to CN5 on the main printed circuit board 2 (see Fig. 7-1). The normal voltage should be within 18±0.3V.
(2) Confirmation of disconnection of mass flow sensor
Decouple each connector of CN2 to CN5 from the main printed circuit board, and check the resistance values between pins ② and ④ , and between pins ③ and ④ (see Fig. 7-1). The normal value of each resistance should be within 25 to 50Ω.
(3) Leak of detector seal gas
After the confirmation (1) and (2) are finished, take out the detector, and check the gas-seal pipes, and window for scratches or contamination, etc.

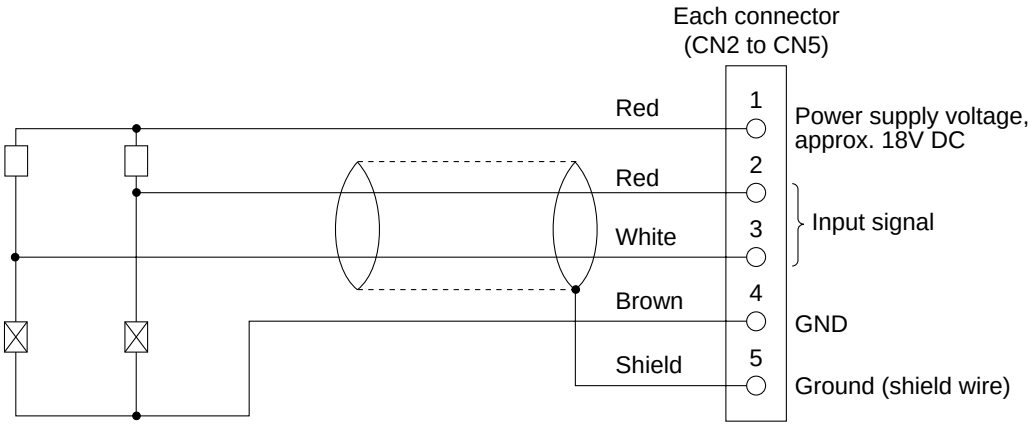


Fig. 7-1

Replacement : The douser, interference compensation detector, light adjusting plate, and detector can be taken out simultaneously by removing the detector mounting bolts (2 pcs). See Fig. 7-3.
After replacement is finished, make the optical zero adjustment in accordance with section 6.3.

7.3 Motor unit

Fault : Rotation error

Check : (1) Check if the motor shaft is turning with the power supply turned ON.

(2) Turn OFF the power supply, and remove the sector cover (M4 × 4 pcs), and then make sure that the sector does not touch any other parts.
If faulty, make repair.

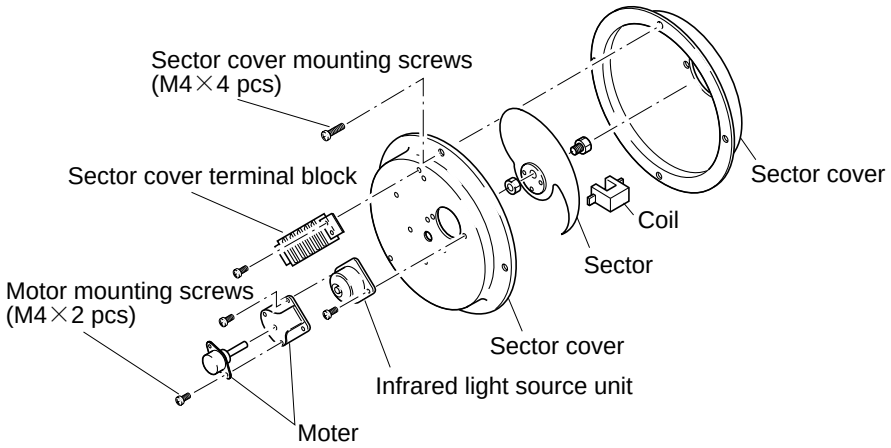


Fig. 7-2

Replacement : (1) Disconnect the motor terminals from the sector cover terminal block.

(2) Remove the motor mounting screws (M4 × 2 pcs), and replace the motor.
After replacement is finished, check the optical zero in accordance with section 6.3. If deviated greatly, make adjustment.

7.4 Distributing cell unit

Fault : Leak of seal gas

Check : Check the gas seal pipes and window for damage, scratches or contamination.

Replacement : (1) Detach the covers A and B as shown in Fig. 7-3

(2) Remove the sector cover (B) and the distributing cell mounting screws (M4 × 2 pcs), and replace the distributing cell.
Since the optical adjusting trimmer is attached to the distributing cell, attach this trimmer at the same time.
After replacement is finished, check the optical zero adjustment in accordance with section 6.3.
If the optical zero point deviates greatly, make adjustment.

7.5 Cell unit

Fault : Scratches on the window, or corrosion of cell inner faces.

Check : Make cleaning in accordance with Chapter 6 “Maintenance”. If the cell unit is corroded severely, replace it.

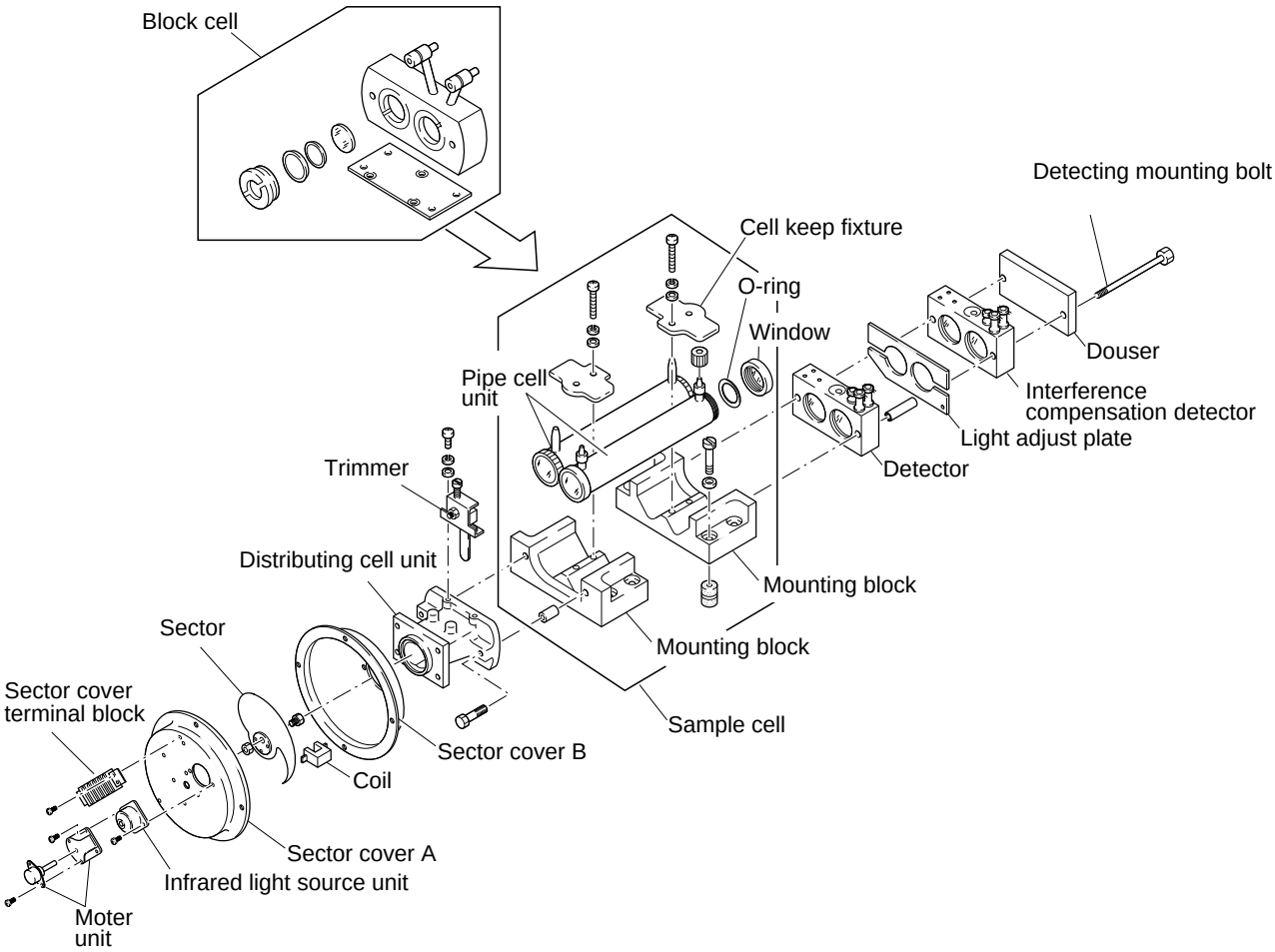


Fig. 7-3 Optical system assembly drawing

7.6 Printed circuit board unit

7.6.1 Main printed circuit board 1

Fault : Power supply voltage error, digital circuit fault

Check : Check the power supply voltage, and adjust it in accordance with section 6.5.

Replacement : The main printed circuit board 1 can be replaced by decoupling each connector and removing the PCB mounting screws (M3 × 2 pcs).
After replacement is finished, make the zero and span calibrations.
Set each parameter as required.

7.6.2 Main printed circuit board 2

Fault : Power supply voltage, sync signal, input signal, or output signal error

Check : (1) Check and adjust each of the power supply voltage, sync signal, and input signal in accordance with section 7.5.
(2) Check and adjust the output signal in the parameter mode 14 (section 4.3.2).

Replacement : The main printed circuit board 2 can be replaced by decoupling each connector and removing the PCB mounting screws (M3 × 2 pcs).
After replacement is finished, make adjustment in the parameter mode 14 (section 4.3.2).

7.6.3 Indication printed circuit board

Fault : Lighting failure of each LED or 7-segment LED

Check : Light on all LEDs in the parameter mode 17 (section 4.3.3).

Replacement : (1) Remove the connector between the main printed circuit board 1 and the indication printed circuit board, then remove the screws (M4 × 6 pcs on side and M3 × 2 pcs on bottom) holding the front panel. The front panel is now removed. Be careful with the wiring of the power switch connected to the panel.
(2) Remove the screws (M3 × 8 pcs) holding the display print panel for replacement.

7.6.4 Output printed circuit board (COMP1, COMP2, O_2, AUTO-CAL)

Fault : Relay contact fault

Check : Check the relay operation, while turning ON/OFF the relay contacts by setting an alarm or the like.

Replacement : Remove the mounting screws (M3 × 2 pcs) of the terminal block on the rear surface of the main unit, and the terminal block and output printed circuit board will be able to be replaced together.
Decouple the connectors and replace the output printed circuit board.

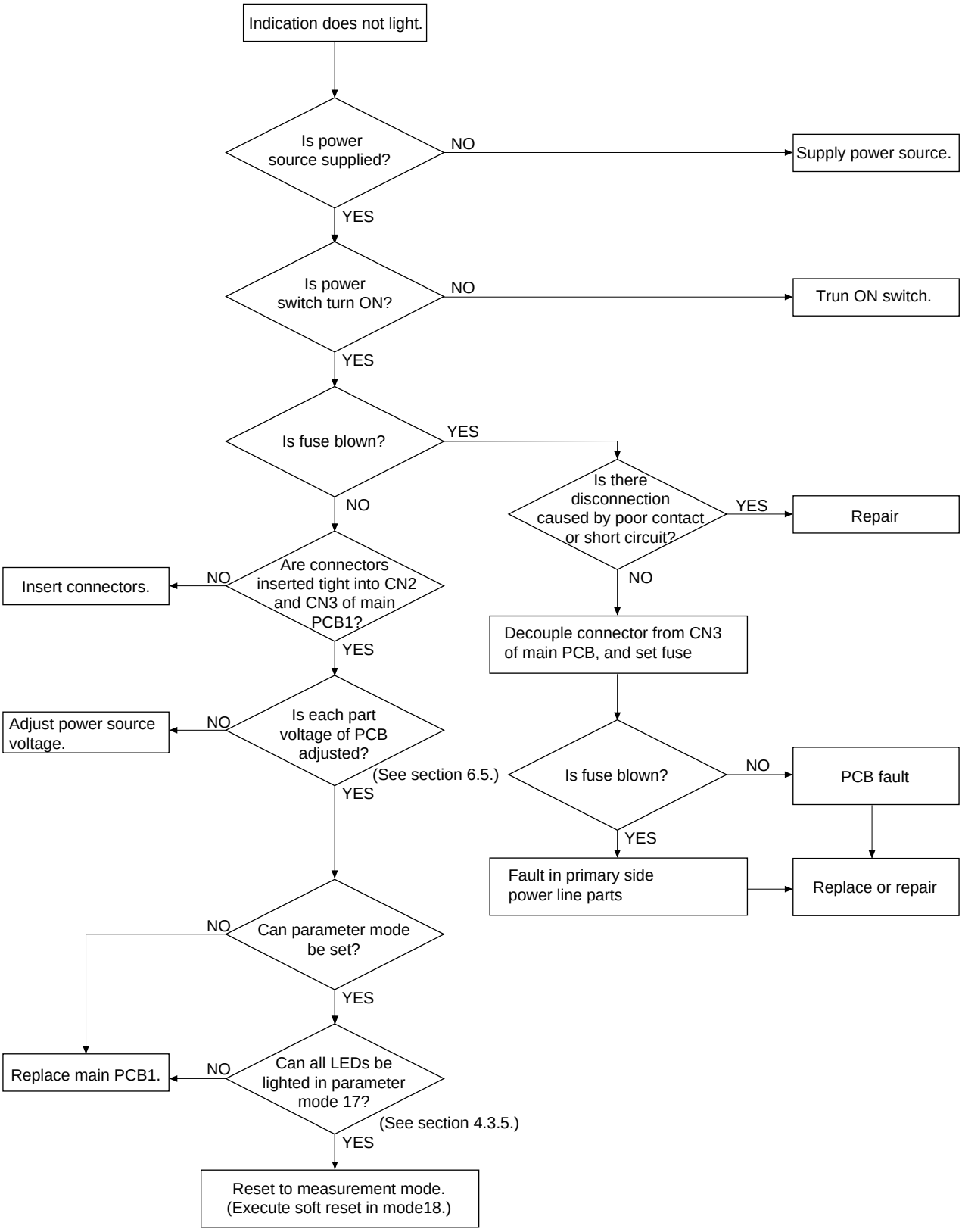
7.7 Parts to be adjusted after parts replacement (for the parts, see the parts list.)

	Replacement parts	Contents of adjustment and setting
1	Infrared light source	After balance adjustment of the optical system, make zero and span calibrations, and interference correction coefficient setting.
2	Distributing cell	After balance adjustment of the optical system, make zero and span calibrations, and interference correction coefficient setting.
3	Motor unit	After balance adjustment of the optical system, make zero and span calibrations.
4	Cell unit	After balance adjustment of the optical system, make zero and span calibrations, interference correction coefficient setting and air tight check.
5	Detector unit	After balance adjustment of the optical system, make zero and span calibrations, interference correction coefficient setting and air tight check.
6	Main printed circuit board 1	Each parameter mode is set at shipment from the factory. Check the output signal, and adjust it in the parameter mode 14 if the output value deviates. Also make zero and span calibrations.
7	Main printed circuit board 1	Check the output signal, and adjust it in the parameter mode 14 if the output value deviates. Also make zero and span calibrations.
8	Indication printed circuit board	Adjustment and setting are not necessary.
9	Output part printed circuit board for 1st component	Adjustment and setting are not necessary.
10	Output part printed circuit board for 2nd component	Adjustment and setting are not necessary.
11	Output part printed circuit board for O_2	Adjustment and setting are not necessary.
12	Output part printed circuit board for AUTO CAL	Adjustment and setting are not necessary.
13	Flowmeter, filter unit	Check for proper sealing
14	CO, CO_2 converter	Check for proper sealing

Note) If the optical system unit is detached during replacement of any parts other than the above, check the optical system balance after reattaching it.

8. TROUBLESHOOTING

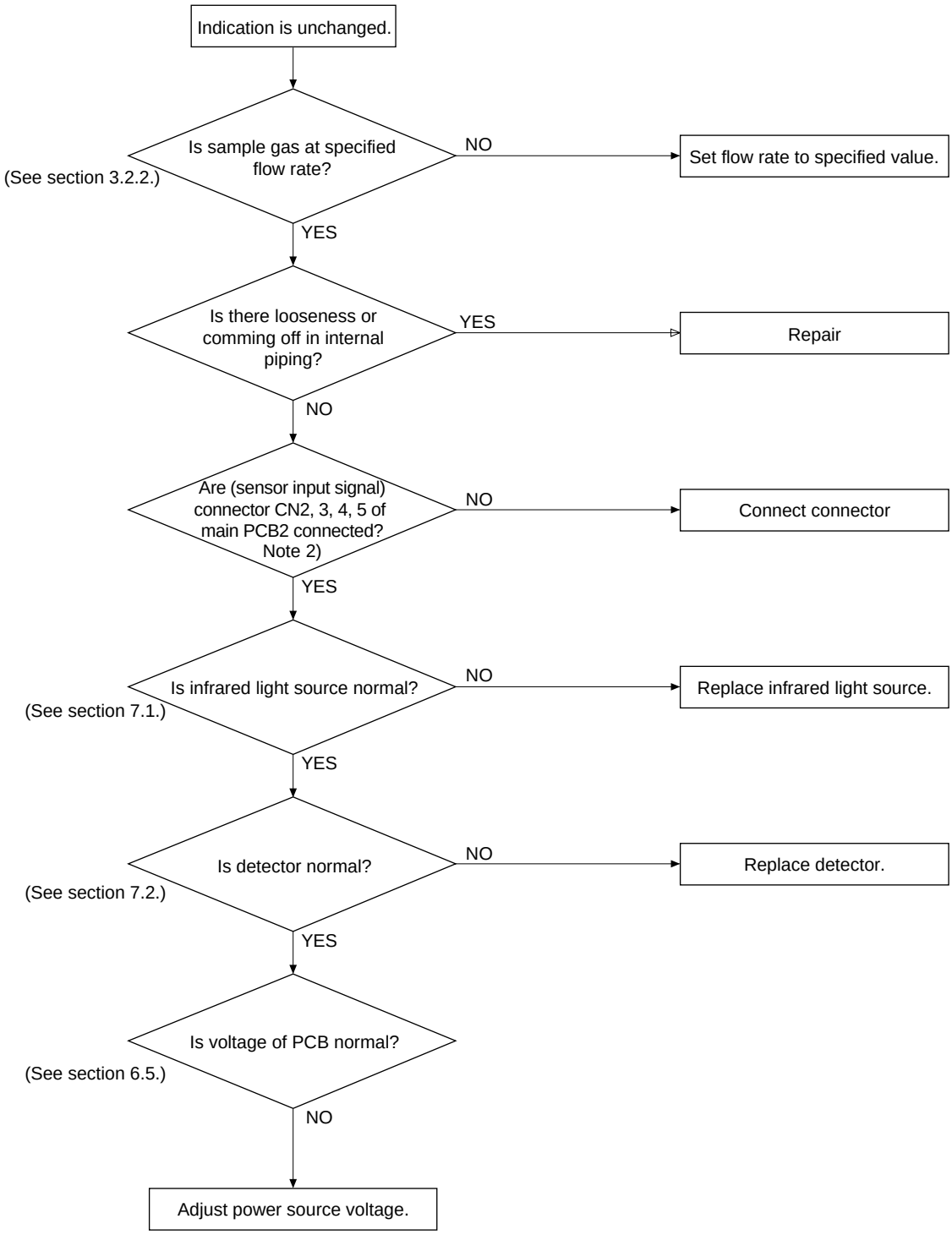
8.1 In case the indication does not light



8.2 In case the indication does not change

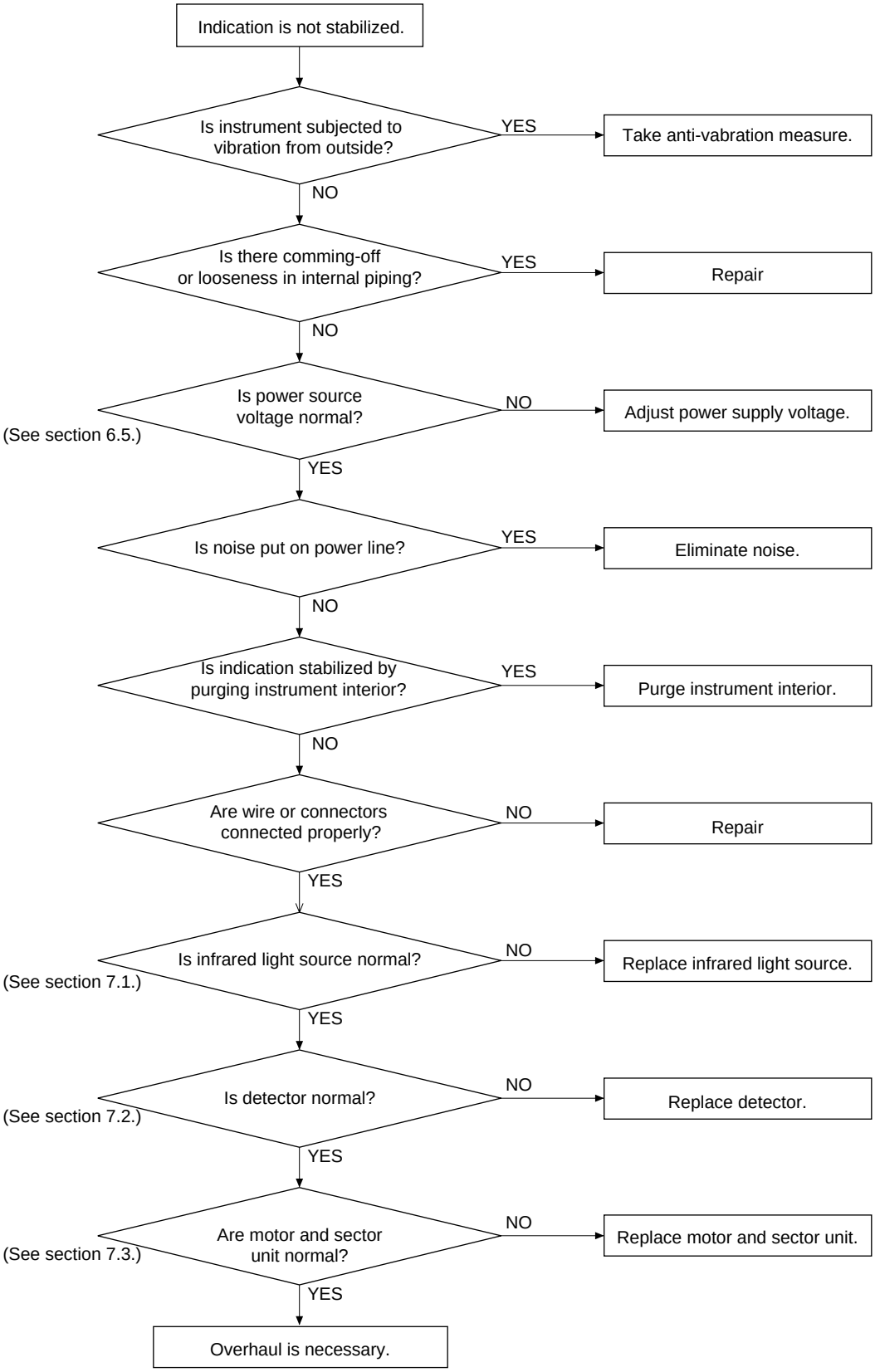
Note 1) If an error code is indicated, see the error code table (Section 9.2).

Note 2) Connect CN2, 3 only in the one-component analyzer. Connect CN2, 3, 4, 5 only in the two-component analyzer.



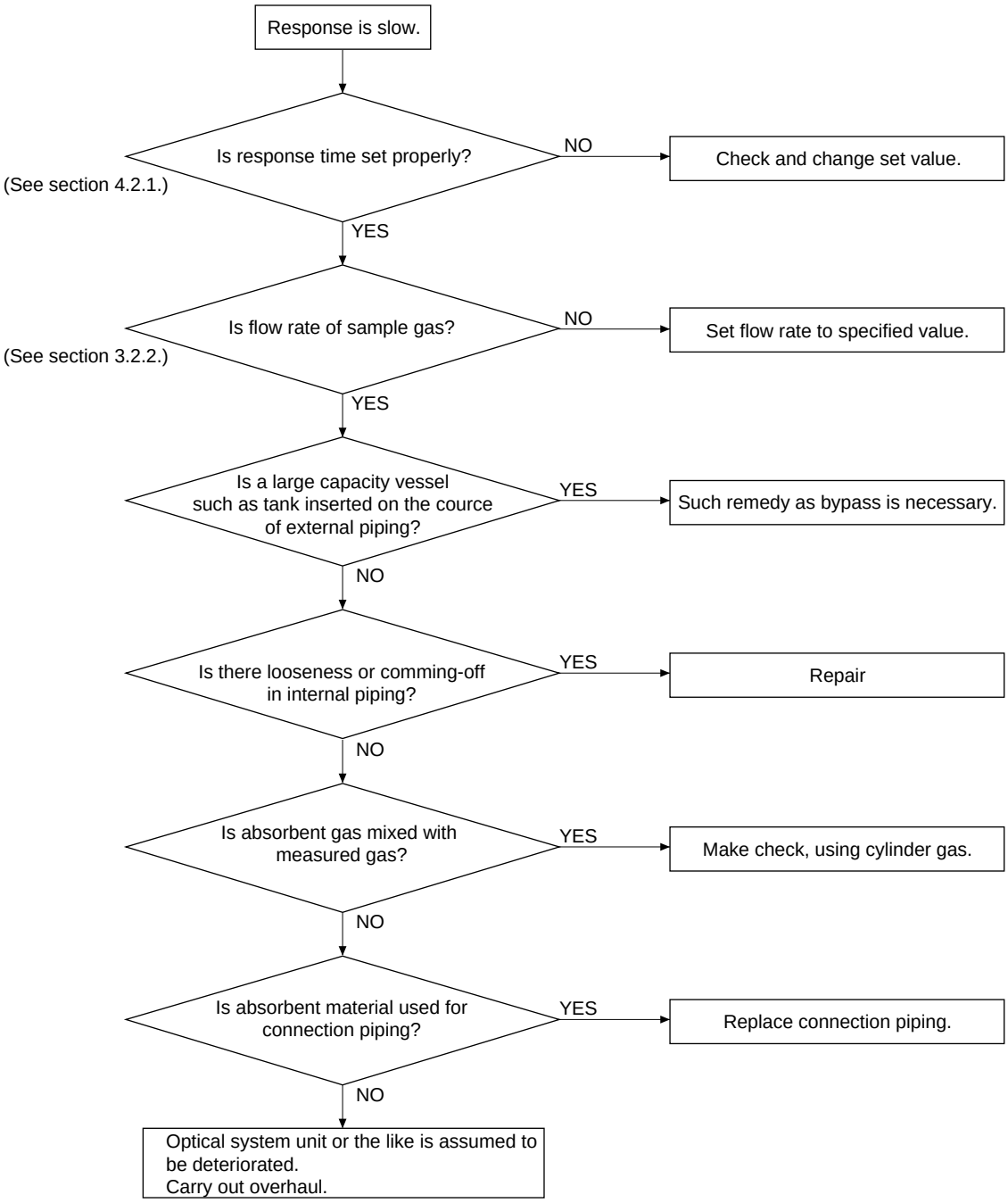
8.3 In case the indication does not stabilized

Note 1) If an error code is indicated, see the error code table (Section 9.2).



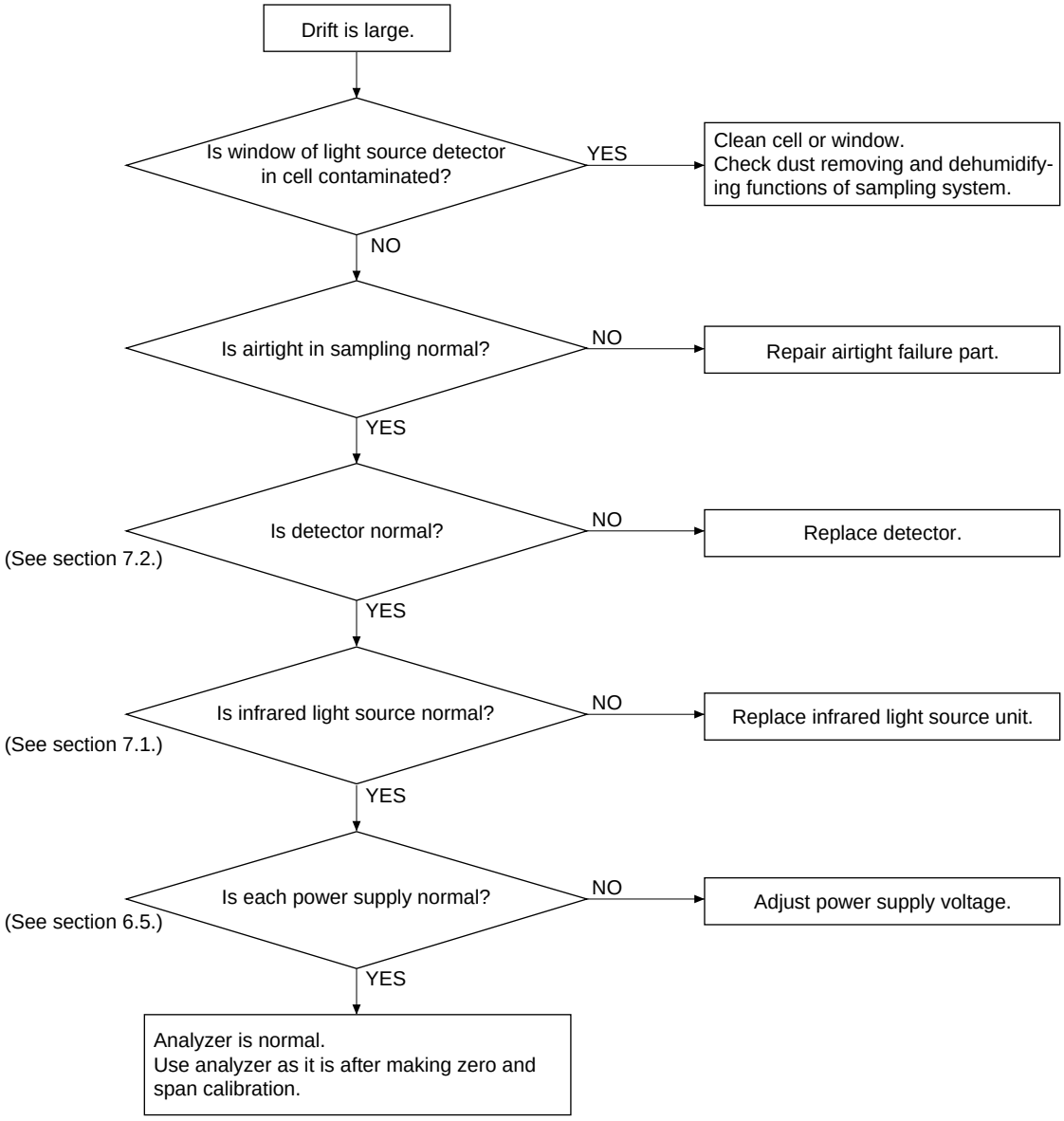
8.4 In case the response is slow

Note 1) If an error code is indicated, see the error code table (Section 9.2).



8.5 In case a drift is large

Note 1) If an error code is indicated, see the error code table (Section 9.2).



9. ERROR CODES AND REMEDIES

9.1 Error codes and remedies

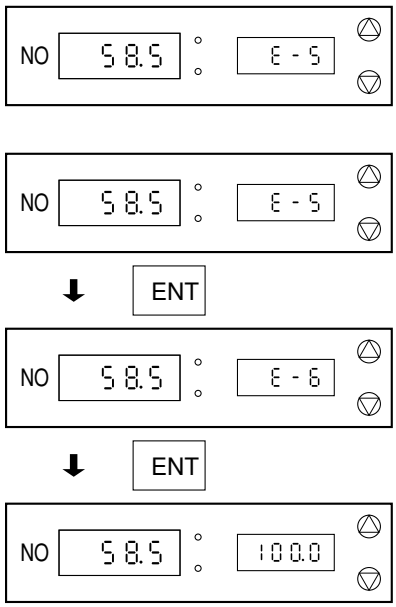
If the instrument has caused an error, an error code is indicated.

When an error code is indicated, apply the following remedies.

(1) An error code is indicated on the sub indicator in case of the one-component analyzer, or on the sub indicator of the second component in case of the multi-component analyzer.

(2) If more than one error have occured, errors are indicated sequentially by pressing the ENT key, starting with the error code having the lowest numbered one.

When the ENT key is pressed again after all error codes are indicated, the error indication is cleared, but the errors appear again so far as they remain.



(3) If an error code is indicated, first check the power source and gas piping for abnormality.

(4) If error occurs, the FAULT contact output is contactive.

(5) An error code may be indicated due to disturbance noise or one-shot noise.
Locate the cause, and apply the appropriate remedy in accordance with the error code table (section 9.2).

9.2 Error codes list

This analyzer is provided with self-diagnosis function, and an error code is displayed if an abnormality occurs in the instrument.

Carry out the following remedies when an error code appears.

- **When an error code appears, first check for an abnormality in the power supply or gas piping.**
- **The analyzer will not operate correctly unless the cause of the error is removed. But, the error indication remains as it is as a history until the ENT key is pressed.**

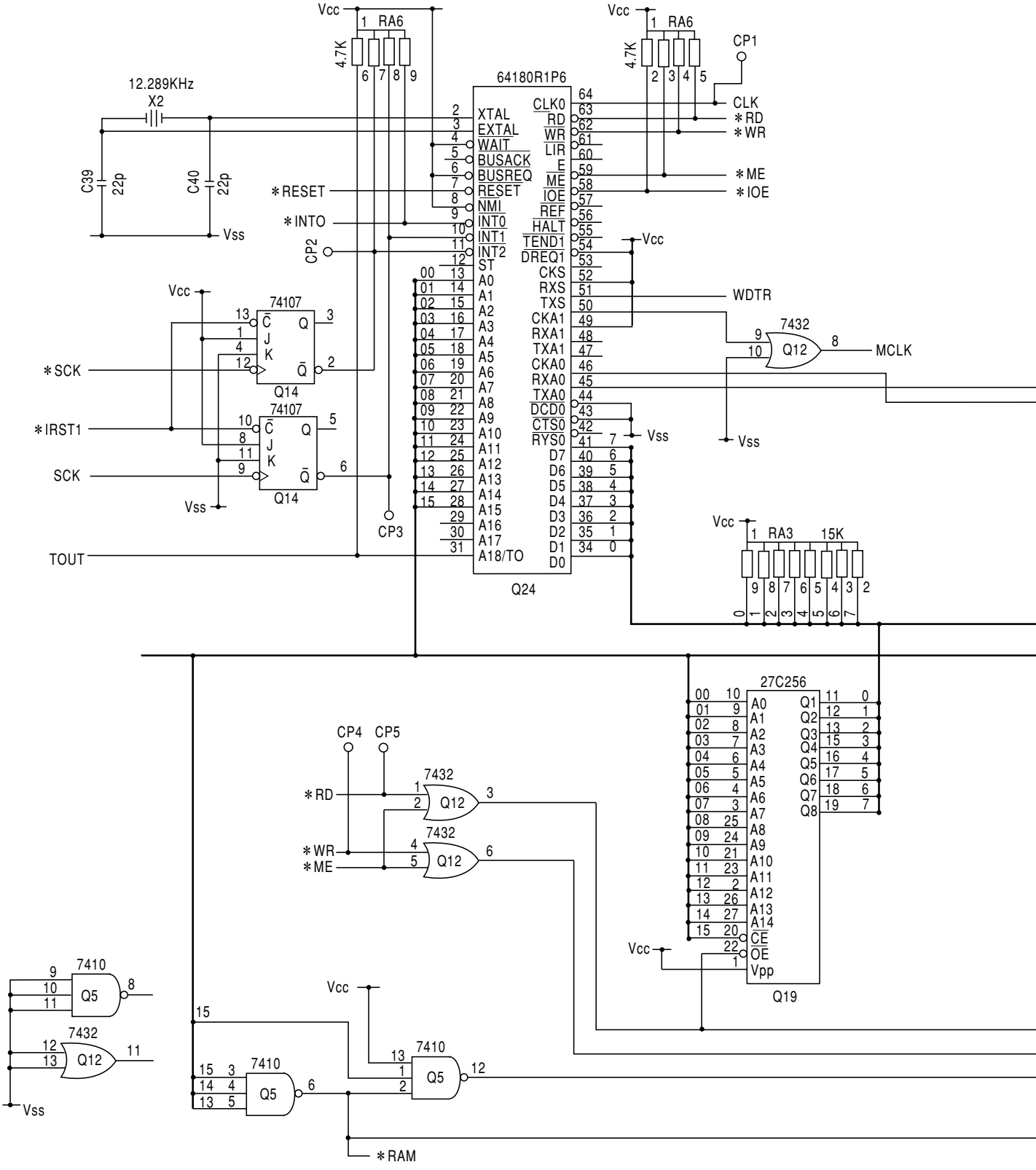
Error codes and countermeasures

Error code	Contents of error code	State of analyzer	Cause	Check and countermeasure
E-0	Trouble with digital circuit (memory read/ write impossible)	Not operated until trouble is removed.	• Malfunction due to noise • Digital circuit is defective.	• Turn ON the power supply. When the analyzer operates correctly, it is considered normal. • Replace the main printed circuit board.
E-1	Trouble with digital circuit (output ic read/ write impossible)			
E-3	Synchronizing signal has stopped.	• Both the indicated value and output value have stopped. • LED stops flickering at each setting.	• Improper adjustment of synchronizing signal • Improper rotation of motor and chopper • Synchronizing signal process circuit is defective. • Instantaneous power failure	• Adjust synchronizing signal on main printed circuit board 2. (CP1 - CS, VR1) • Check motor and chopper for proper rotation. • Check connector for proper connection. • Replace main printed circuit board 2.
E-4	Zero point calibration is out of the calibration range.	Measurement is possible but zero calibration is impossible.	• Improper zero gas • Unbalance of optical system • Optical system parts are defective.	• Check gas components and dew points. • Check sampling system. • Check the inside of cell for contamination. • Adjust the balance of optical system. • Replace light source. • Replace sensor.
E-6	Integrated drift of zero point exceeds 50%/FS of each measurement range.			
E-8	One-time zero point calibration exceeds 50%/FS of measurement range.			
E-5	Span point calibration is out of calibration range.	Measurement is possible but zero calibration is impossible.	• Improper setting of calibration set value and cylinder • Unbalance of optical system • Optical system parts are defective.	• Check calibration set value and cylinder. • Check sampling system. • Check the inside of cell for contamination. • Adjust the balance of optical system. • Replace light source. • Replace sensor.
E-7	Integrated drift of span point exceeds 50%/FS of measurement range.			
E-9	One-time span point calibration exceeds 50%/FS of measurement range.			
E-10	Zero calibration is impossible due to unstable input.	Measurement is possible but calibration is impossible.	• Abnormal sampling system (improper gas flow) • Defective sensor • Effect of vibration	• Check piping connection and gas flow. • Replace sensor. • Check wiring and connector. • Check operating conditions and carry out vibration-proofing.
E-11	Span calibration is impossible due to unstable input.	Measurement is possible but span calibration is impossible.		
E-16	O_2 input signal is low.	Measurement value of O_2 analyzer is different from density.	• O_2 sensor is defective. • Input circuit is defective.	• Check O_2 sensor output voltage • Check wiring and connector.
E-23	O_2 input signal is over.			
E-17	Temperature sensor input signal is low.	Measurement error due to ambient temperature may become large.	• Temperature sensor is defective. • Temperature circuit is defective.	• Check resistance of TMP 1 on printing circuit board 2 (approx. 3KΩ).
E-24	Temperature sensor input signal is over.			

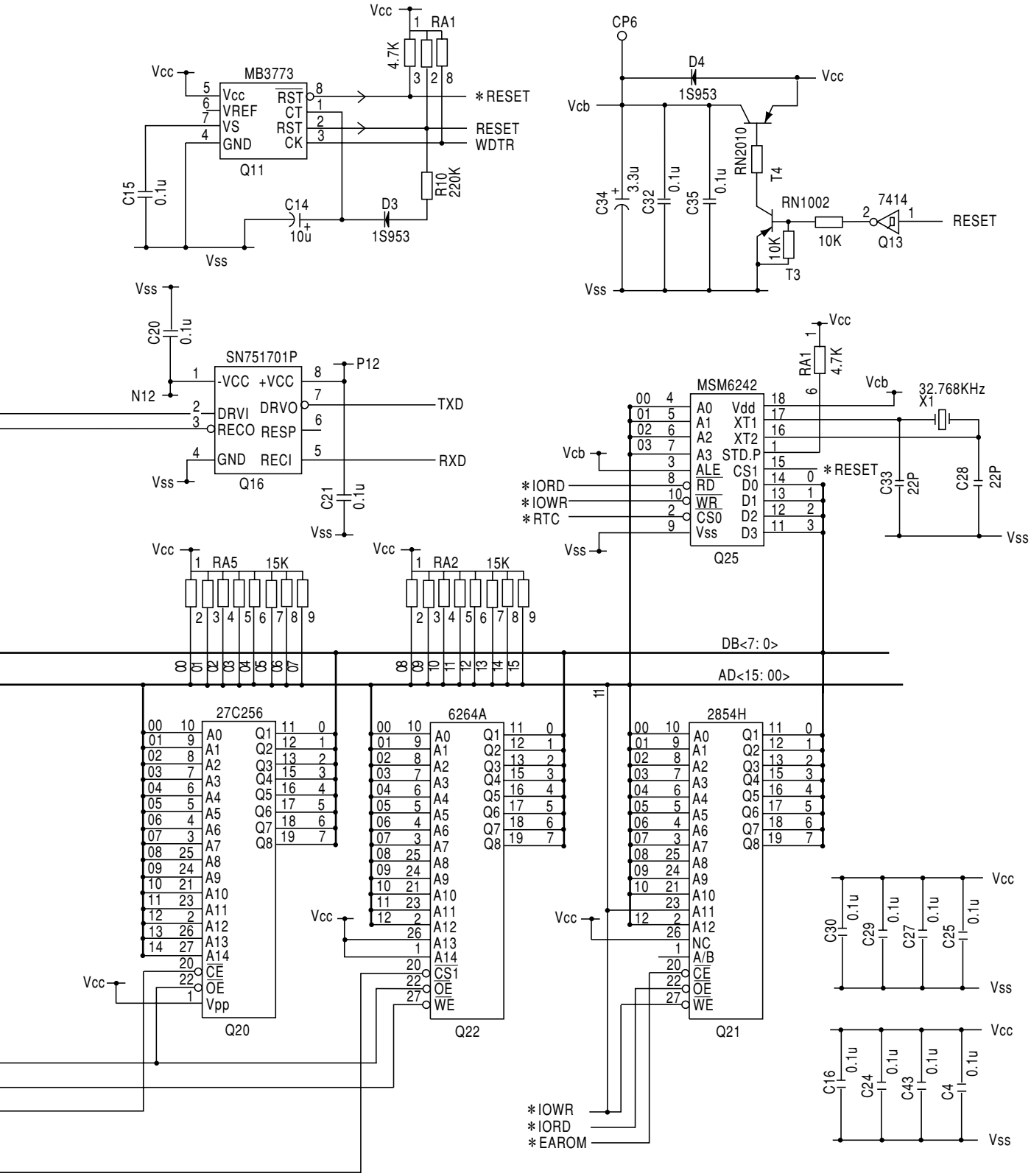
1. Error code appears at the sub indication in the case of a single-component analyzer, and at the 2nd component sub indication in the case of multi-component analyzer.
2. When multiple errors have occurred, the error codes appear successively starting from the lowest numbered one upon pressing ENT key.

   After displaying all the error codes, press ENT key again and the error display disappears, but they will reappear if the fault is not removed.
3. Turn ON the power supply. When the analyzer operates correctly, it is considered normal.
4. When an error occurs, the FAULT contact output is conductive.

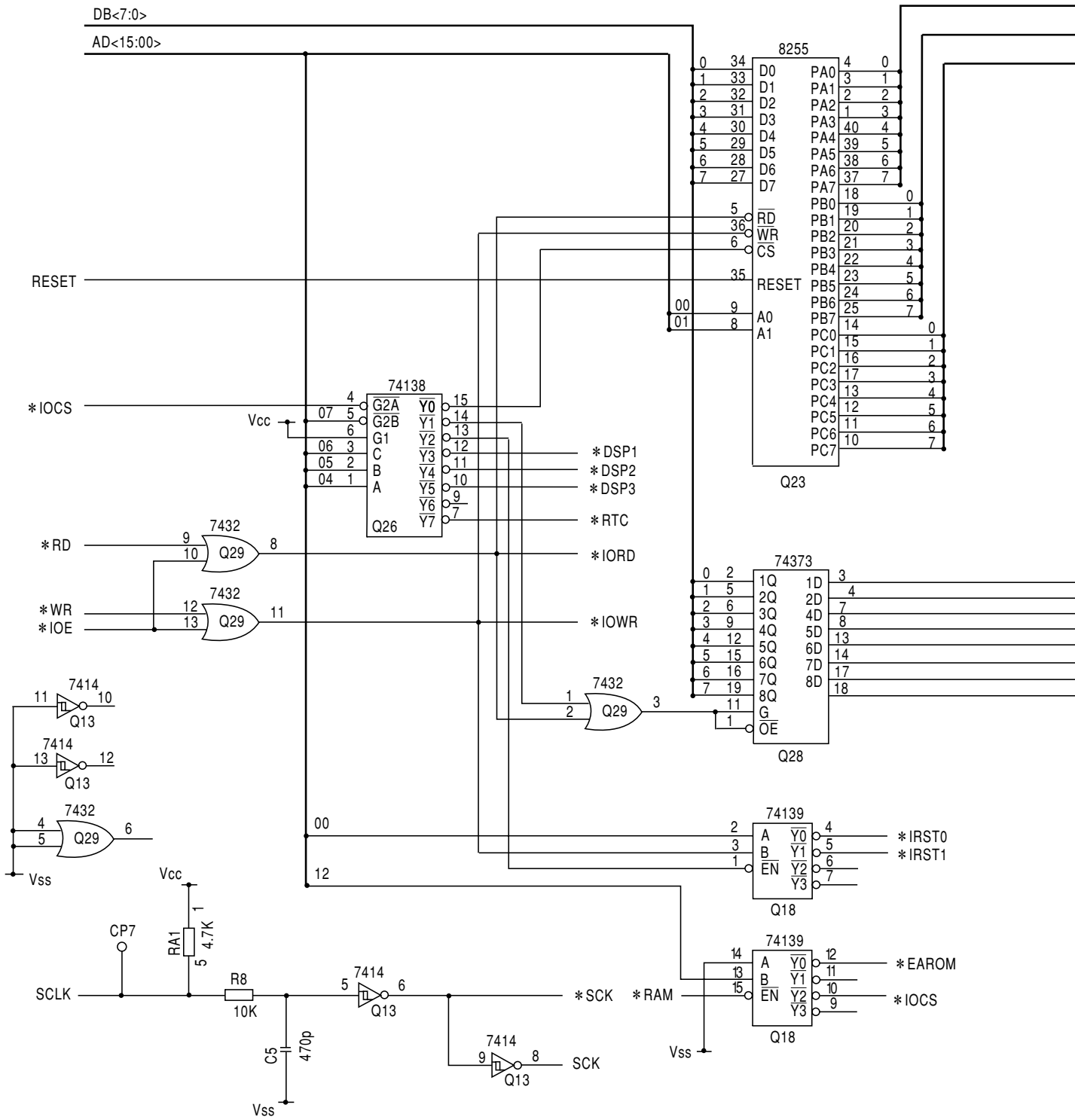
Appended figure 1. Main printed circuit board 1 circuit diagram



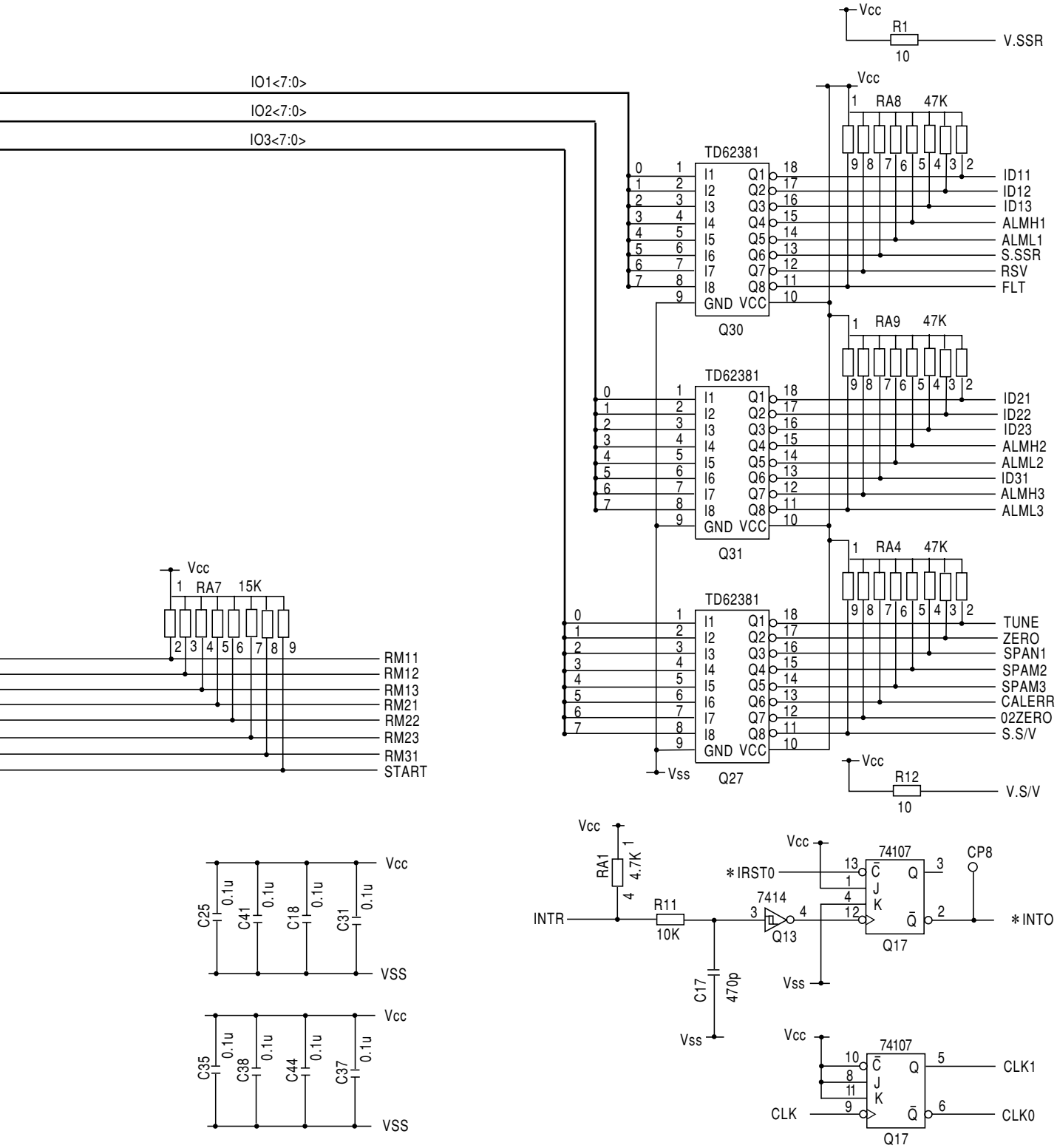
Appended figure 1. Main printed circuit board 1 circuit diagram



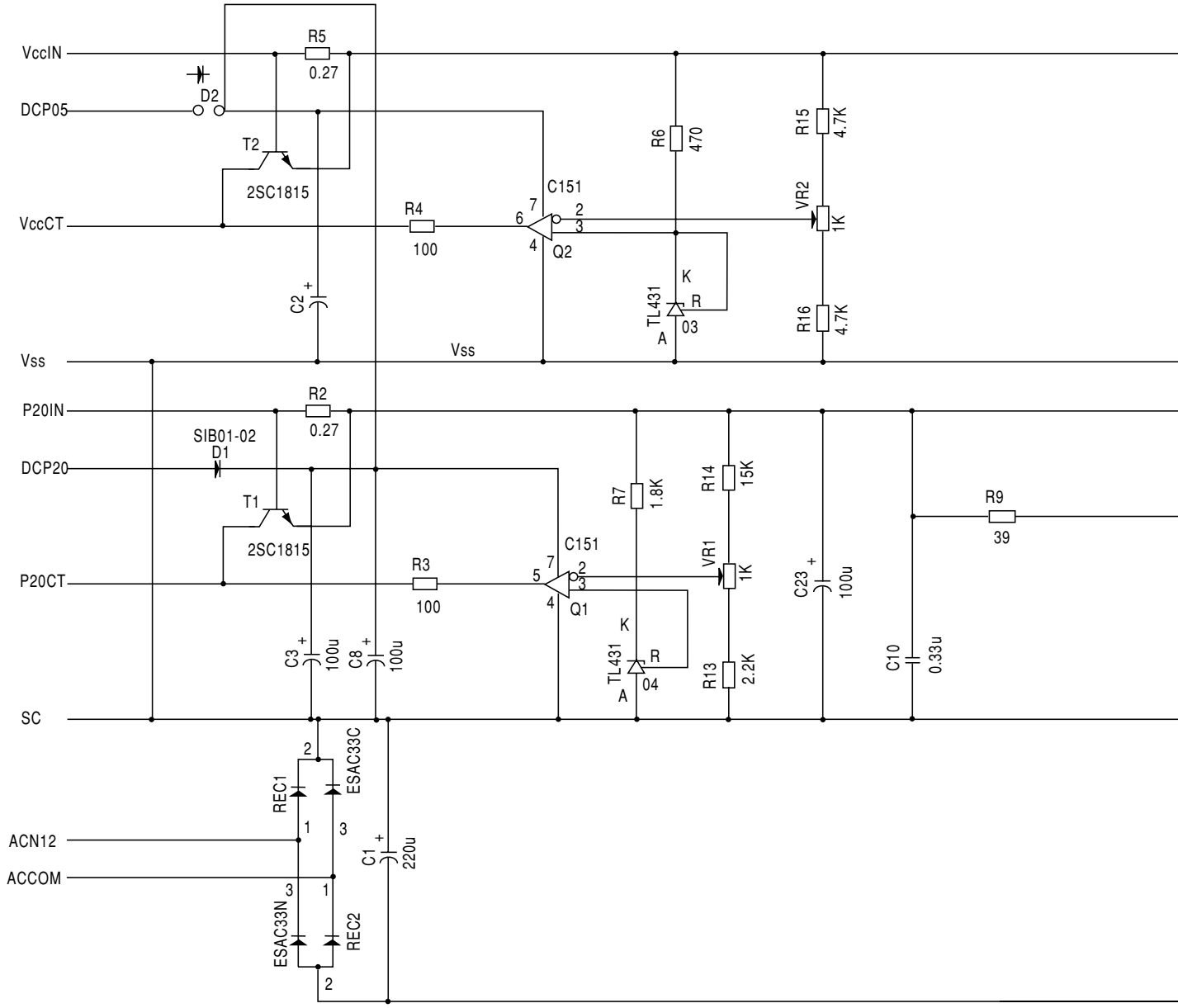
Appended figure 1. Main printed circuit board 1 circuit diagram



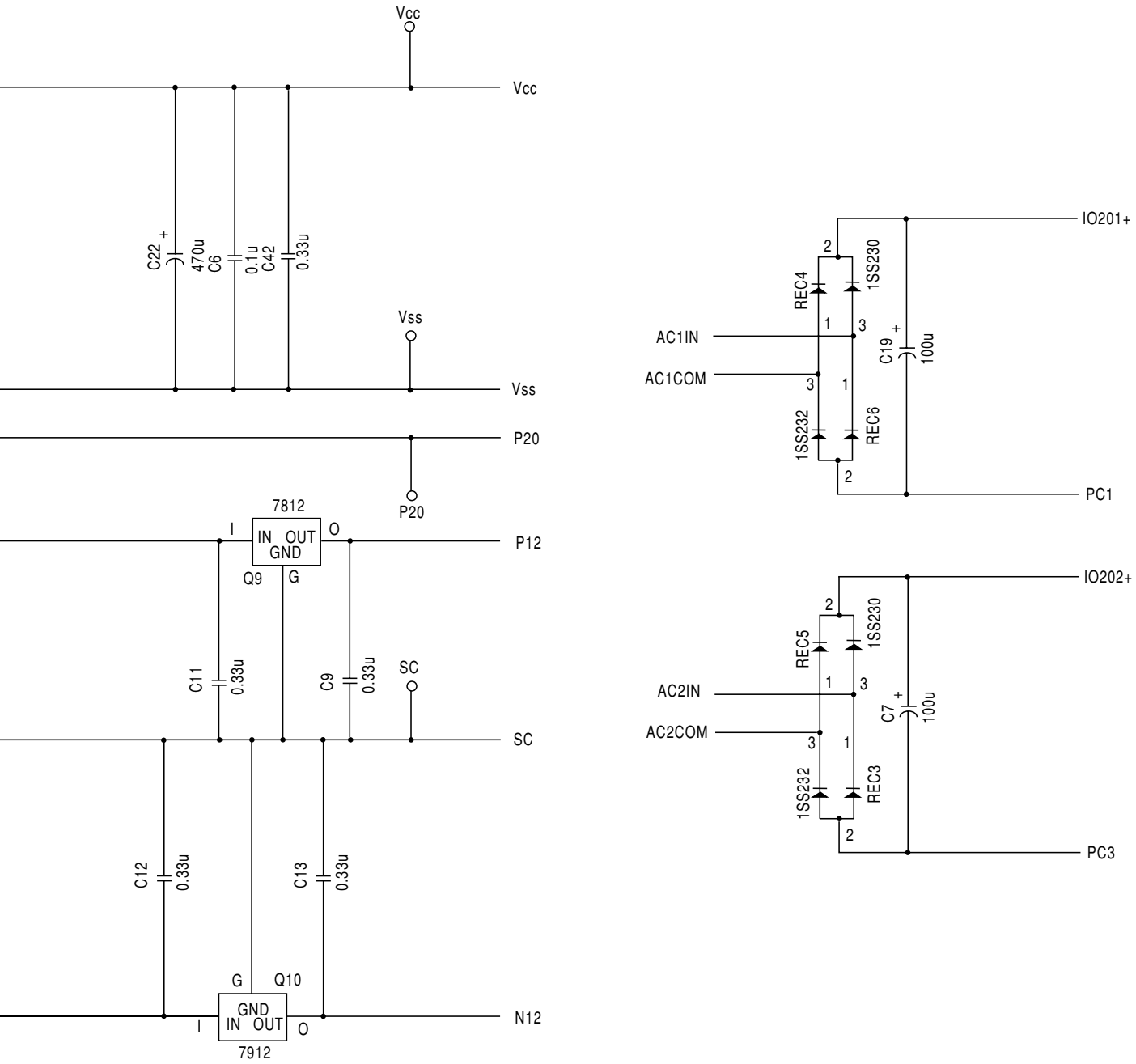
Appended figure 1. Main printed circuit board 1 circuit diagram



Appended figure 1. Main printed circuit board 1 circuit diagram



Appended figure 1. Main printed circuit board 1 circuit diagram



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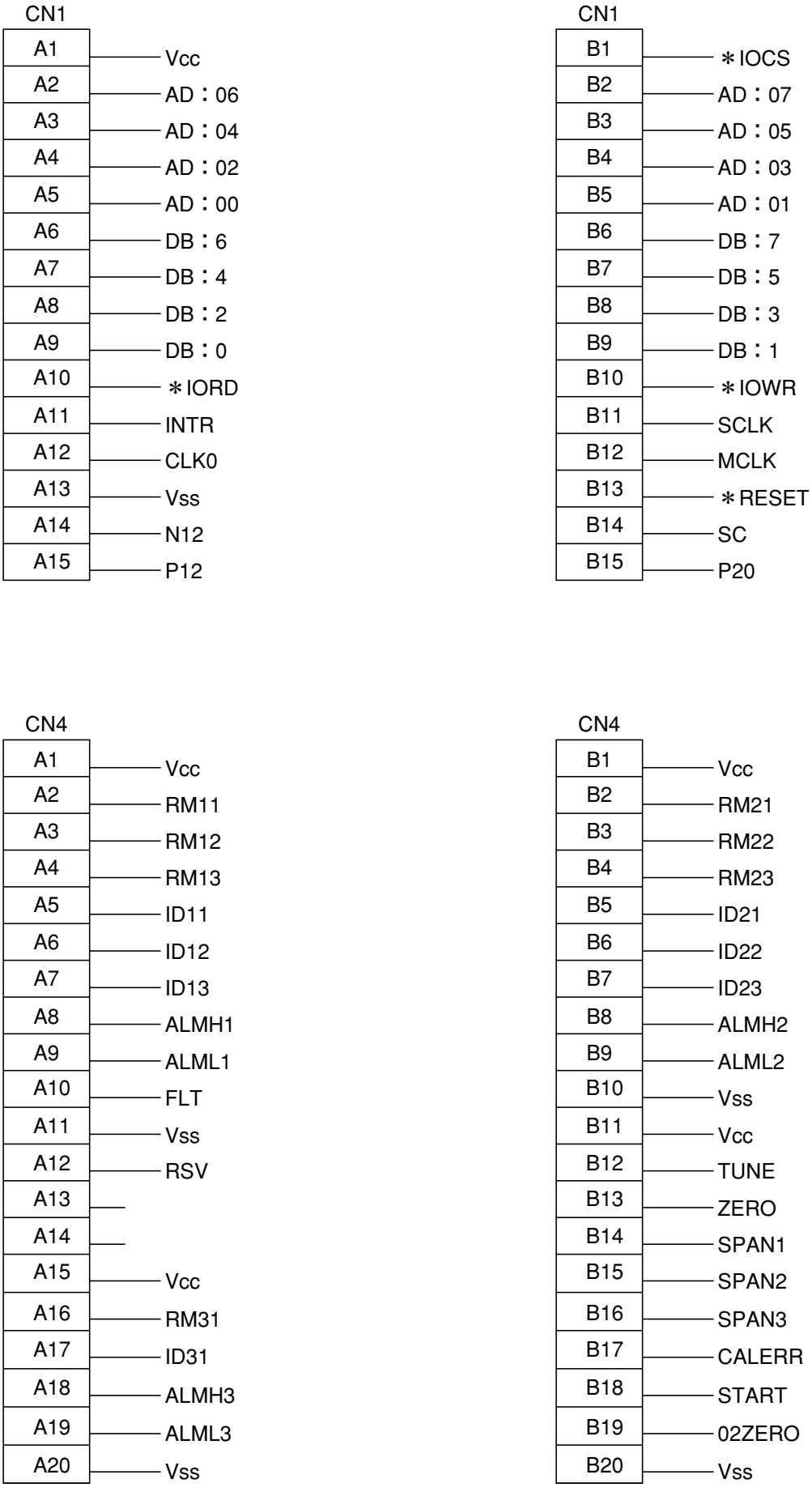

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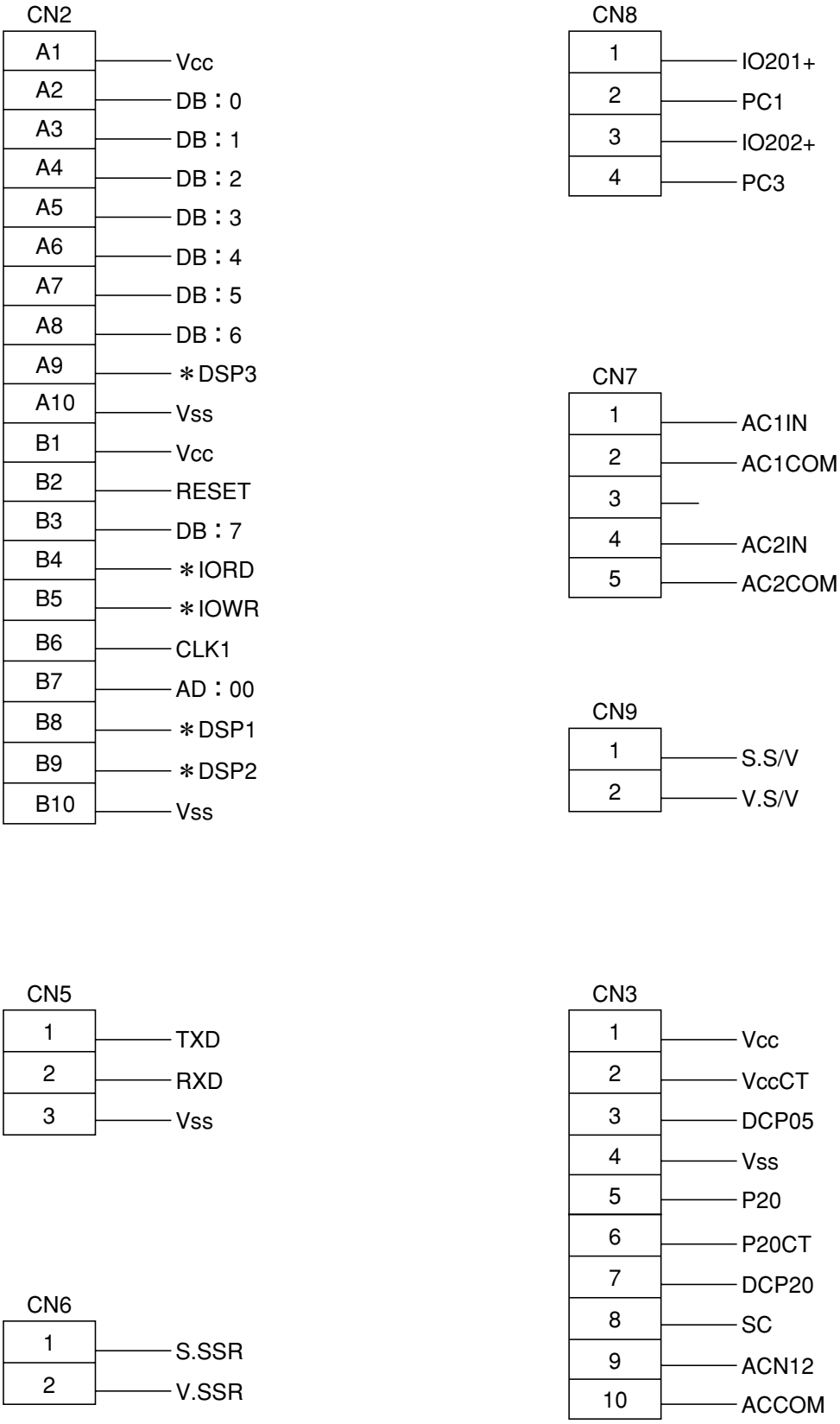
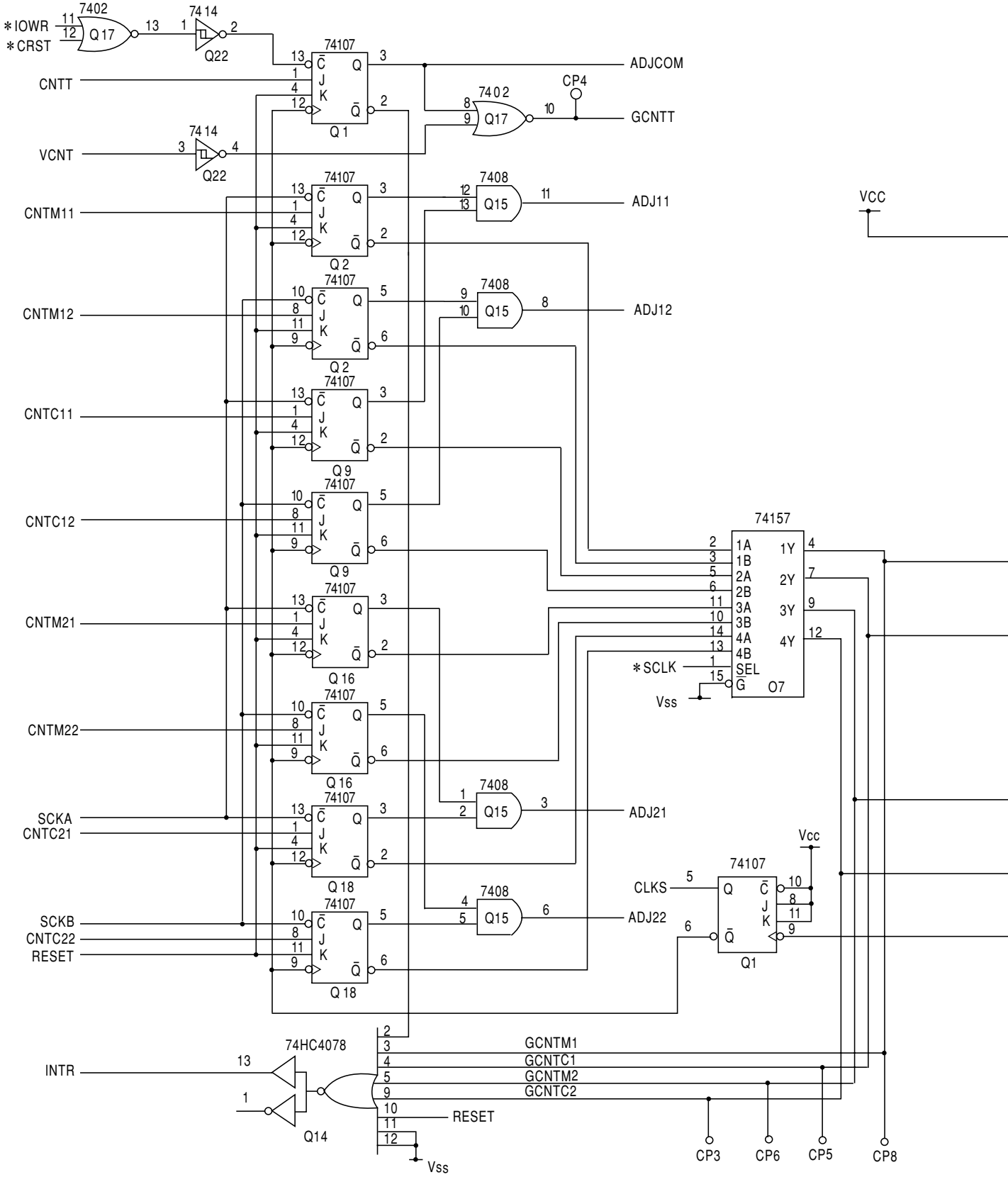


Appended figure 2. Main printed circuit board 2 circuit diagram



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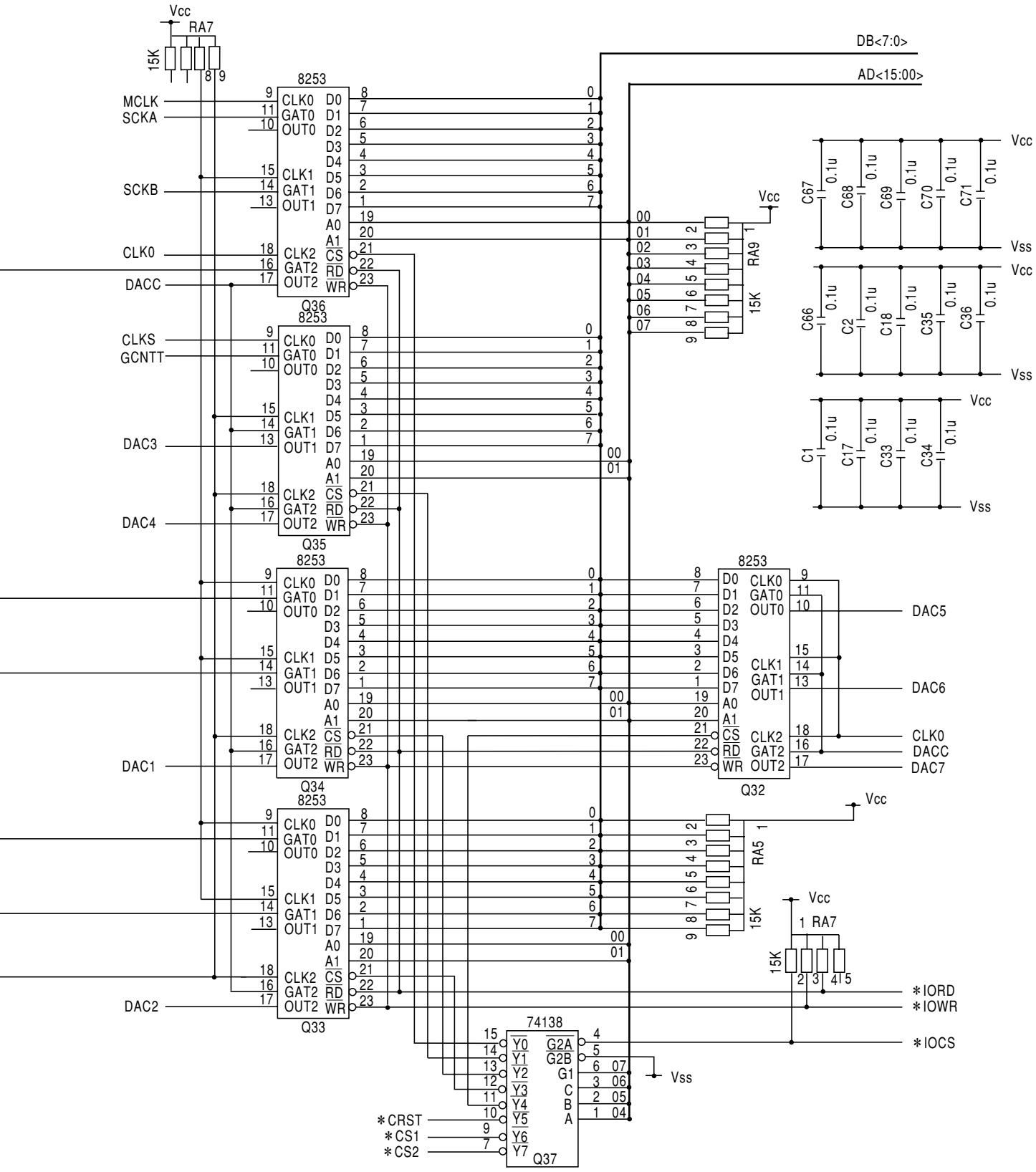

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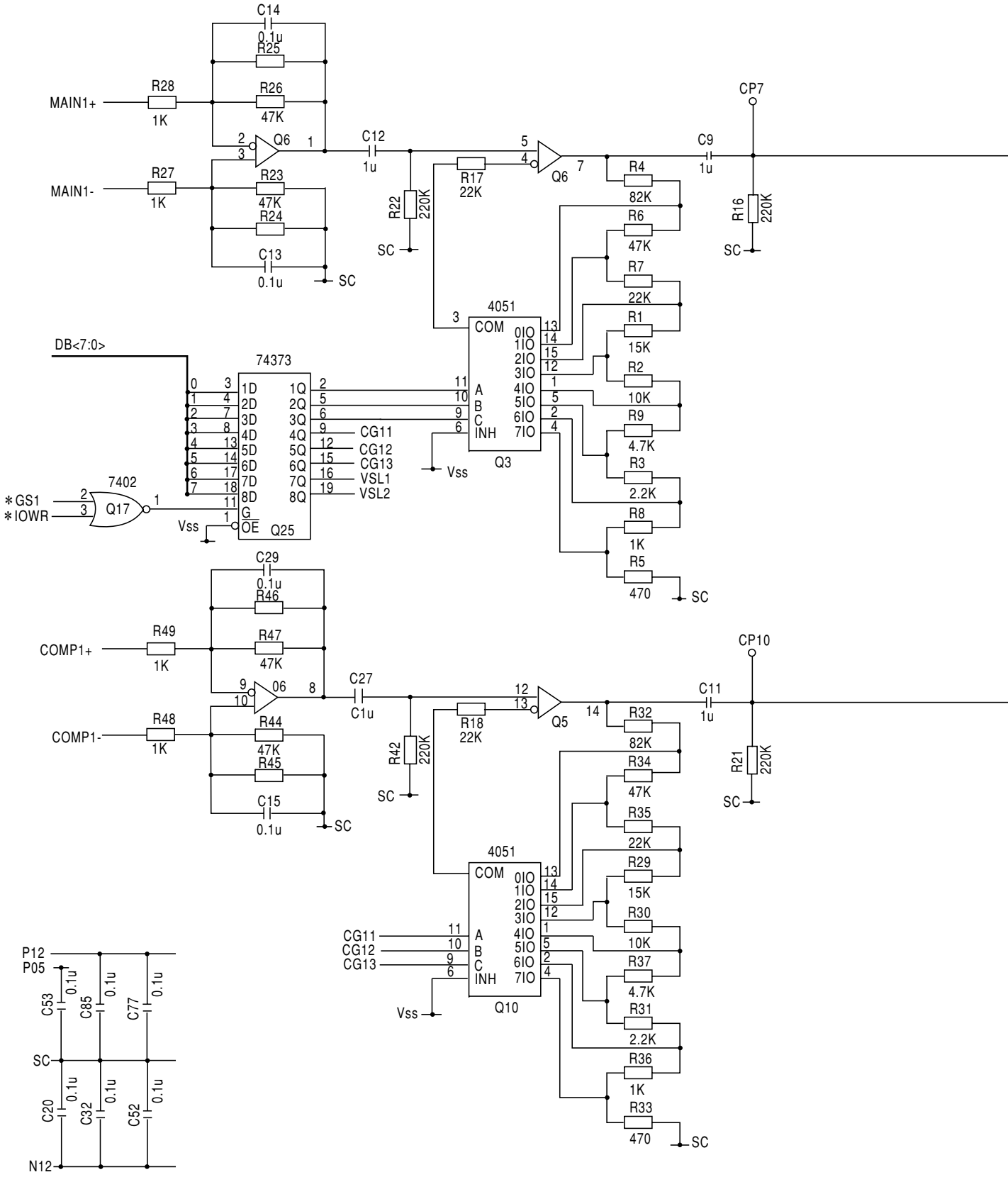

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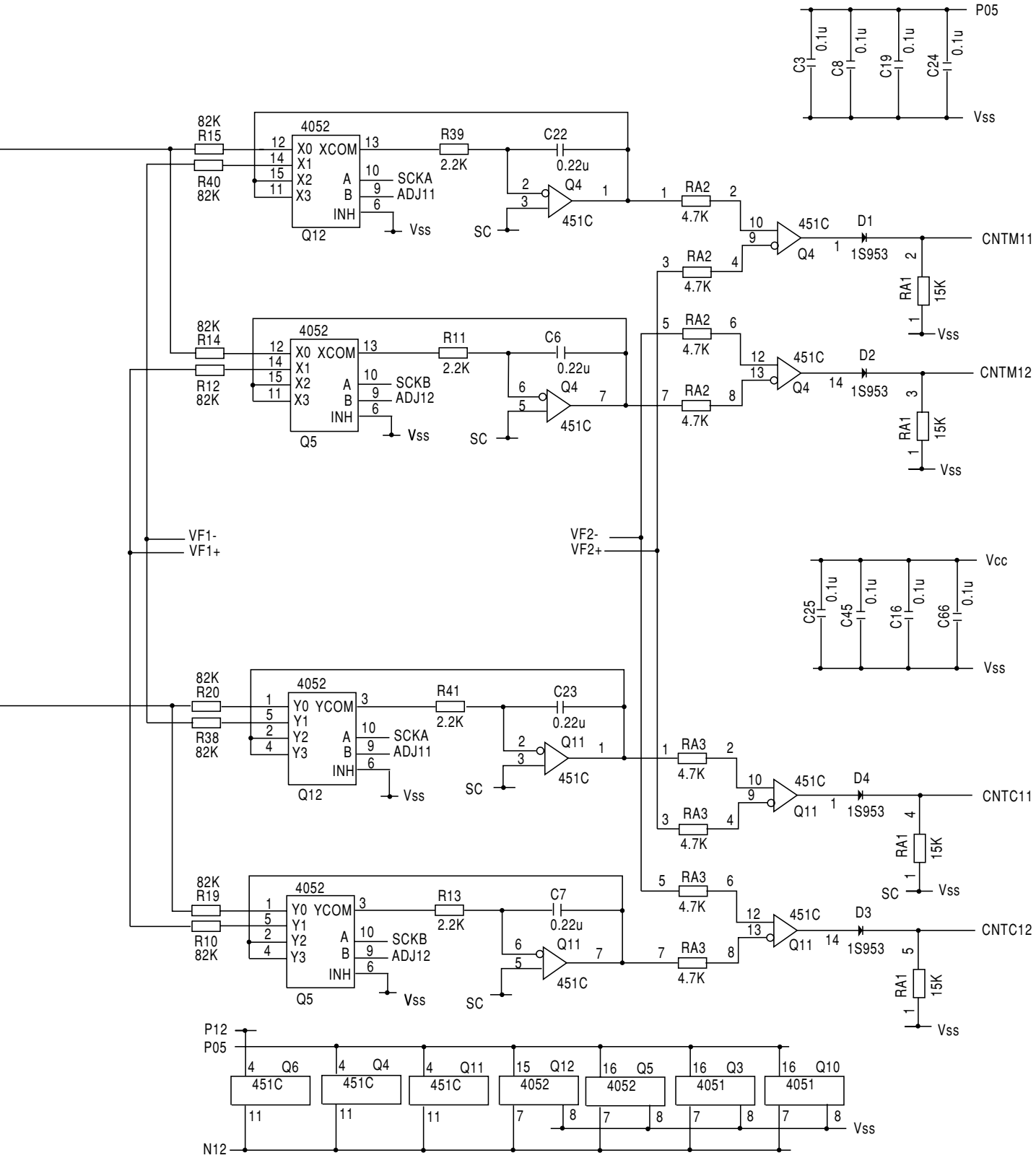

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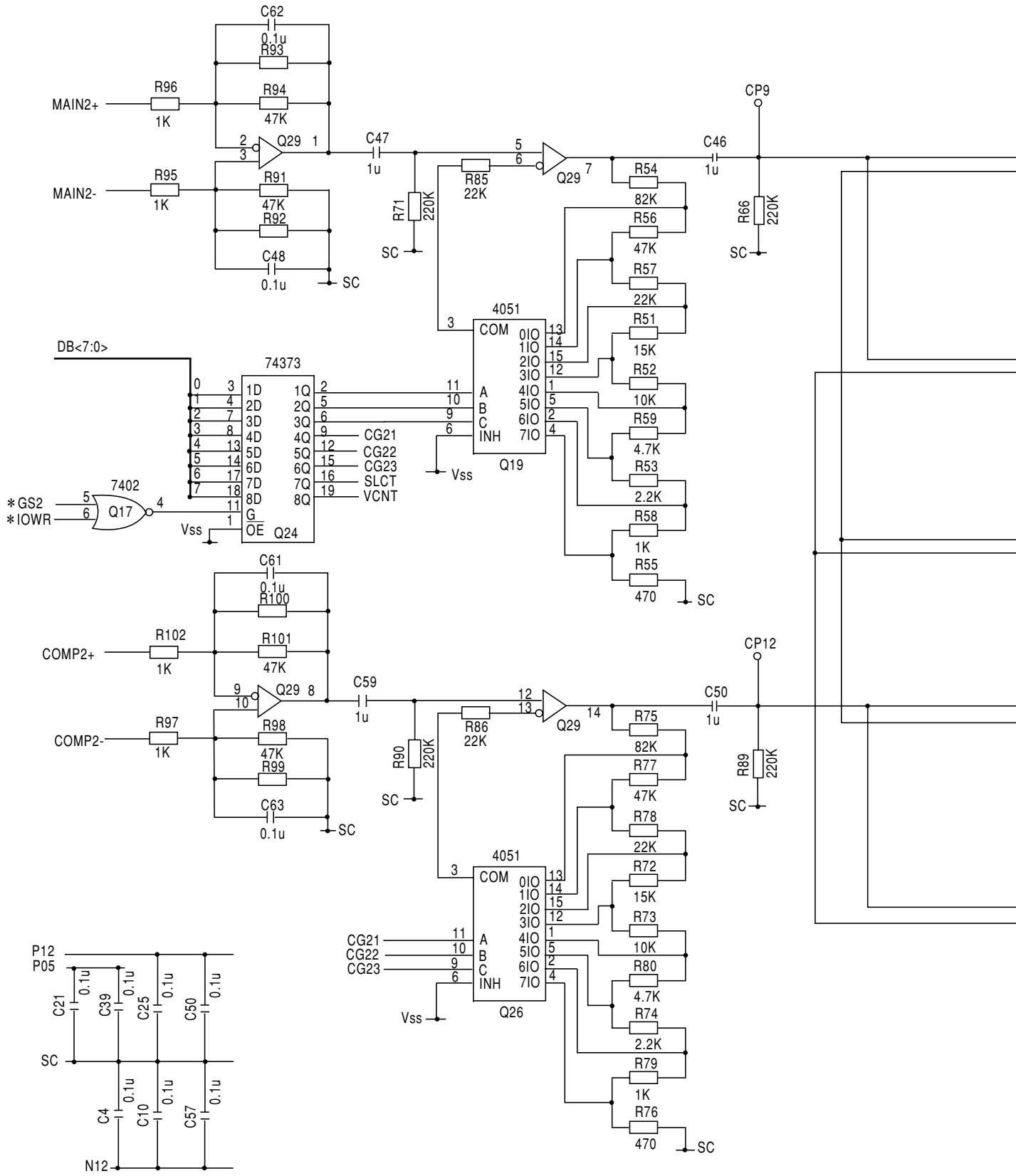

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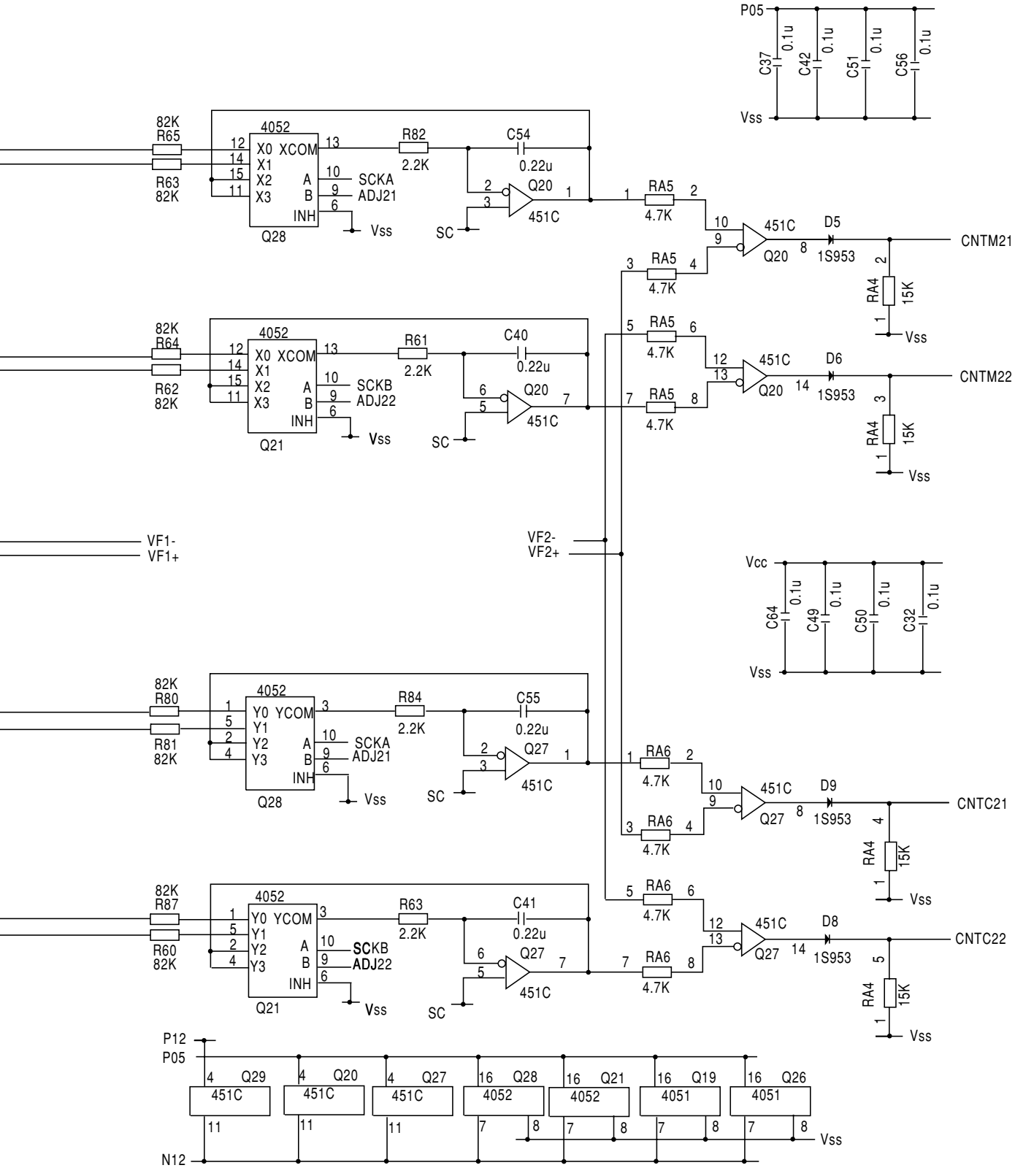

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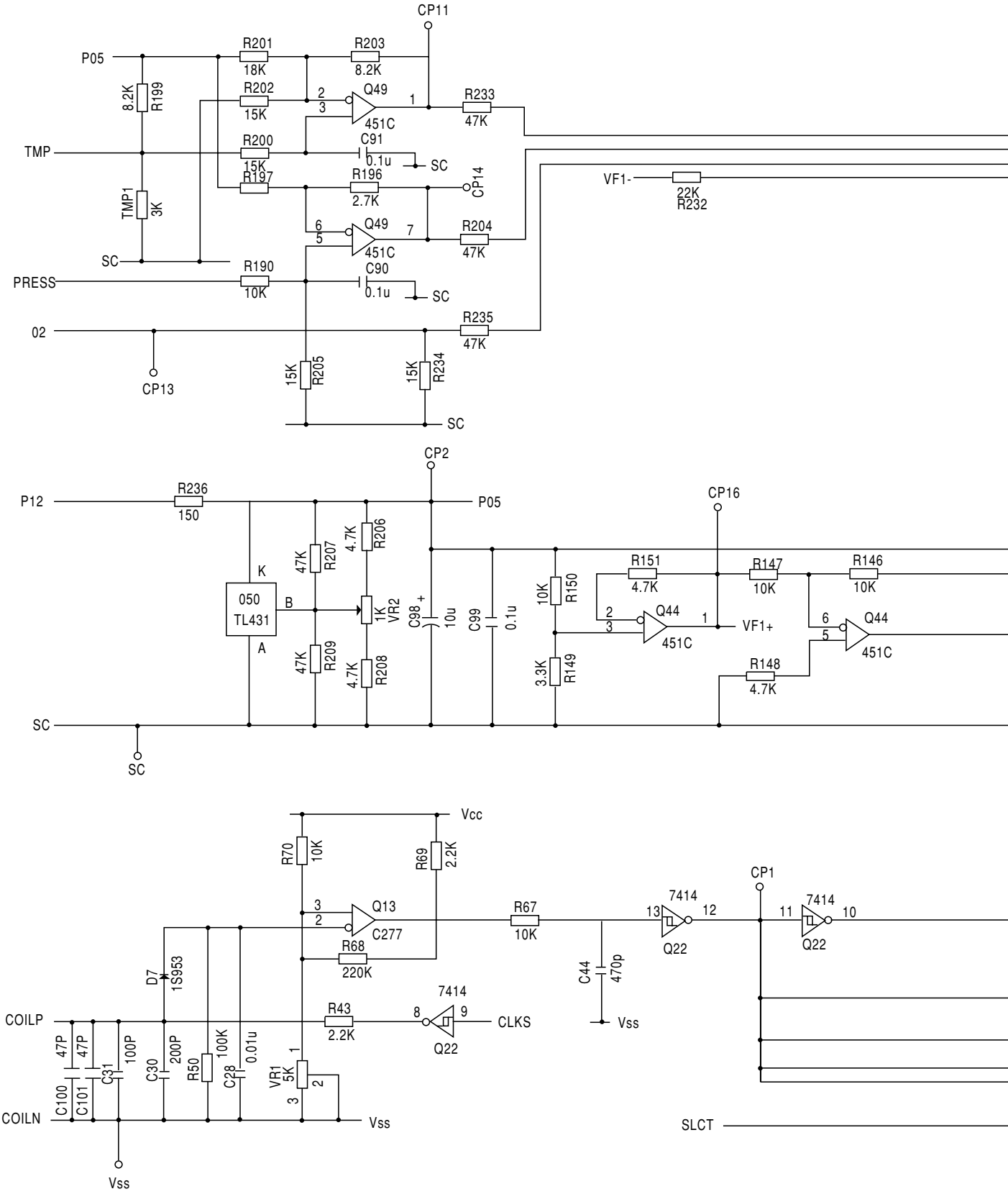

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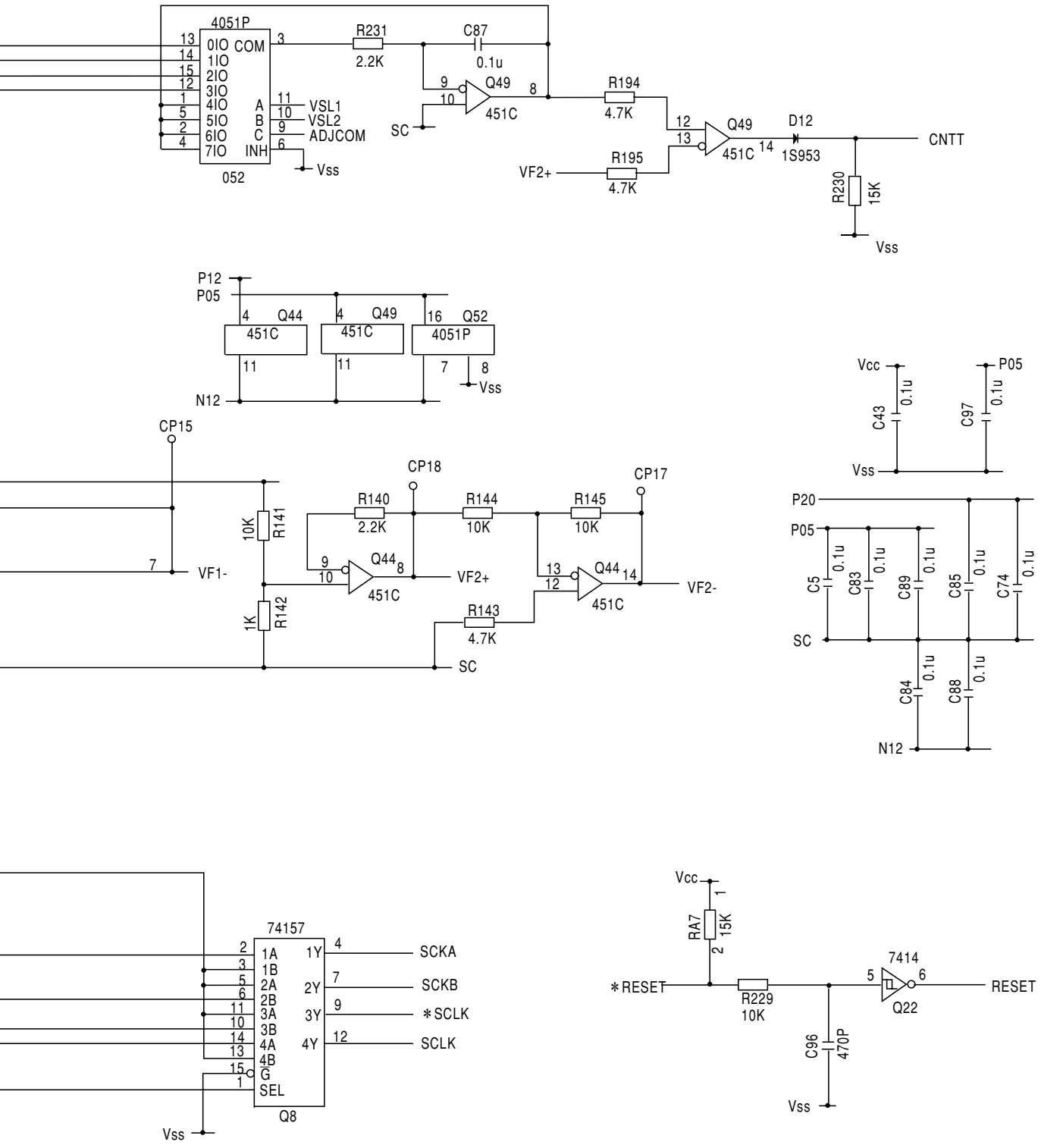

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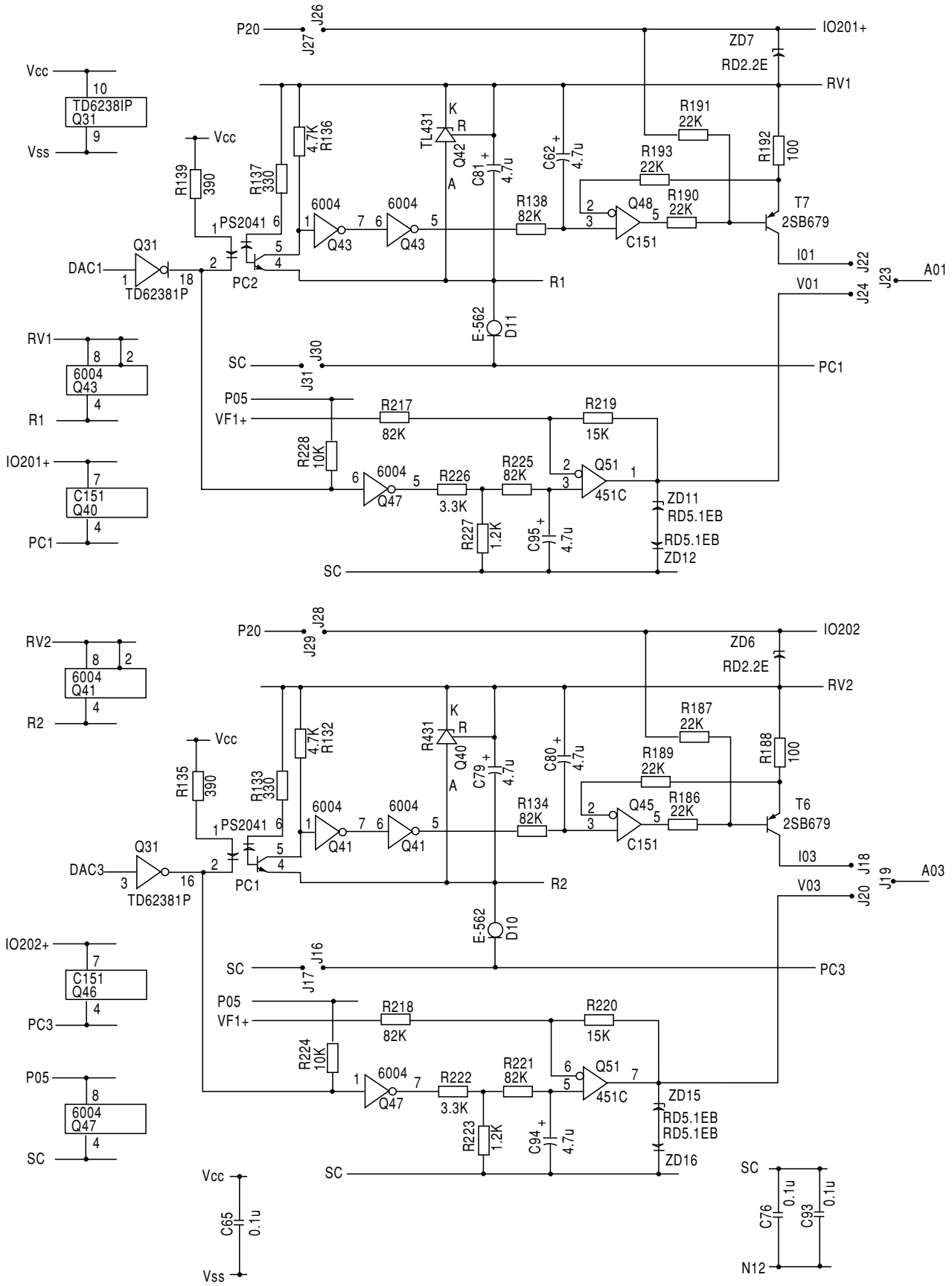

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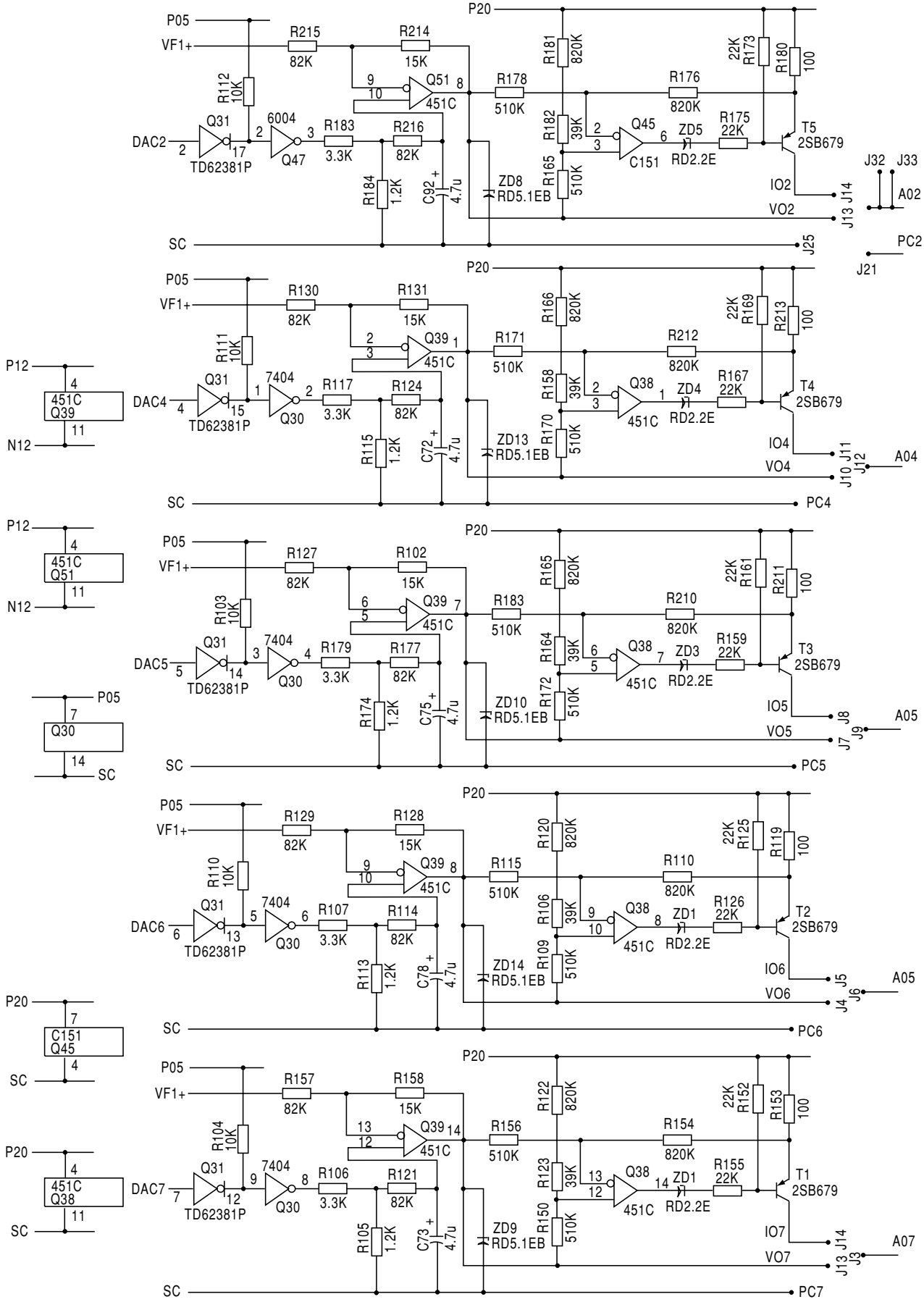

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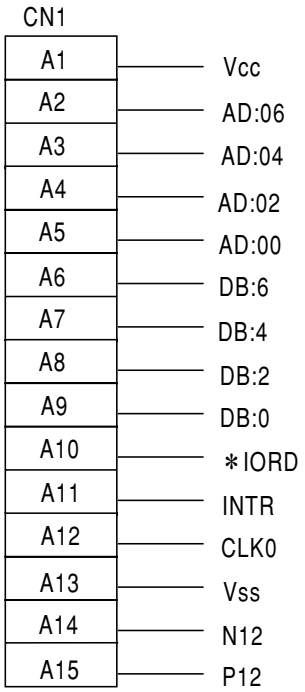
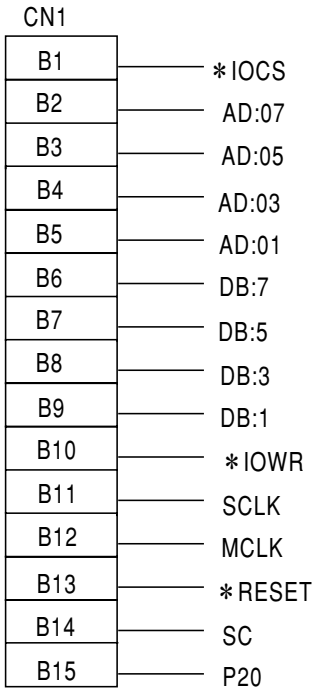
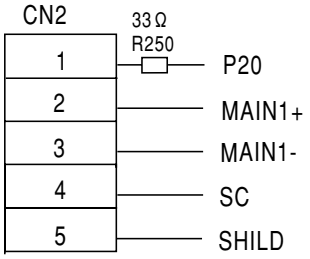
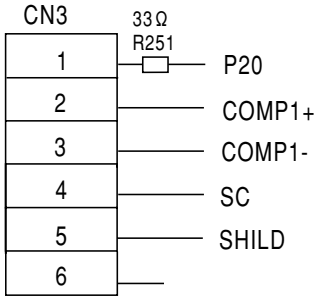
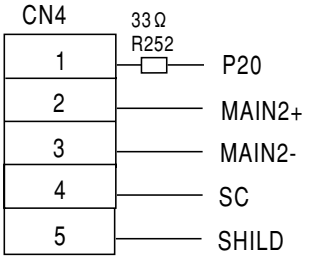
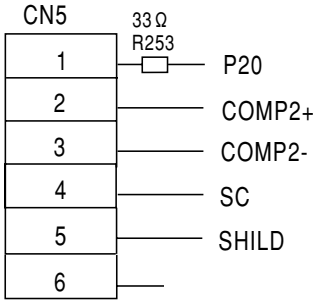




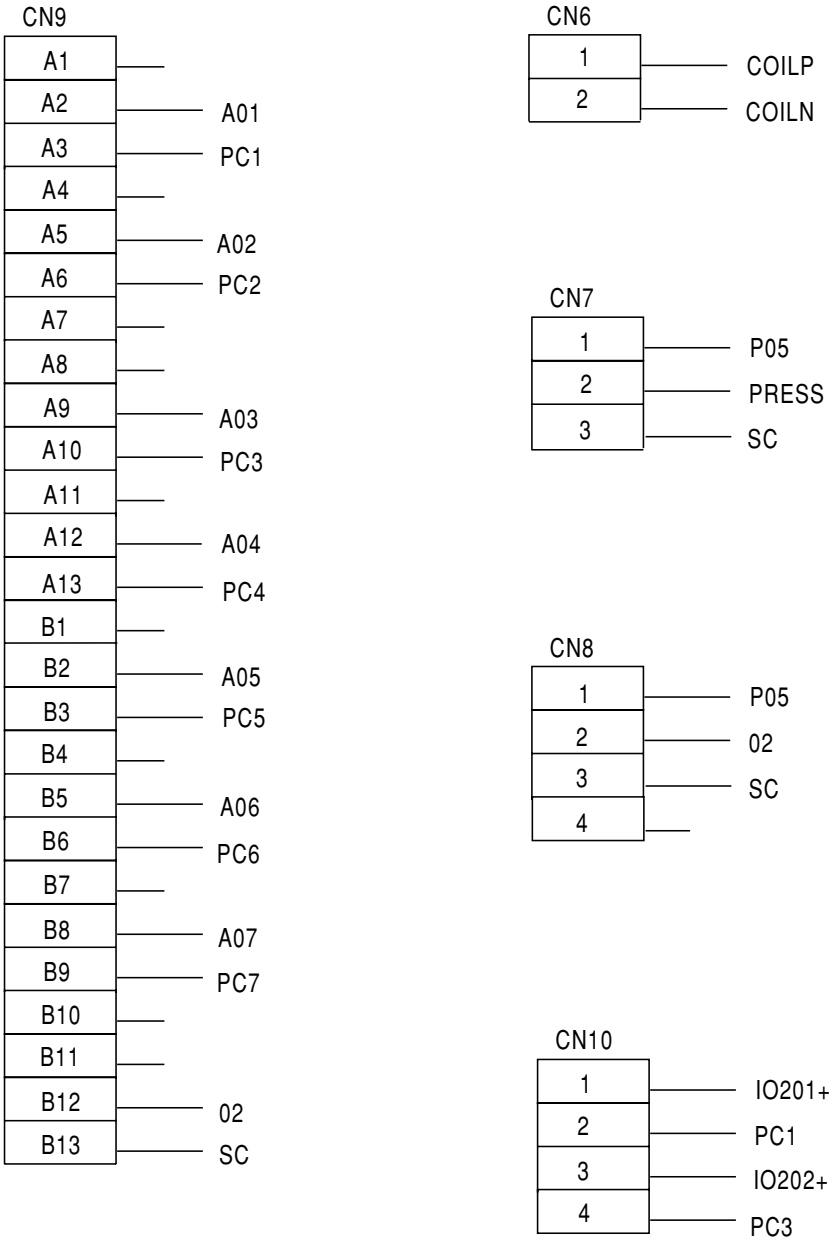




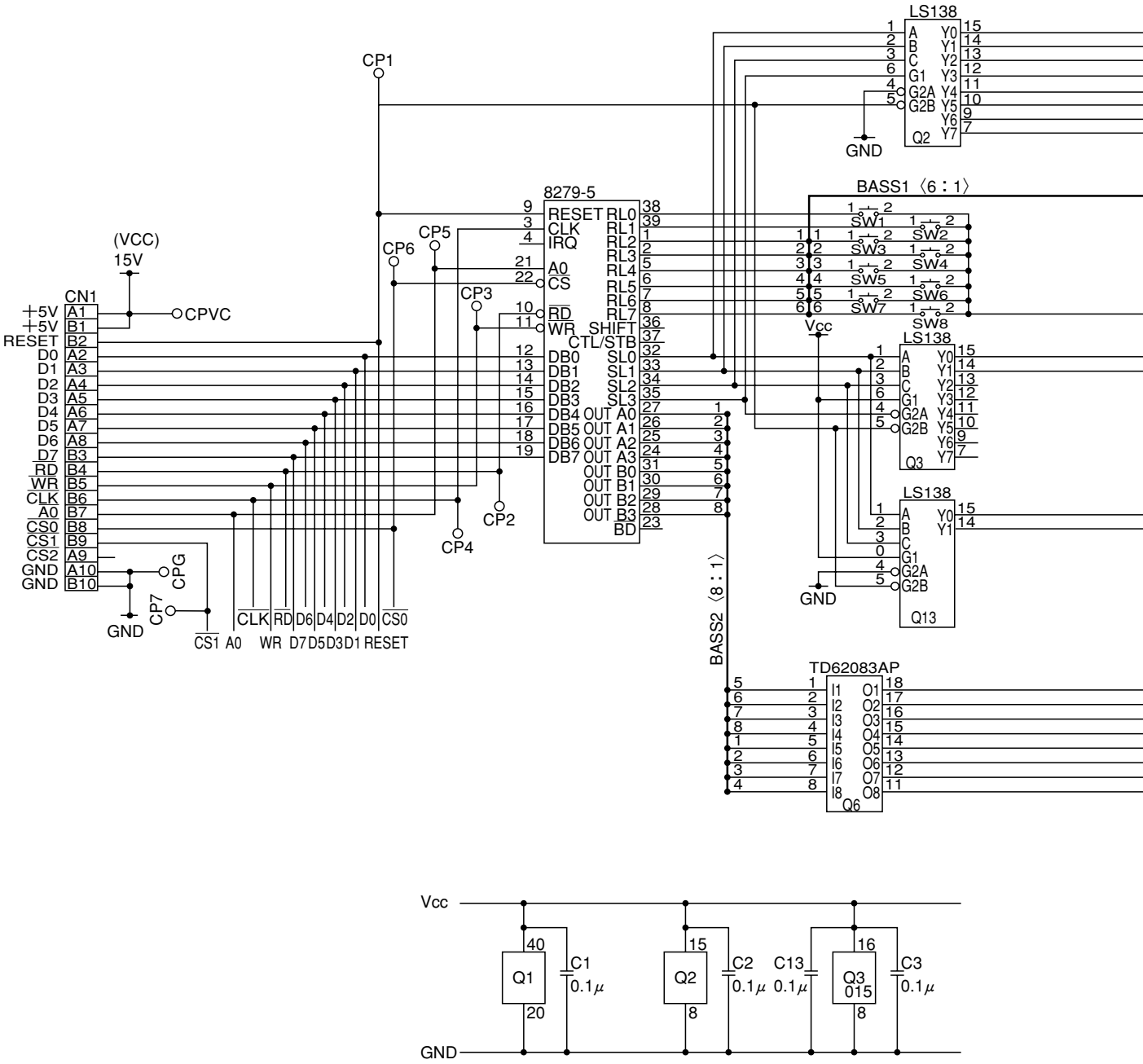




Appended figure 2. Main printed circuit board 2 circuit diagram



Appended figure 3. Indication printed circuit board circuit diagram



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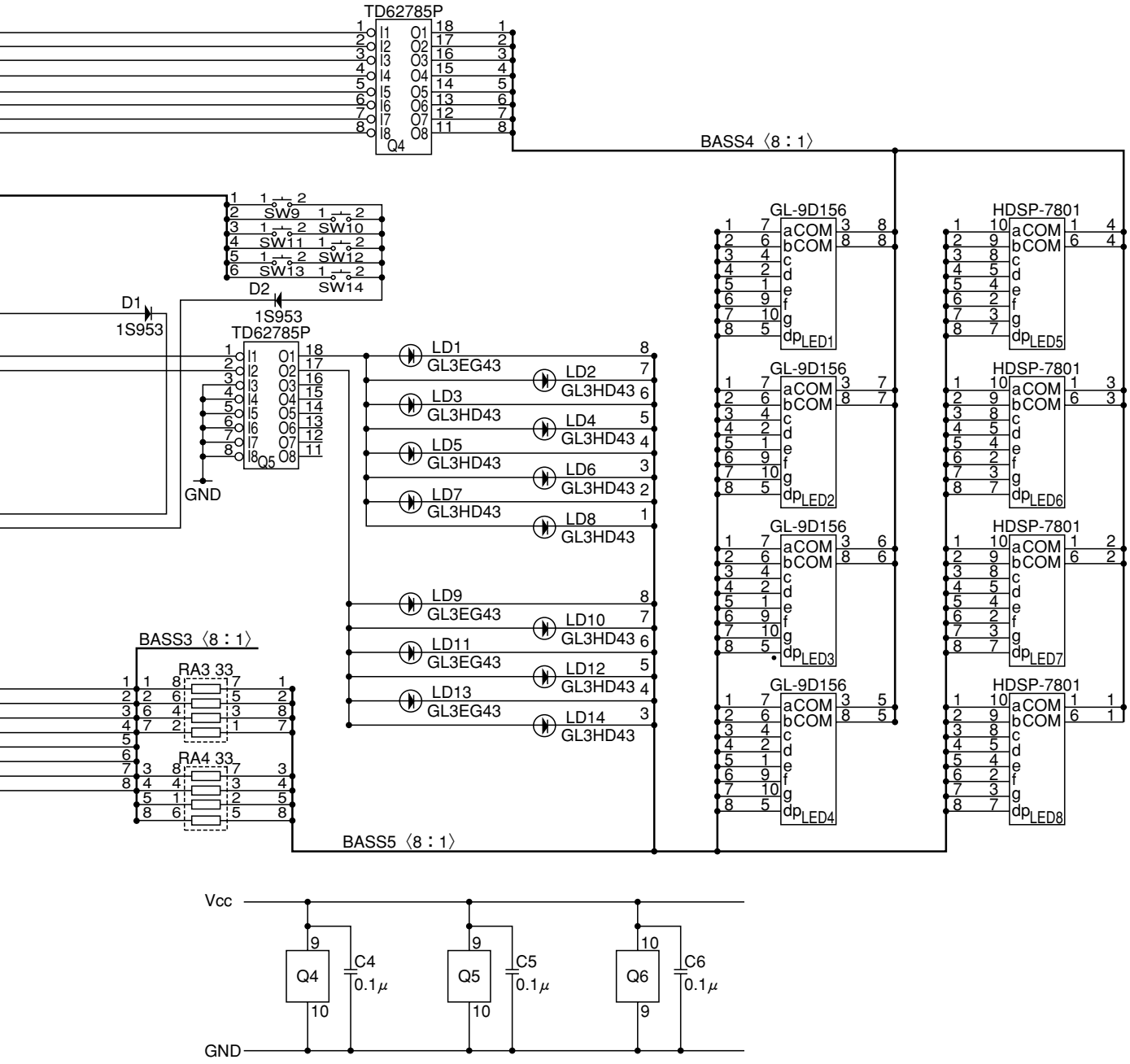

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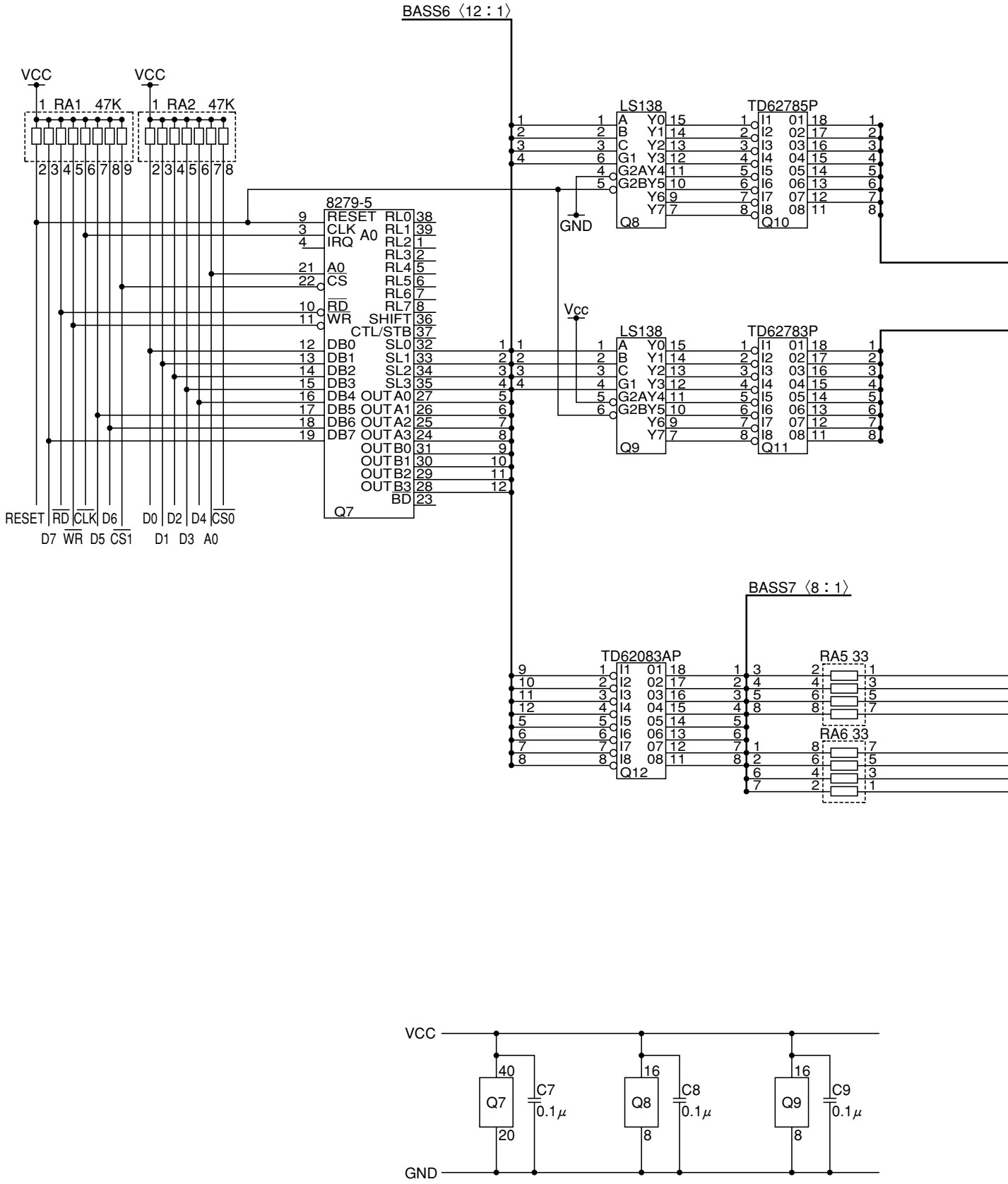

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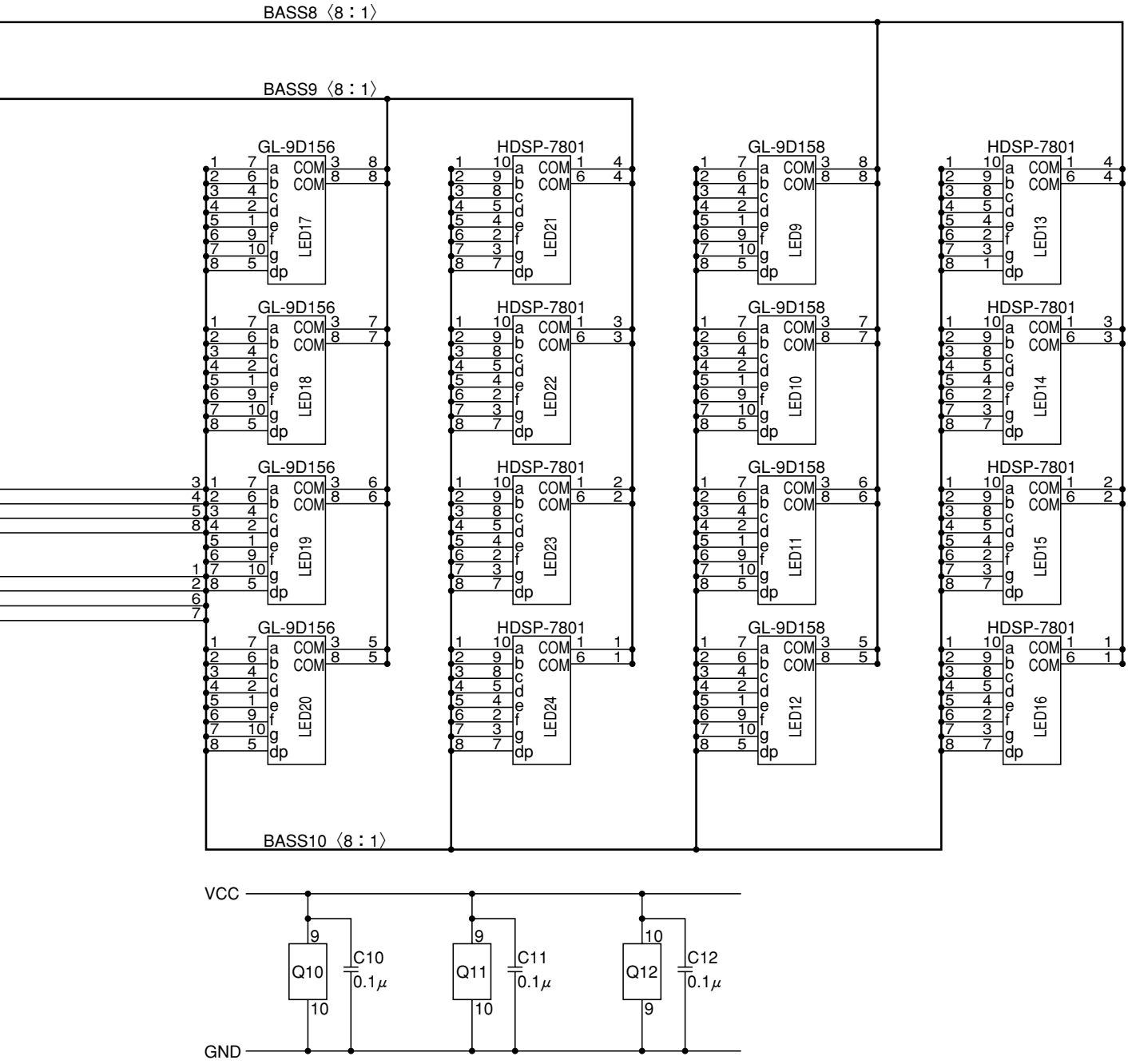
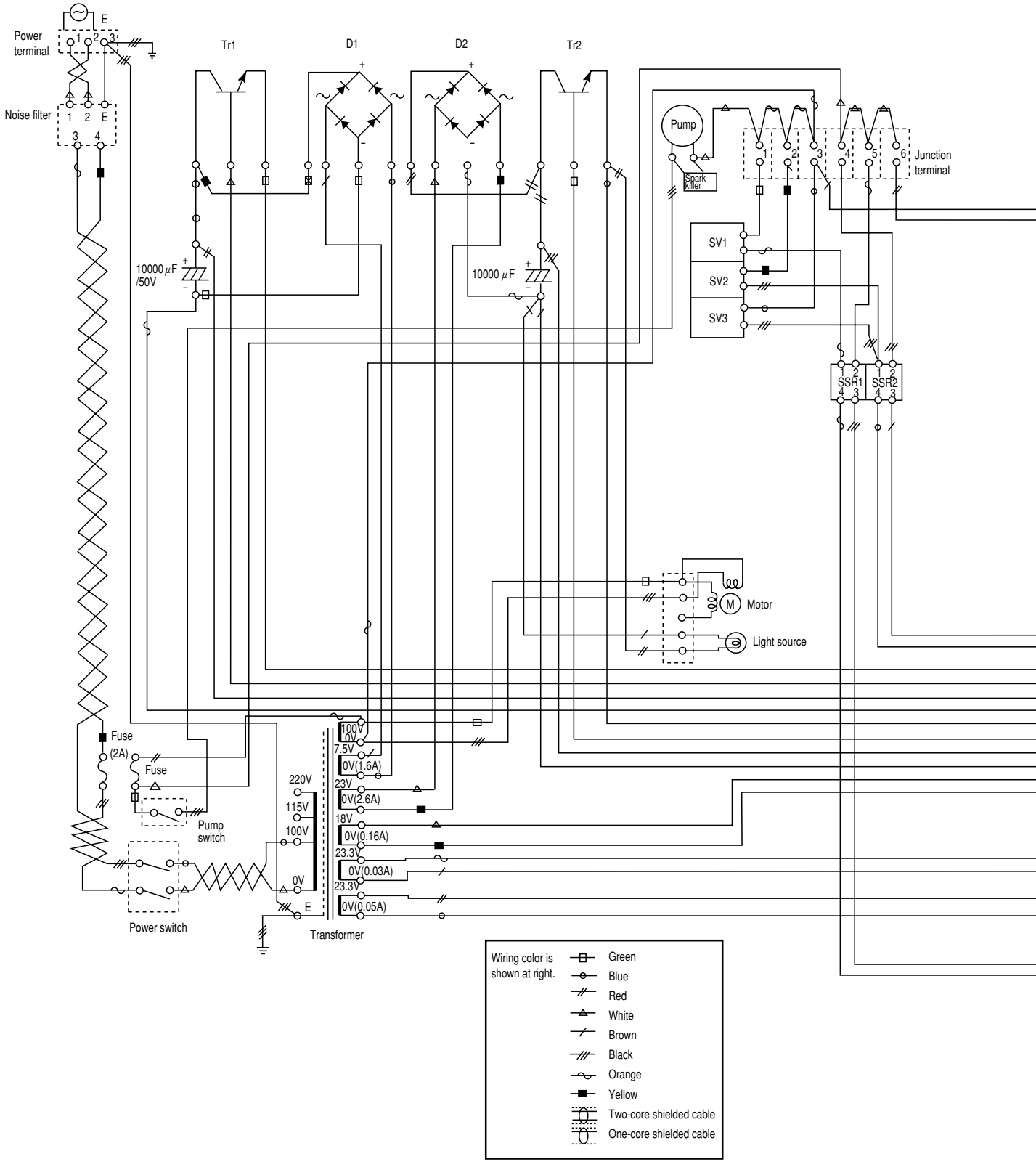
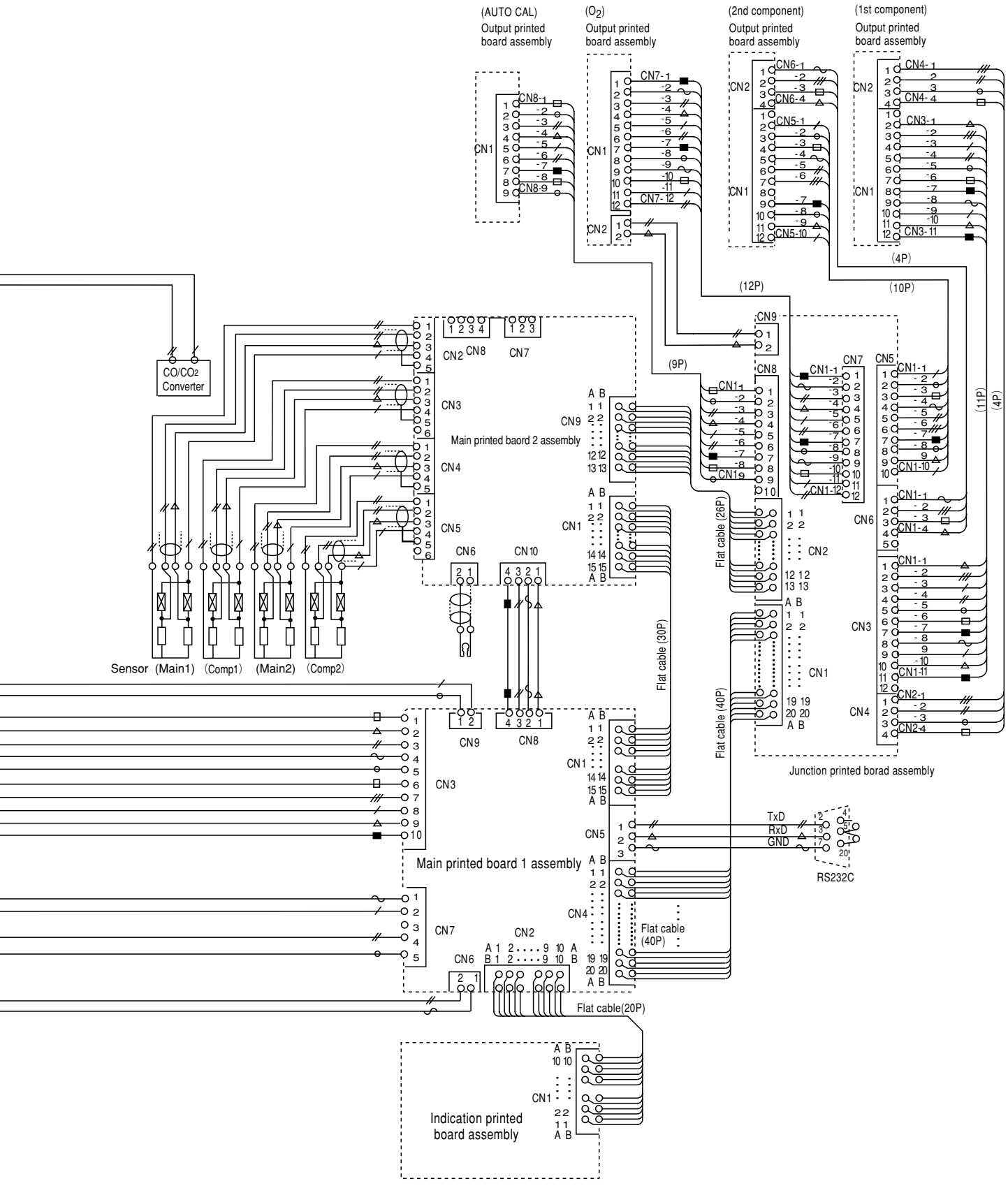


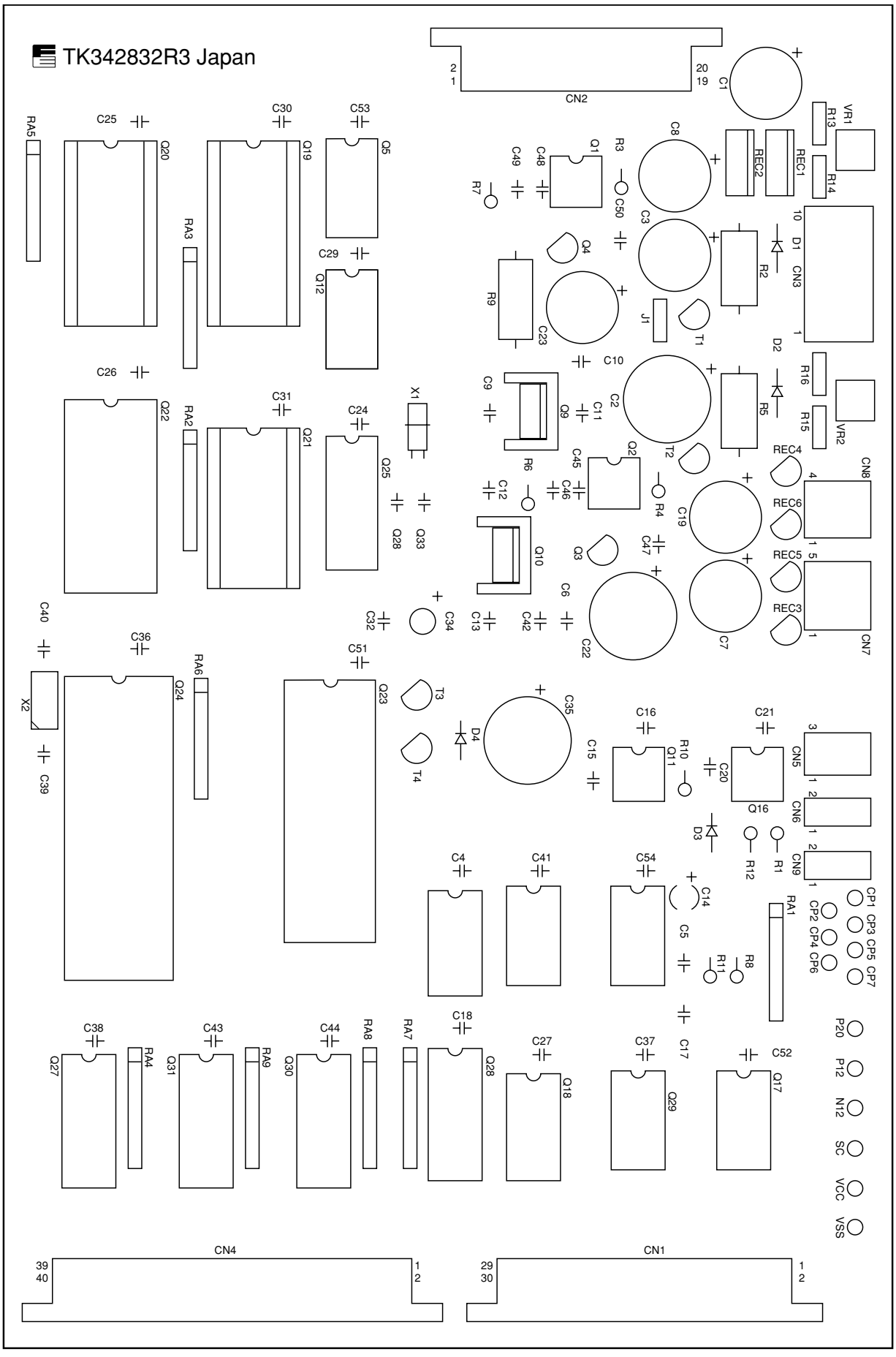
Appended figure 4. Wiring fiagram (full option product)



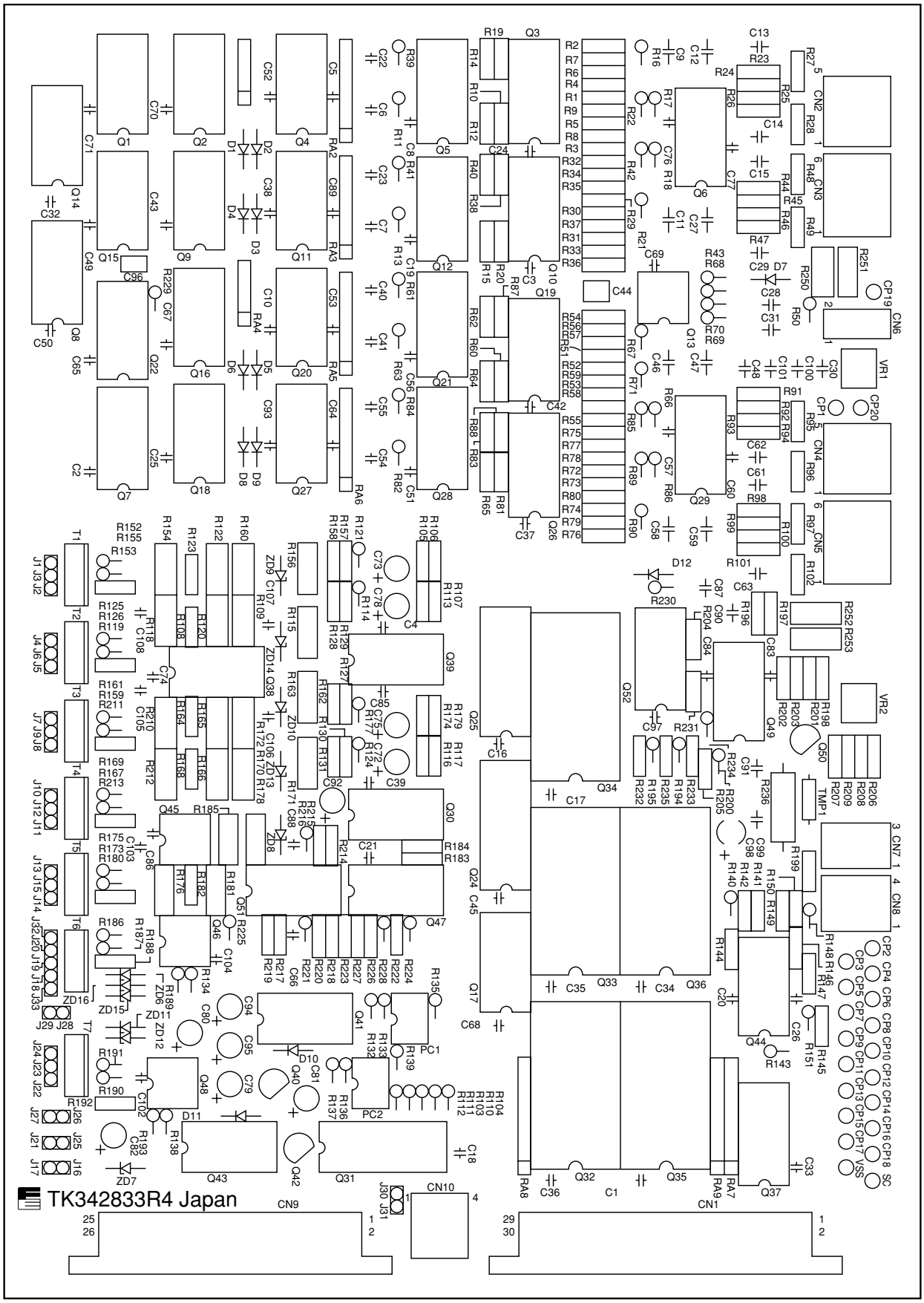
Appended figure 4. Wiring fiagram (full option product)



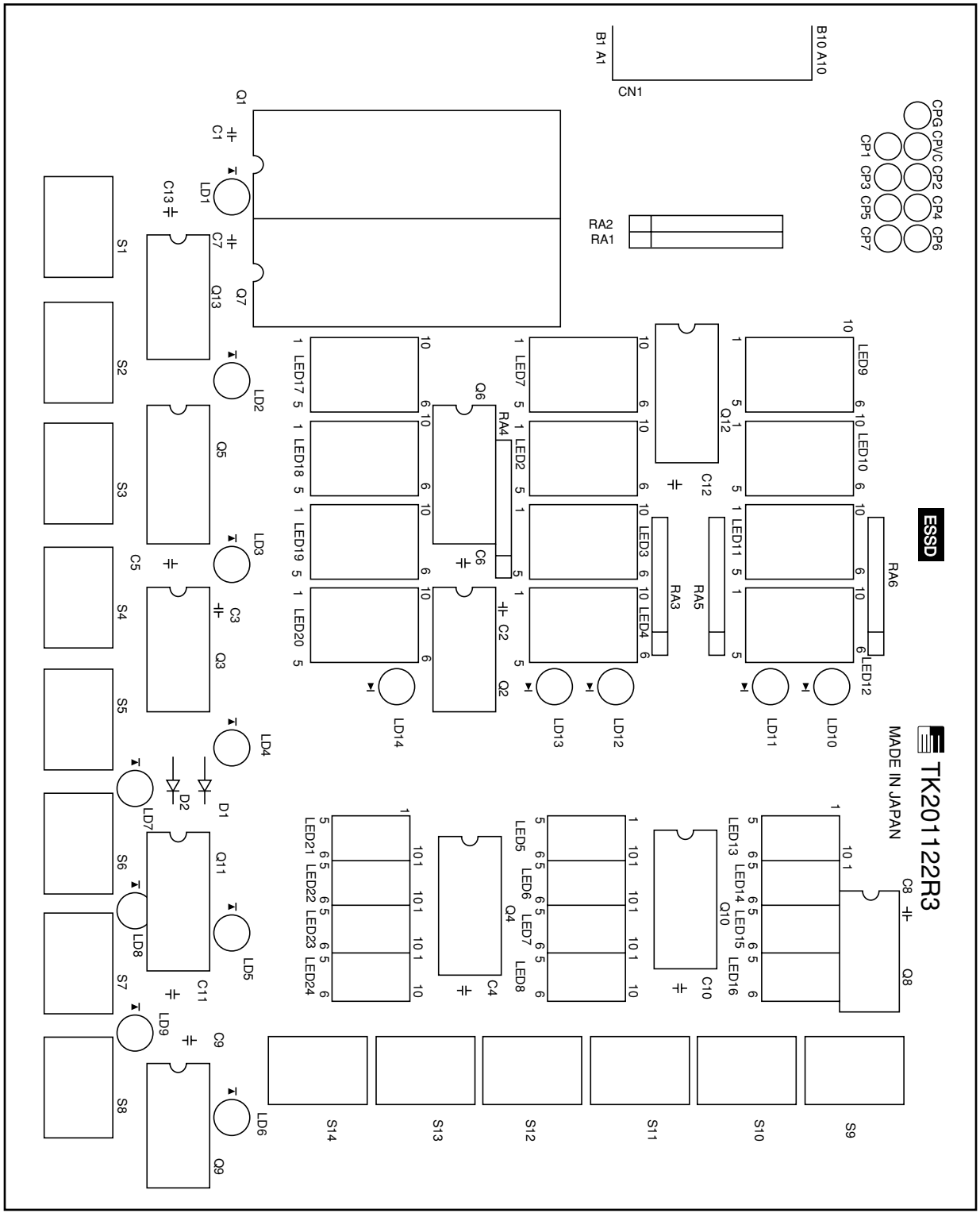
Appended figure 5. Main printed circuit board 1 layout



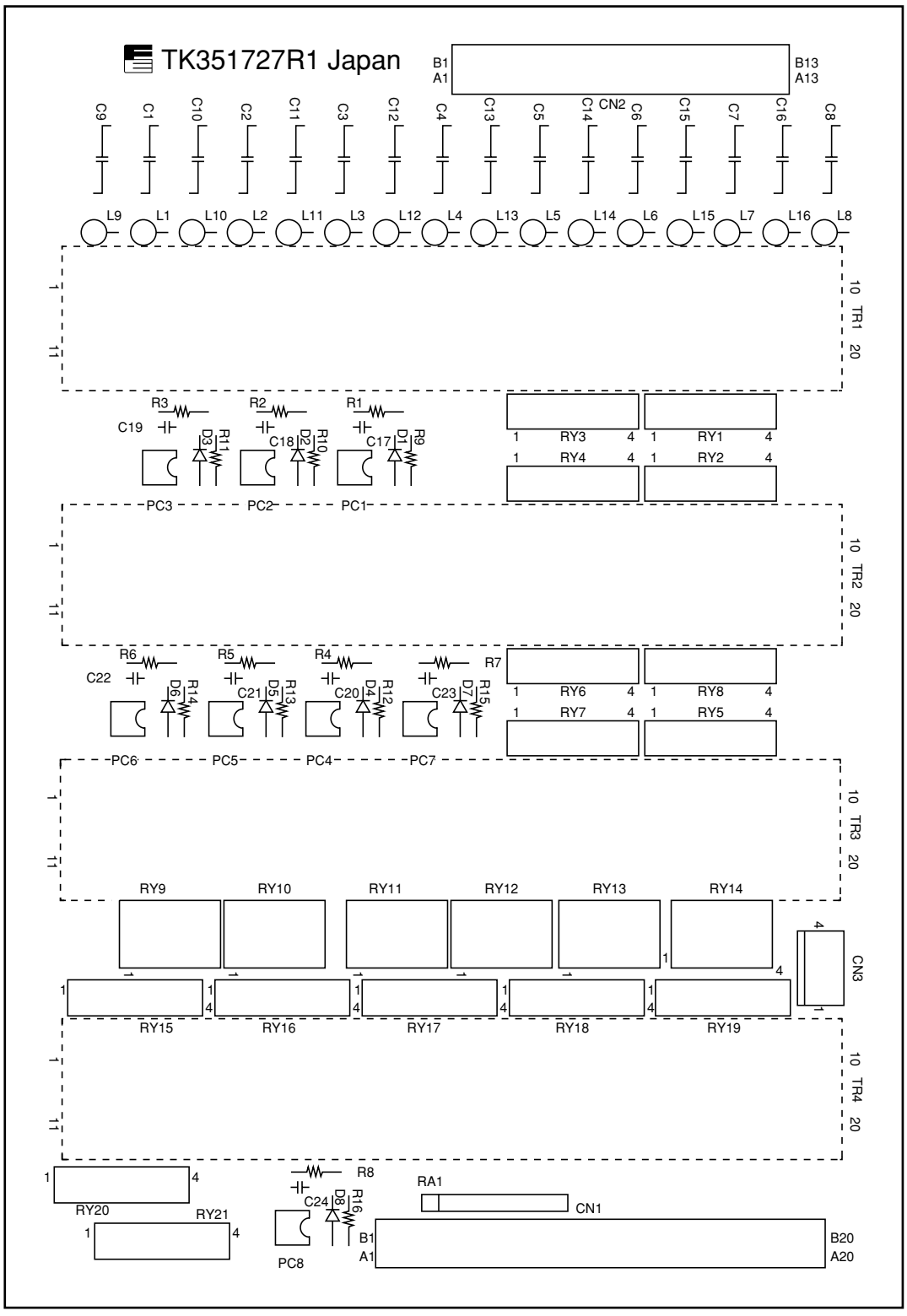
Appended figure 6. Main printed circuit board 2 layout



Appended figure 7. Indication printed circuit board layout



Appended figure 8. Output printed circuit board layout



Fuji Electric Systems Co., Ltd.

Head Office
Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome,
Shinagawa-ku, Tokyo 141-0032, Japan
http://www.fesys.co.jp/eng

Instrumentation Div.
International Sales Dept.
No.1, Fuji-machi, Hino-city, Tokyo 191-8502, Japan
Phone: 81-42-585-6201, 6202 Fax: 81-42-585-6187
http://www.fic-net.jp/eng