

作成承認印

配布許可印



SB-28

FSA02901

SB-28

FSA02911

(For European countries)
(欧 州 向)

REPAIR MANUAL

Nikon | **NIKON CORPORATION**
Tokyo, Japan

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Specifications for SB-28

1. Differences from SB26

- (1) Just one mode for the FP high-speed synch. flash
- (2) The xenon tube in the inner zoom head is shifted by the stepping motor drive.
- (3) No slave flash function
- (4) No synch. selector for both of front and rear curtains
- (5) Due to the command to lower voltage in accordance with 'EN 60491' as its external power source terminal on FSA 02911 for European spec., the form of external power source terminal is different from the conventional ones so that the item FSA 02911 has no compatibility with the presently used external power units such as 'SD-6', 'SD-7', 'SD-8', and 'SK-6'.

2. Power supply

The followings are power sources available to the SB 28.

*For integrated power supply :

The number of 4 pieces of any AA-type battery available such as 'Alkaline-Manganese', 'Nickel-Cadmium', 'Nickel-Hydrogen' or 'Lithium'.

Unavailable in the irregular usage's in the battery combinations such as 'new and used' or 'mixed up with different battery types'.

*For external power supply :

- In the usage together with the integrated power supply ;
SD-6, SD-7, SD-8 as individually sold items
- On FSA 02901 ;
SD-6, SD-7, SD-8, SD-8A as individually sold items
- On FSA 02911 ;
SD-8A as individually sold item

*Power bracket : In the combination usage with the integrated power supply ;

- On FSA 02901 ; SK-6, SK-6A as individually sold items
- On FSA 02911 ; SK-6A as individually sold item

3. Flash duration

Flash mode	Flash duration
Full flash in manual mode	Approximately 1.2 [mS]
1/2 flash in manual mode	Appr. 1.2 [mS]
1/4 flash in manual mode	Appr. 800 [μ S]
1/8 flash in manual mode	Appr. 400 [μ S]
1/16 flash in manual mode	Appr. 235 [μ S]
1/32 flash in manual mode	Appr. 155 [μ S]
1/64 flash in manual mode	Appr. 115 [μ S]
Pre-flash	Appr. 42 [μ S]
FP-flash from 85 mm of zoom position	More than appr. 9 [mS]

4. Guide No.

The followings are the guide numbers for the 135 type film.

(in accordance with ISO 100 ; unit : m)

	18mm *1	20mm *1	24mm	28mm	35mm	50mm	70mm	85mm
Full	18	20	30	32	36	42	48	50
M 1/2	12.7	14	21	22.5	25.5	30	34	36
M 1/4	9.0	10	15	16	18	21	24	25
M 1/8	6.4	7.0	10.5	11.3	12.7	15	17	18
M 1/16	4.5	5.0	7.5	8.0	9.0	10.5	12	12.7
M 1/32	3.2	3.5	5.3	5.7	6.4	7.5	8.5	9.0
M 1/64	2.3	2.5	3.8	4.0	4.5	5.3	6.0	6.3
Pre-flash	1.0	1.1	1.7	1.8	2.0	2.4	2.7	2.8
FP-flash	----	----	9.9 (20.8)	10.6 (22.2)	12 (25)	14 (29.2)	16 (33.3)	16.7 (34.7)

(1*) - Each '18mm' and '20mm' of dispersion for the values at equipped with the internal wide panel.

Note 1 : The guide numbers for the FP-flash are the values at 1/500 sec. as the shutter speed.

Incidentally, any No. in each parenthesis is the value at the moment being measured by with the flash meter.

Note 2 : As regards to the FP-flash at each '18mm' or '20mm'

of dispersion, although it emits light, its standard value shall not be defined.

The guide numbers for the APS type film

(in accordance with ISO 100 ; unit : m)

	16mm *1	18mm *1	24mm	28mm	35mm	40mm	50mm	60mm	70mm
Full	18	20	32	36	39	42	45	48	50
M 1/2	12.7	14	22.5	25.5	27.5	30	31.8	34	36
M 1/4	9.0	10	16	18	19.5	21	22.5	24	25
M 1/8	6.4	7.0	11.3	12.7	13.7	15	15.9	17	18
M 1/16	4.5	5.0	8.0	9.0	9.8	10.5	11.3	12	12.7
M 1/32	3.2	3.5	5.7	6.4	6.9	7.5	7.9	8.5	9.0
M 1/64	2.3	2.5	4.0	4.5	4.8	5.3	5.6	6.0	6.3
Pre- flash	1.0	1.1	1.8	2.0	2.2	2.4	2.5	2.7	2.8
FP- flash	----	----	10.6 (22.2)	12 (25)	13 (27)	14 (29.2)	15 (31.3)	16 (33.3)	16.7 (34.7)

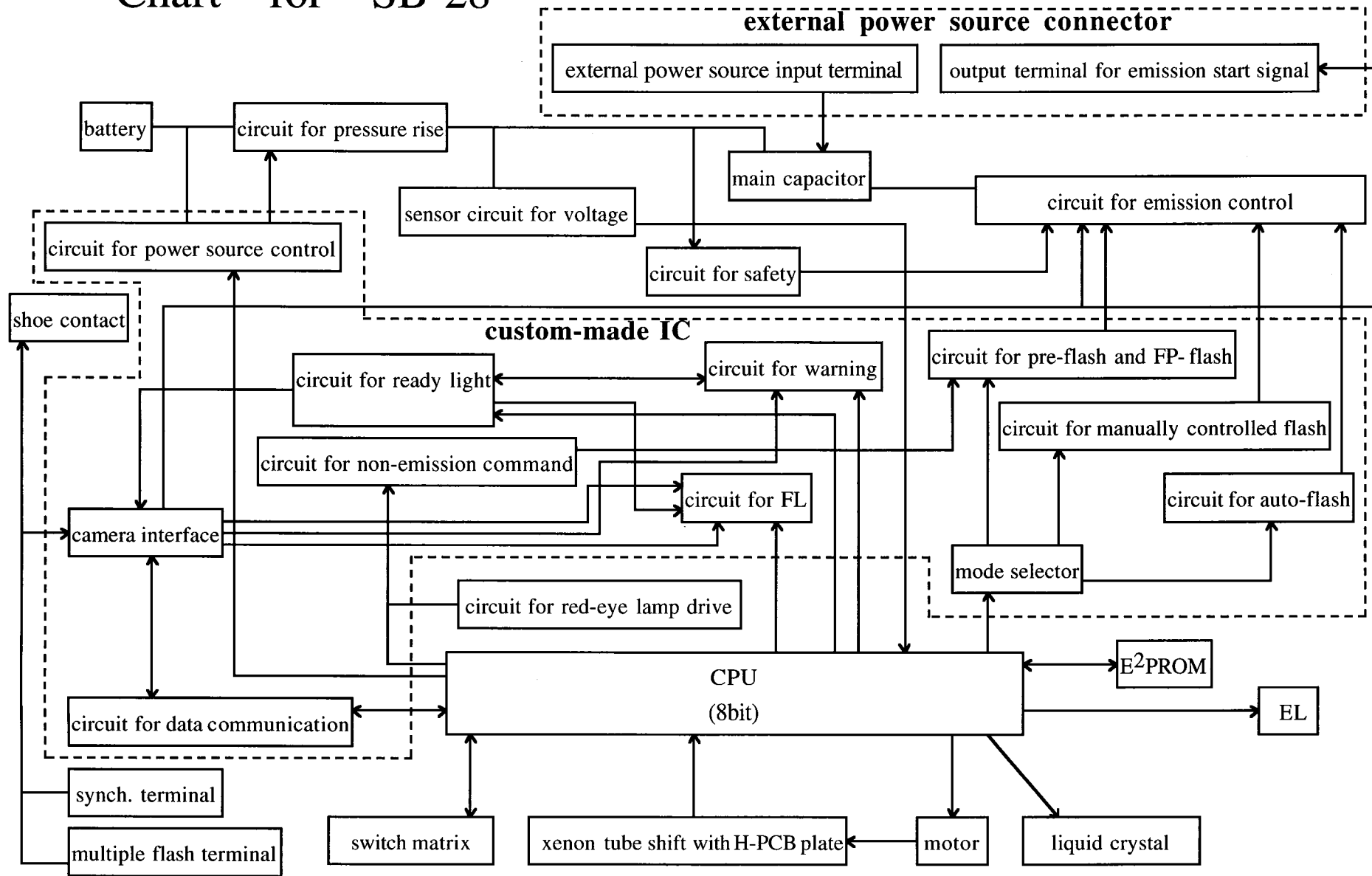
(1*) - Each '18mm' and '20mm' of dispersion for the values at equipped with the internal wide panel.

Note 1 : The guide numbers for the FP-flash are the values at 1/500 sec. as the shutter speed.

Incidentally, any No. in each parenthesis is the value at the moment being measured by with the flash meter.

Note 2 : As regards to the FP-flash at each '18mm' or '20mm' of dispersion, although it emits light, its standard value shall not be defined.

Chart for SB-28



5. Structure

As shown in the chart in appendix, the SB is composed of 'custom-made IC(s)', '8-bit CPU', 'E²PROM' and other peripheral circuits.

Explanations for each

Re : The custom-made IC(s)

This is made of each circuit made in the purpose of 'power supply control', 'ready light', 'warning', 'FL-flash', 'camera interface', 'data communication', 'mode selection', 'auto-flash', 'manually controlled flash', 'pre-FP flash', 'pre-flash cancel' and other-oriented functions.

Re : The 8-bit CPU

This conducts each operation of 'control for data communication', 'reading of the switch matrix', 'power supply control for set up mode', 'control for FL-flash', 'indication of LCD', 'control for EL drive', 'control for zoom head drive', 'control for E²PROM' and some others. Besides, as mentioned above, this is composed of the peripheral circuits of ICs such as 'for battery', 'for pressure rise', 'for main capacitor', 'for external power source connector', 'for interface to external power supply', 'for light emission control', 'for red-eye reduction lamp drive', 'for switch matrix', 'for shoe contact', 'for synch. terminal', 'for multiple flash terminal' and some others.

Re : Battery

It is incorporated to the SB 28 which is available to settle 4 pieces of AA-type battery.

Incidentally, its available types of battery are 'Alkaline-Manganese', 'Nickel-Cadmium', 'Nickel-Hydrogen' and 'Lithium'.

Re : Circuit for power supply control

This monitors the voltage of battery, and stops the operation of pressure rise circuit in case the voltage goes lower than 3 V.

Besides, it can also stop directly in cases of the zoom motor driving, or warning after something happened.

Re : Circuit for pressure rise

This is to make internally equipped 4 batteries to maintain pressure-rise condition and to charge the main capacitor to its rated voltage of 330V.

In addition, just in case the battery voltage lowers than 3 V or so, the pressure rise operation is tentatively stopped by the command from the circuit for power supply control.

Re : Sensor circuit for voltage

It outputs the ready light flash voltage and the pressure rise stop voltage to the A/D input terminal of CPU.

Re : Main capacitor

It stores the emission energy up for the SB 28.

Using the circuit for pressure rise, 330 V as its rated voltage can be charged to the capacitor.

In addition, the electric charge of main capacitor has a structure which hardly leaks the saved electric charge even after the pressure rise circuit stops.

Re : Circuit for safety

In case any batteries are loaded in the SB 28 regardless of the power supply's switch-on/off condition of the SB 28, it always monitors the terminal voltage of main capacitor.

Besides, in case its voltage goes beyond 350 V as the rated voltage, it protects the main capacitor against its breakdown by emitting the light forcibly.

Re : External power supply connector

This is external power supply input terminal in order to directly charge the main capacitor.

There are two types of external power supply input terminals which are 'FSA 02901' and 'FSA 02911 for Europe'.

Of them, FSA 02901 is available to connect with individually sold external power sources such as SD-6, SD-7, SD-8, SD-8A, power bracket SK-6 and SK-6A.

Besides, FSA 02911 is available to connect with individually sold external power sources such as SD-8A and power bracket SK-6A.

Re : Circuit for ready light

After the CPU detects the voltage which is output from the voltage sensor circuit, the signals of RY1 and RY2 are output to the ready light circuit. By receiving these signals, the ready light circuit makes the SB 28 and the in-finder ready light to work the flashing operation in accordance

with the mode specified by the flash mode selector.

Re : Circuit for warning

It outputs 'the precaution' and 'the post-caution' which are explained in the repair manual for SB 25.

It operates the in-finder ready light to blink, or, the ready light on this item to blink for limited period of time, or any specified segment on the LCD to blink as the demonstration of warning.

Re : Camera interface

This is a contact electrically connecting with the camera.

It is composed of 5 contacts such as CX, CRY, CSTP, CSP and GND.

By modifying each voltage value and current value of these terminals, it conducts input and output for the data communication, the warning signal and other operations.

Re : Circuit for FL-flash

It supports the AF operation of camera.

In accordance with any command from the camera, it conducts to turn on and off the light and helps any AF mode to measure the distance.

Incidentally, in case the non-emission mode is set for the AF assist illuminator, it ignores any flash command from the camera so that the flashing operation always stops.

Re : Circuit for data communication

It works for sending and receiving any signal from each data of 'ISO', 'lens aperture condition', 'focal length', 'compensation for exposure mode on strobe' or such.

Re : Mode selector

This is used for changing any light emission mode from the SB 28 by using the signal from 8-bit CPU.

It selects any flash mode from the category of 'TTL', 'auto-flash', 'manually controlled light', 'pre-flash' or 'FP-flash'.

Re : Circuit for auto-flash

The photo-detecting device is arranged on the front red panel of SB 28.

In order to maintain any appropriate quantity of light for any subject brightness after receiving the reflecting light from the object, this works to control the light emission quantity from the SB 28.

Re : Circuit for manually controlled flash

The photo-detecting device inside the flash function of the SB 28 receives the light from the xenon tube.

Then, this works to control the quantity of light in order to meet its defined volume within the range from 'M 1/64' to 'full'.

Re : Circuit for pre-flash and FP-flash

The photo-detecting device inside the flash function of the SB 28 receives the light from the xenon tube.

Then, this works to control the quantity of light in order to meet its defined mode either from 'pre-flash' or 'FP-flash'.

Re : Circuit for light emission control

It employs IGBT including the xenon tube for light emission, the trigger circuit, the secondary high voltage circuit and so on.

In response to any mode selected by the flash mode selector, it emits the light.

Re : Switch matrix

This is used for reading any switched condition on the rear body of strobe. In response to any situation, the 8-bit CPU conducts to display on the LCD of SB 28 and to switch the auto-flash gain.

Re : Shoe contact

This should be electrically connected with the camera.

It is composed of 5 terminals such as 'for CX as light emission start', 'for CRY as timing switch, and as charge completion signal', 'for CSTP as light emission stop signal', 'for CSP as camera monitor' and 'for GND'.

Besides, the synch. terminal is composed of each CX and GND terminal, and the multiple flash terminal is formed by each CX, CSTP and GND terminal.

Re : 8-bit CPU

It conducts 'reading of the switch matrix', 'control for the flash mode selector', 'control for the power source for FL-flash', 'data communication with camera', 'control for the pressure rise condition', 'display of any data on the LCD', 'control for the EL drive as LCD illuminator', 'control for the circuit for zoom head drive', 'flash control for the preparatory illuminating lamp for red-eye reduction'

and so on.

Re : Circuit for red-eye reduction lamp drive

It controls to turn on and off the lamp according to any command from the 8-bit CPU.

In addition, the lamp is turned on only when any command is conveyed from the camera connected with the SB 28.

Re : Circuit for non-emission operation

It works to stop the pre-flash mode even if any flash command is conveyed from the camera at bounce flash moment on the SB 28.

Re : E²PROM

It memorizes 'specified power source condition', 'flash mode', 'm / ft', 'non-emission mode for the AF assist illuminator' and 'the number of flash operation times'.

Re : Motor and xenon tube shift with H-PCB plate

As well as controlling the position of xenon tube by the stepping motor which receives any command from CPU, by shifting the plate simultaneously, it defines any appropriate illuminating angle.

2-21. Safety of the product

In accordance with the specifications of this product, the used ICs are formed to be always conductive even if its power source is off.

In this accord, in case these parts are damaged by the static electricity or such, the worst battery condition such as dead-and-short mode may occur.

For the sake of responding to such a condition, the safety of product shall be maintained by putting multiple temperature fuses into the power source(s), or so.

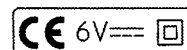
2-22. CE marking


This product is one of the objects of the CE marking conducted in Europe so that it is necessary for the product to fully meet the EMC command and the lower voltage command.

As mentioned formerly, there are two types of this product such as 'FSA 02911 for Europe' and 'FSA 02901 for the rest of the world'.

For the European type, the labels below shall be attached.

Besides, its internal structure is partially different between the product for Europe and the another one.



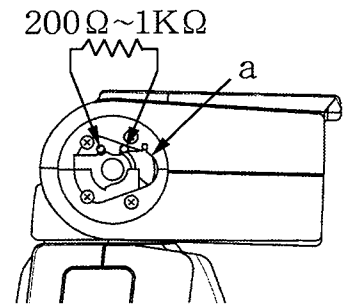
⚠ WARNING	
	<ul style="list-style-type: none"> ● There are high voltage parts inside. Be careful of this electric shock, when you remove the cover. ● You must discharge the main condenser according to the instruction of this repair manual after you remove the front cover.

Assembly and disassembly manual

1. Disassembly

This procedures are basically the same as the SB-25's and the SB-26's. Hence, for its disassembly, the repair manual for the SB-25 shall be referable.

As shown in the right figure, remove the rubber cover as 'a' area. Then, after discharging the electricity in the main capacitor through the two small holes by with the discharging tool(s), disassemble the SB-28.



2. Precautions for repair

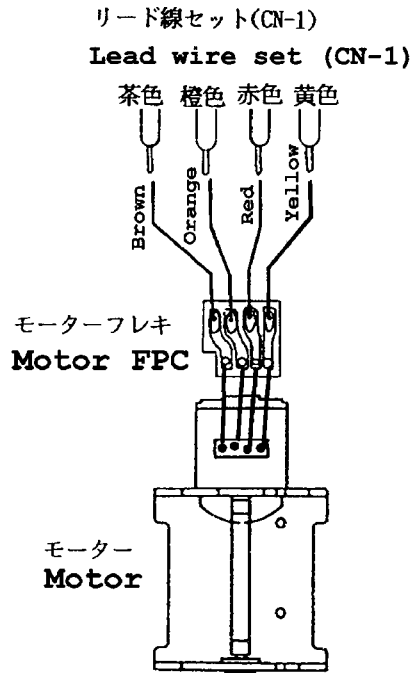
- 1) In case of damaged FPC for the zoom motor, remove the FPC and solder the lead wire(s) directly onto the terminal of zoom motor.
- 2) In case of each damaged FPC part below for K-FPC, connect additional lead wire(s) with each pattern of K-FPC. ⚠ Refer to page "E10".
 - (1) Shoe area
 - (2) Auto sensor
 - (3) Red-eye reduction lamp area
 - (4) External power source

Incidentally, due to the EMC command and the lower voltage command, this connecting procedure is unable to apply for the European-spec. products. Hence, replace the X unit part.

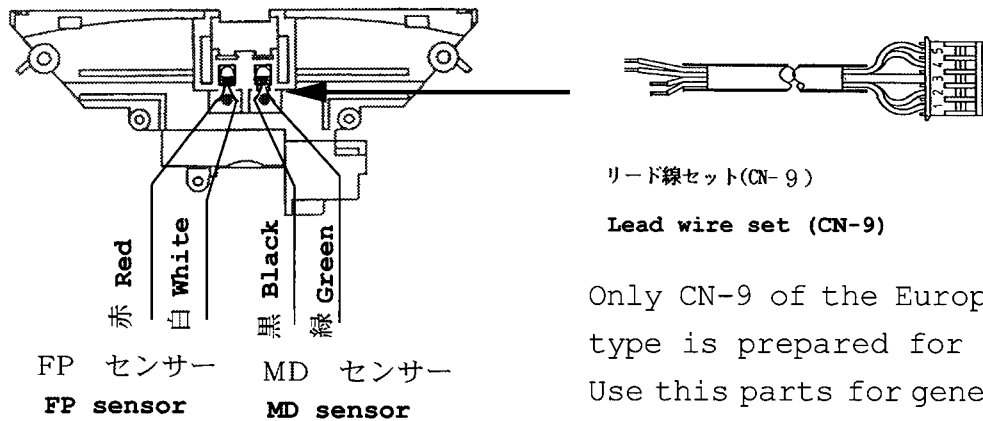
- 3) In the replacement case of each lead wire with its connector on the light emission area, make sure to use the lead wire(s) specified as one of the repair parts.

If any unspecified wire(s) were employed, due to change in temperature, the light emission area may often stop its zooming operation.

3. Soldering for zoom motor FPC



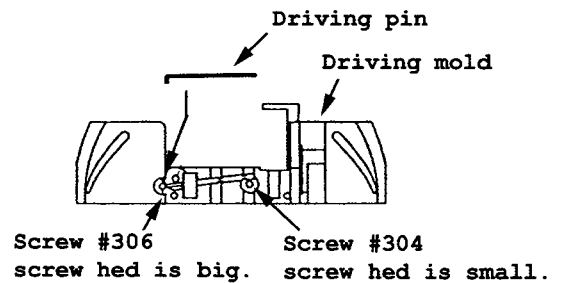
4. Soldering for FP,MD sensor



Only CN-9 of the European countries type is prepared for repair parts. Use this parts for general type SB-28 also.

5. Driving pin

Put the driving pin in the hole of driving mold, then put in the groove. Hold this pin by 2 screws.



How to adjust

a) Summary

Including LVD, on the SB-28, there are three kinds of necessary adjustment such as 'electrical adjustment for 3 areas from semi-fixed resistance VR1 to VR3', 'another 3 kinds of adjustment by communication tool(s) via PC(s)' and 'adjustment for direction of focusing light module'.

The followings are the adjustment procedures.

1. Electrically adjusted γ by VR1
2. Initial value entry adjusted by transmission via PC(s)
3. Entry of home position for zooming by transmission system via PC(s)
4. Voltage of the main capacitor adjusted by transmission system via PC(s)
Definition : 265 V as the set-up value, 290 V and 330 V as the check-up values
5. Set up the F value for auto-flash mode and the quantity of light manually adjusted through transmission system
6. Adjustment for 'pre-flash' and 'FP-flash' by VR2 and VR3

The whole adjustment procedure mentioned above shall be carried out at replacement of the assembly X which is composed of A, K and B.

In case of disassembly of the upper half SB body (Fig2-A) or, of replacement of any part in the upper half SB body, the adjustment above in the process order of No. 3, 5 and 6 shall be performed.

b) Adjustment processes

The adjustment for VR1 to VR3 shall be available by peeling off the protective cover of control area. (Fig 3)

As can be seen from the drawing above, connect both of an anode and a cathode of the rated voltage power source with each other.

Then, enter 5.7V and 4A as the power source voltage for strobe.

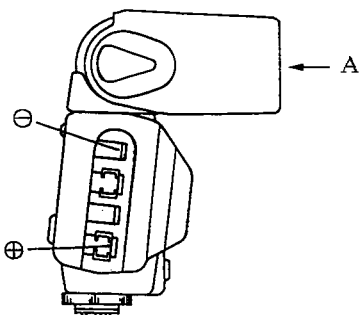


Fig 2

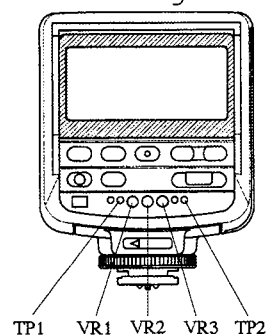
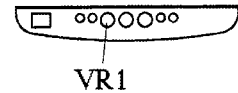


Fig 3

1) For VR1 as 'γ adjustment'



*Aim : As well as the SB 25's

*How to adjust : Set the flash function to any mode and then connect the voltage meter with between TP1 and TP2 for the sake of adjustment.(Fig 2)

*Standard : 204 (± 1) mV in the room temperature of 26° C.

In case the room temperature is not 26° C at adjustment, refer to the following table for controlling the voltage then.

Rm. Temp. in ° C	specified vol. In mV	Rm. Temp. in ° C	specified vol. In mV
15	196.6	23	202.0
16	197.3	24	202.7
17	198.0	25	203.4
18	198.6	26	204.1
19	199.3	27	204.8
20	200.0	28	205.5
21	200.7	29	206.1
22	201.4	30	206.8

2) Initial value entry through communication system

In accordance with the adjustment procedures from 2 to 5 in a) Summary, equip the SB 28 with the communication tool named 'high-speed I/O tool J 15335(hereinafter so-called 'communication tool')' and write the initial value according to the menu.

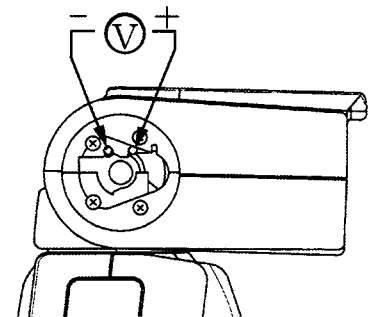
3) Entry to the home position for zooming through communication system

Equip the SB28 with the communication tool and write the home position for zooming according to the menu.

4) Voltage adjustment for the main capacitor through communication system

Set the flash function to the A or M mode.

Then, measure the value of pressure rise voltage of the main capacitor by with the digital meter. Then, enter any numerical value of the voltage measured at flashing moment of ready lamp to PC(s) in operation.



Follow one of each procedure below for check-up after adjustment.

*Set the flash function to A or M mode and measure the voltage value at flashing moment of ready lamp after pressure rise condition examined on the main capacitor.

Standard : 265 (± 4.5) V

*Set the flash function to '3D multiple TTL' or 'FP' mode and measure the voltage value at flashing moment of ready lamp after pressure rise condition examined on the main capacitor.

Standard : 290 (± 4.5) V

*Set the flash function to any mode to make it go to pressure rise condition.

Then, measure the voltage value which is stopped the pressure rise condition by the pressure rise stop circuit.

Standard : 330 (± 4.5) V

The each voltage of 290 V and 330 V is automatically controlled by adjusting the voltage of 265 V.

5) Set-up of the auto-flash F value and manually controlled quantity of light through communication system

Re : Auto-flash F value

Prepare the standard reflection board and the flash meter. Set the SB 28 to 'mode A', '5.6 as the value F', 'ISO 100', '35 mm as zooming position' and '1 m distance taken for metering'.

Adjust the auto-flash F value in accordance with the menu. In addition, in case the standard

reflection board or the flash meter can not be arranged around PC(s), separate the SB28 from

the communication tool(s) and measure the quantity of light.

Then, set the SB 28 onto the communication tool(s) and input the measured value(s) from flash

meter in operating condition on PC(s).

Standard : F = 4 to 8

Re : Manually controlled quantity of light

Set the SB 28 to 'manual mode', '1/8 of light quantity', '35 mm as zooming position' and '1 m distance taken for metering'. Adjust the light quantity in the manual mode in accordance with the menu.

In addition, in case the standard reflection board or the flash meter can not be arranged around PC(s), separate the SB28 from the communication tool(s) and measure the quantity of light.

Then, set the SB 28 onto the communication tool(s) and input the measured value(s) from flash meter in operating condition on PC(s).

Standard : '12.7 + 3.5' to '12.7 - 2.7' as GN

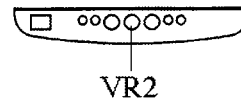
6) Adjustment for the pre-flash and the FP-flash

Re : Adjustment for the pre-flash

What are prepared :

(7) F90

(8) D lens



Its focal length shall be taken 50 mm recommendable.

(9) SB 25

Its pre-flash level shall be pre-adjusted.

(10) Standard reflection board

(11) Waveform observation tool for SB

This is SPD tool used when adjusting the FP-flash timing for SB 25.

(12) Oscilloscope with storage function

How to adjust :

(1) Apply the isolation tape to the contact X on the hot shoe of F90 in order to emit the pre-flash alone.

(2) Set the SB 25 to the normal synch. mode and the TTL-3D mode, and then equip it with the F90 as mentioned above.

(3) Set the standard reflection board 50 cm away from the camera.

(4) In the situation above, release the shutter to make the pre-flash and then observe its waveform by with the oscilloscope.

Adjust the position of standard reflection board in order to make 3 times of flashing through observing the waveform.

Make sure the position for the SPD tool in order to let the peak voltage of waveform to be approximately 1 V.

(Refer to the fig. 4)

(5) Try shutter release operation several times.

Then, put the 'third peak value of waveform from flashing' on record.
(This peak value is named as E1V.)

(6) Replace SB to SB 28.

Try shutter release operation in order to observe the waveform from pre-flashing.

Adjust VR2 of the SB28 to make the waveform as well as what is made in the above column (5).

(7) Measure the third flashing peak value which is named 'E2V'.

Then, rotate the VR2 in order to adjust and let the E2V in the following standard value.

Standard : $0.9E1 \leq E2 \leq 01.1E1$

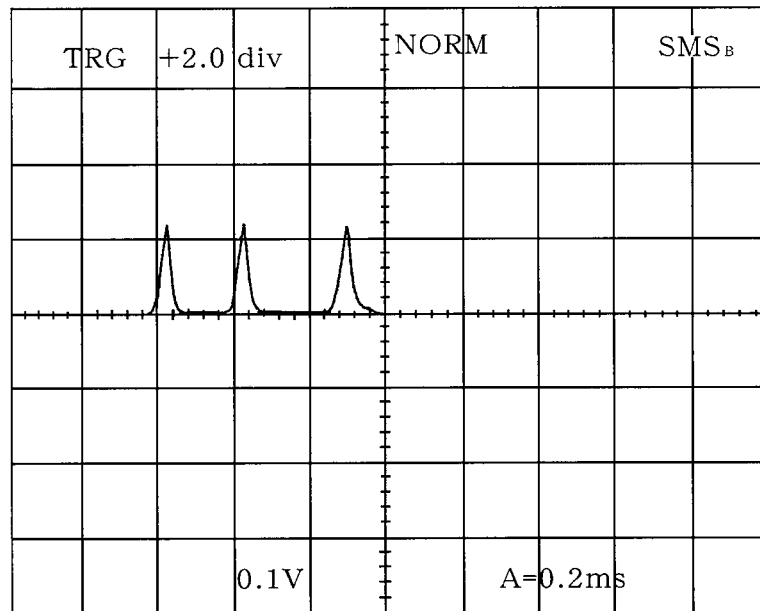
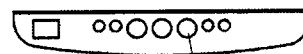


Fig 4

Adjustment for the FP-flash



VR3

As well as the case of FP-flash adjustment for SB-25, follow to try the emission control by VR3.

Standard : 9 ± 0.5 ms

7) Adjustment for FL

*Aim : For the sake of the pattern of focusing light which should be correctly lighting to the AF camera position, adjustment is necessary.

Due to different pattern made by the SB 28 from ones created

by the SB 24, 25 and 26, the FL adjustment for the SB 28 shall be made according to the manner below.

*What are prepared :

- (1) Any AF camera body
- (2) Any AF lens with lens cap
- (3) Tripod

Self-made check-up chart as the figure 5 referable

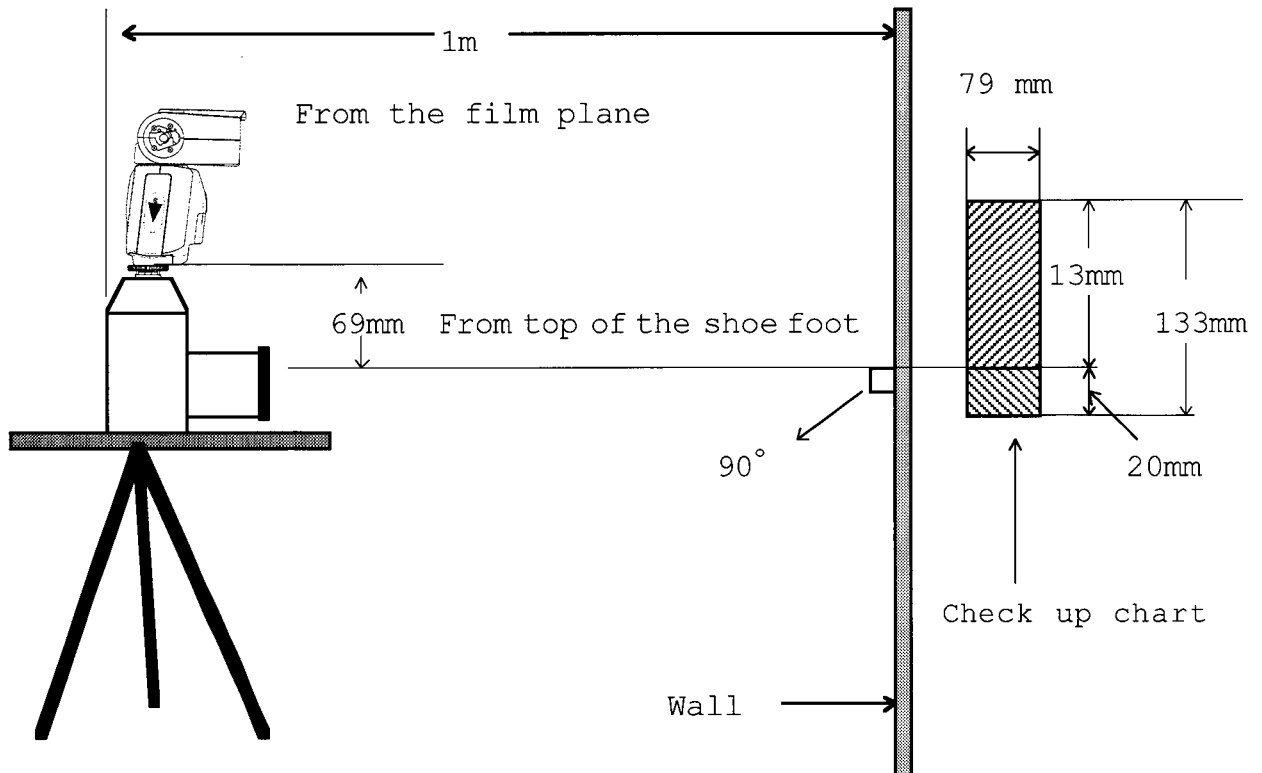


Fig 5

In order to arrange each position as described in the upper figure 5, set the camera and the check-up chart and then set the AF mode of camera to 'S'.

In case of indication of [NO AF - ILL] on the LCD of SB 28, press [MODE] and [-] buttons simultaneously in order to cancel the non-emission mode set in the auto focus assist illuminator.

In addition, the wall in which the camera is equipped and the check-up chart is attached should be maintained exactly vertically, otherwise, it may cause incorrect position for the illuminator.

Remove the FL cover of SB 28 and pre-press the shutter release button on camera in order to emit the LED from the AF assist illuminator.

Then, in order to cover the check-up chart completely (fig. 7) with shadow light on the chart (fig. 6), use the screw #308 to adjust the position of focusing light.

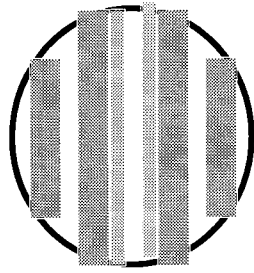


Fig 6

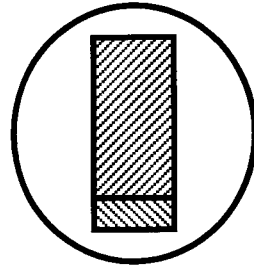
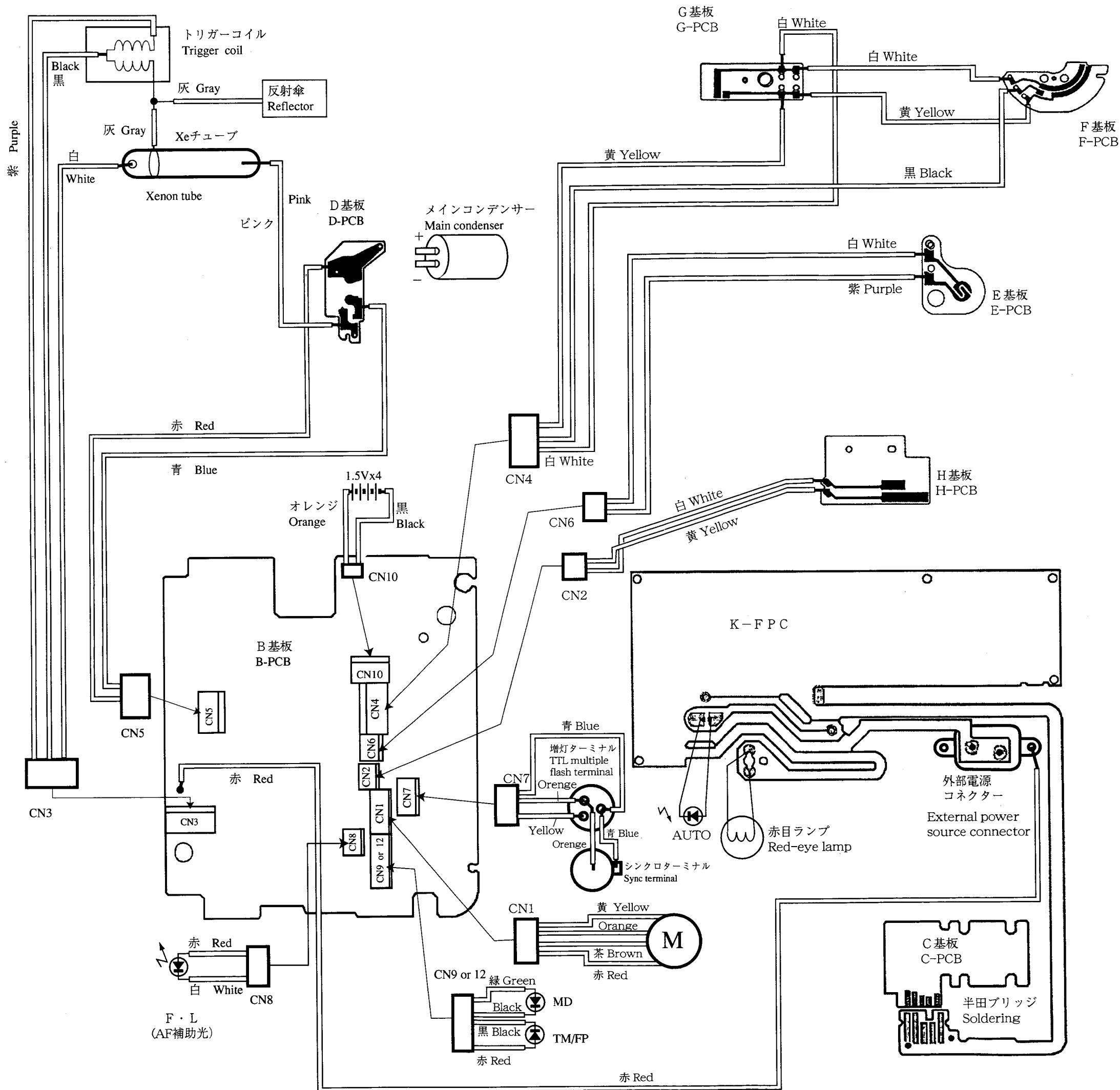
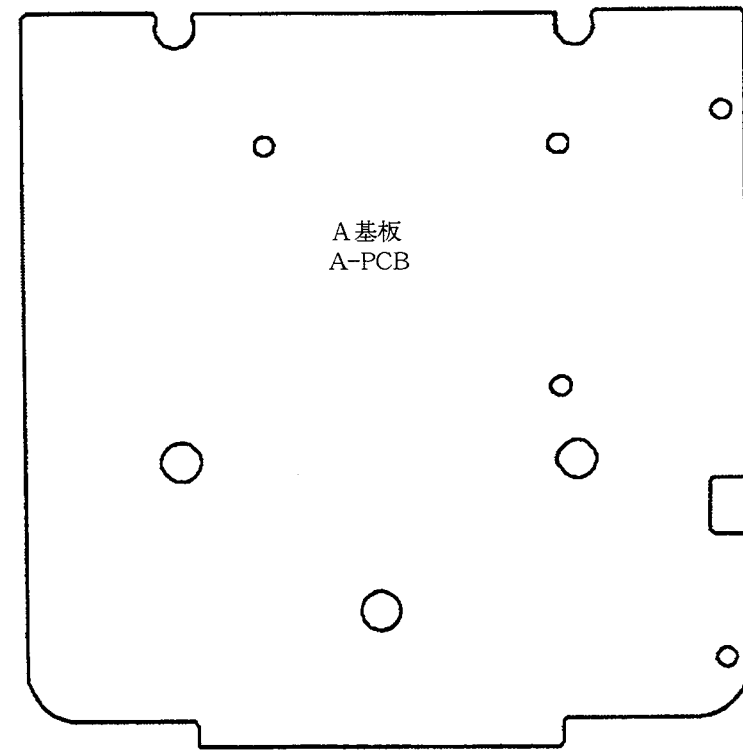


Fig 7

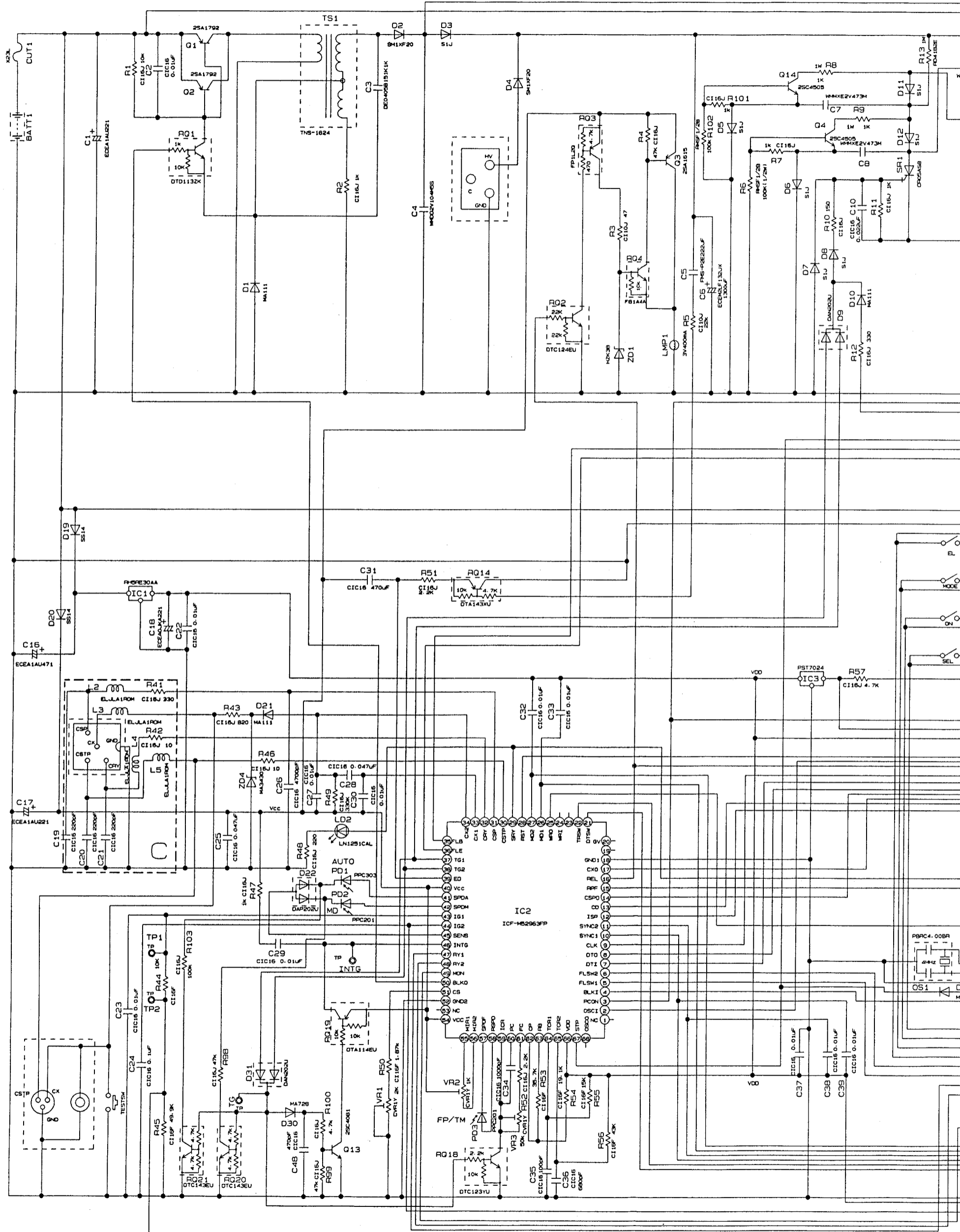
△ After adjustment, adhere the screw #308 by with Screw Lock.

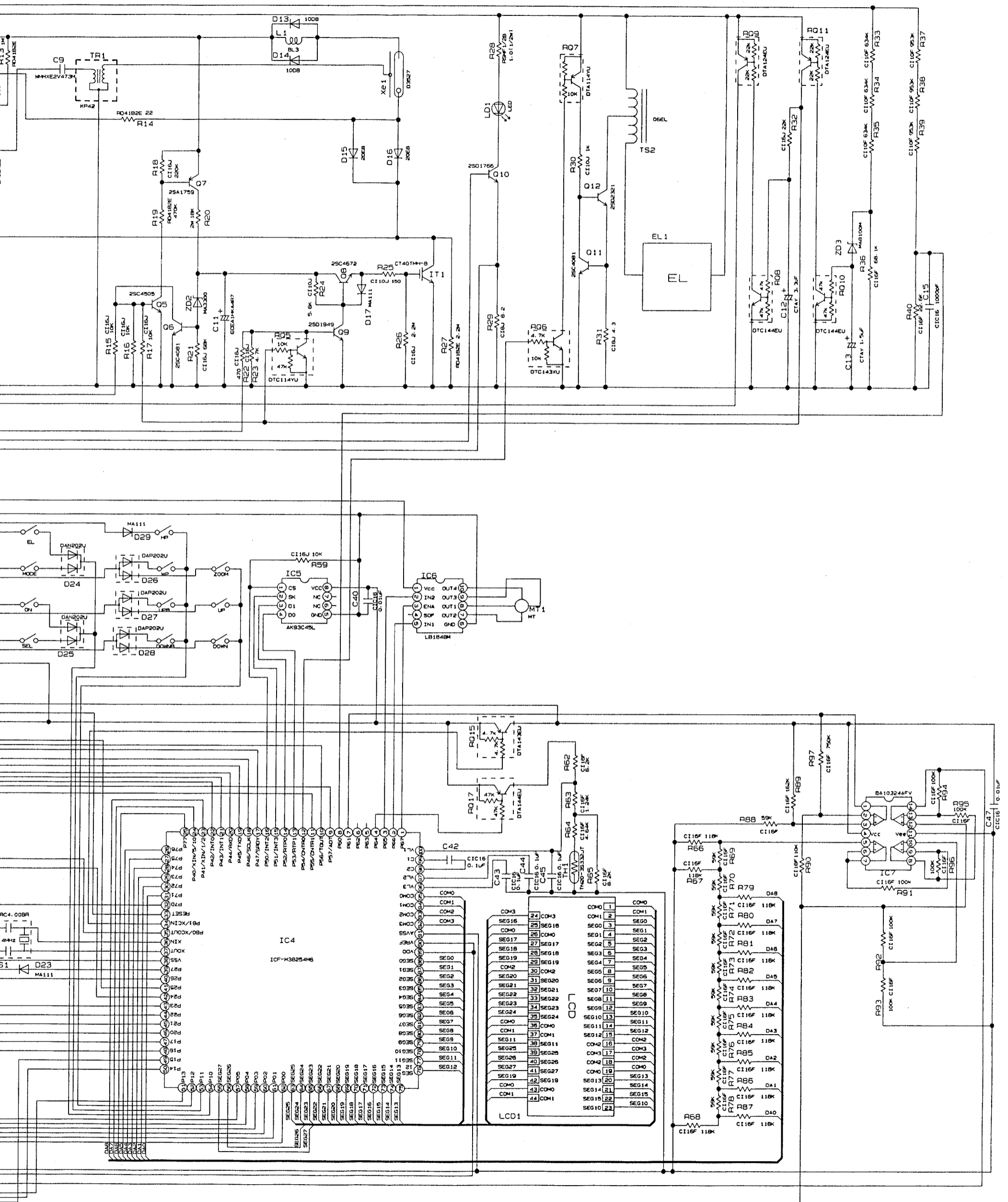


実体配線図 WIRING

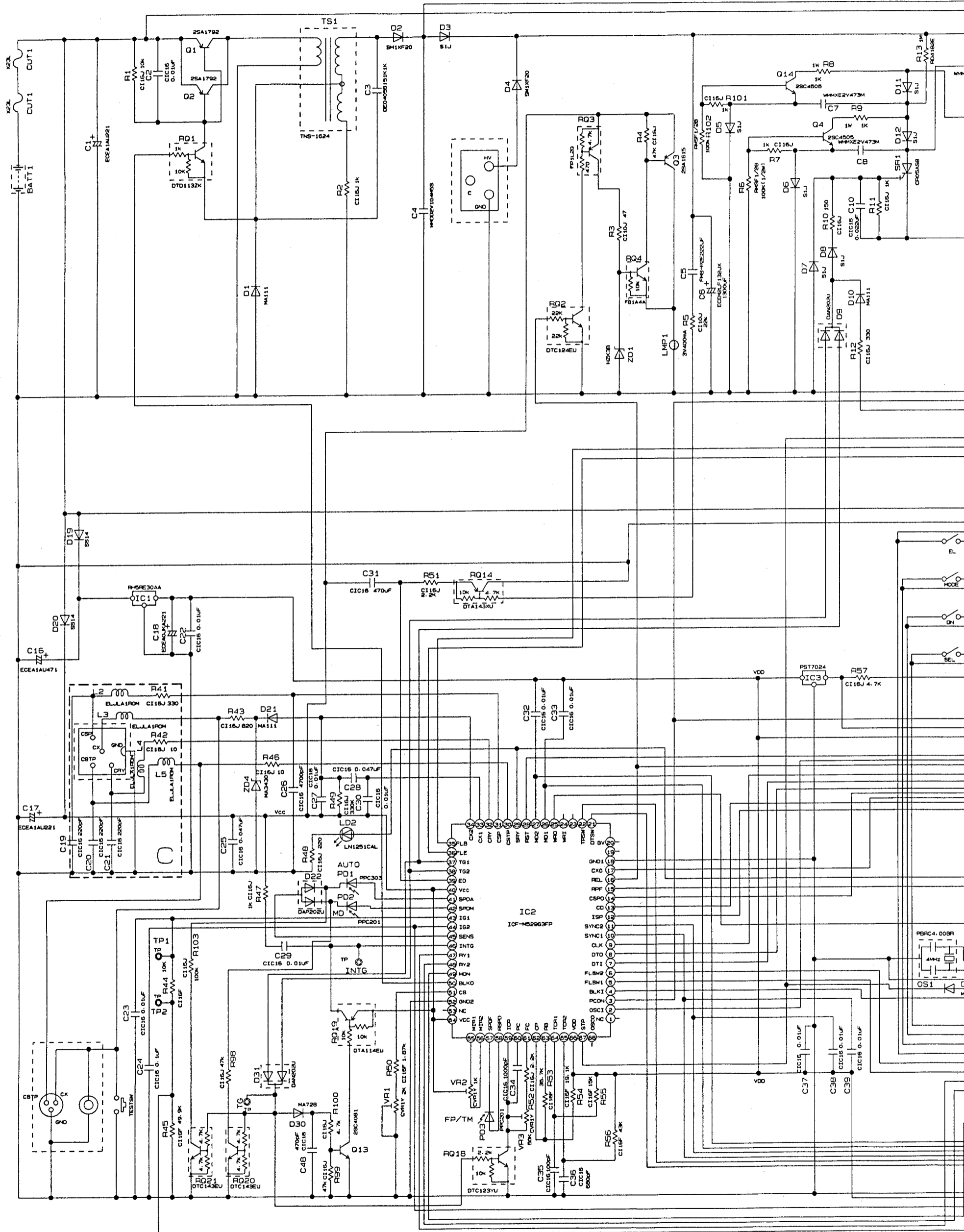


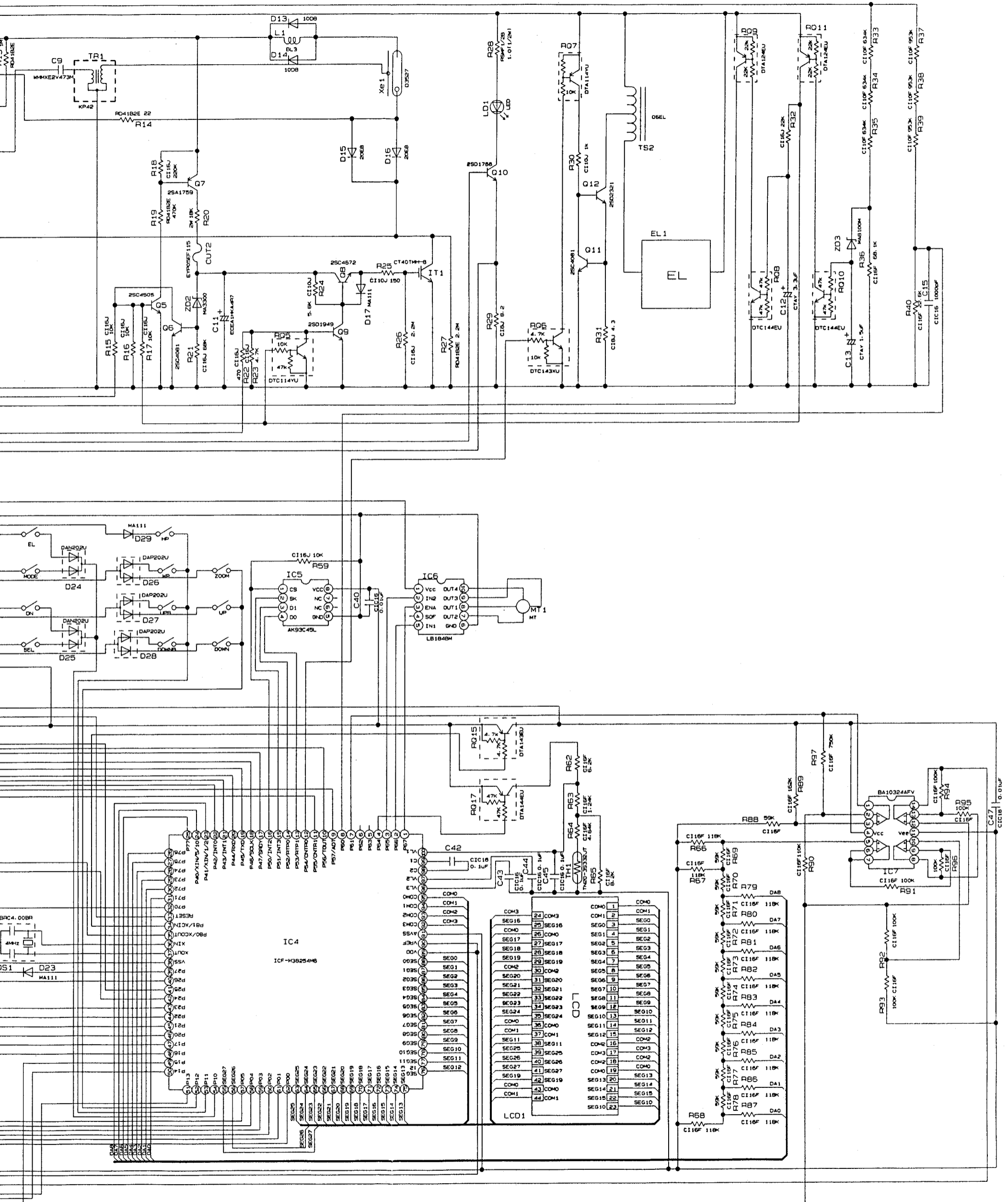
回路图 CIRCUIT



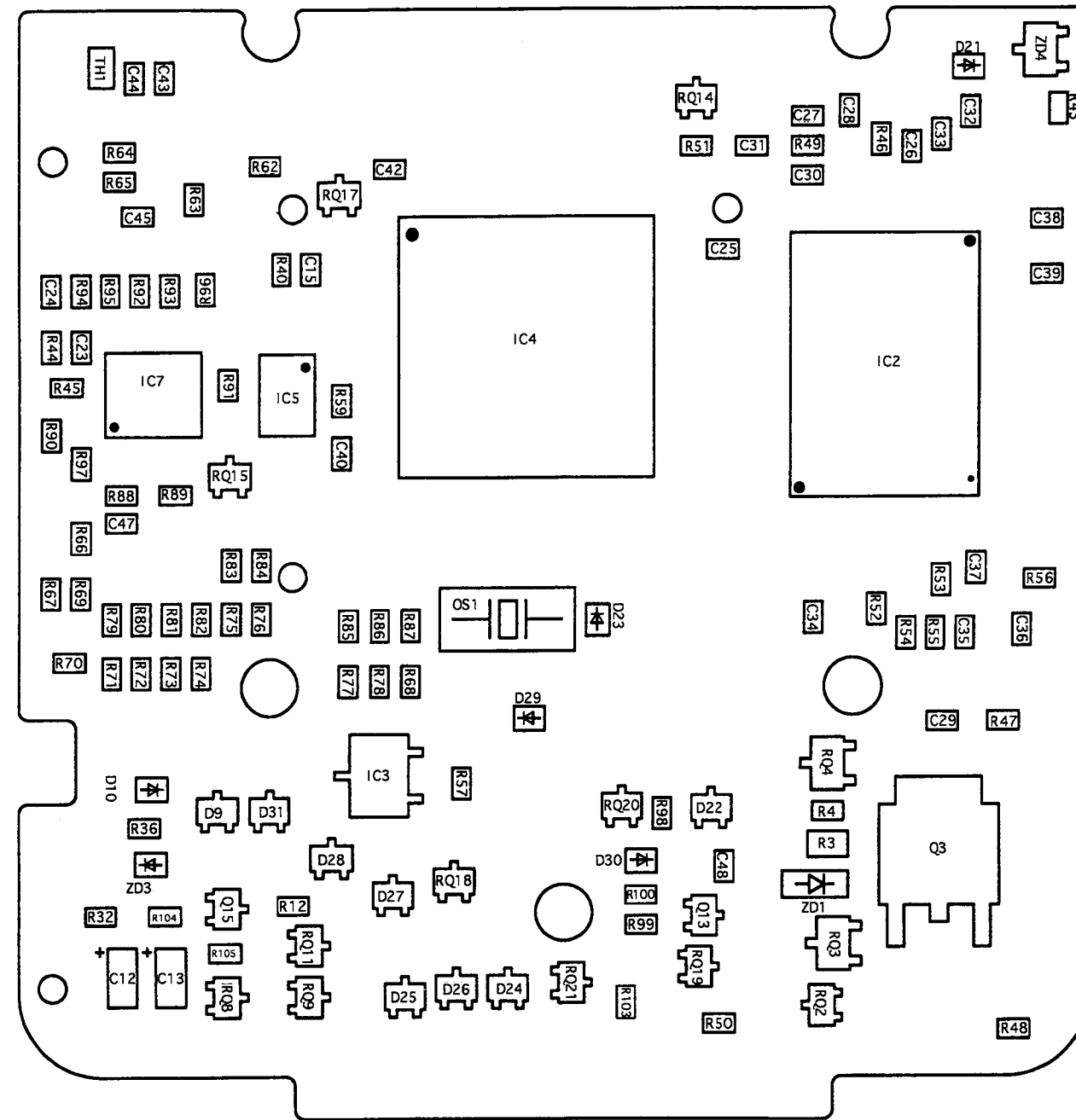
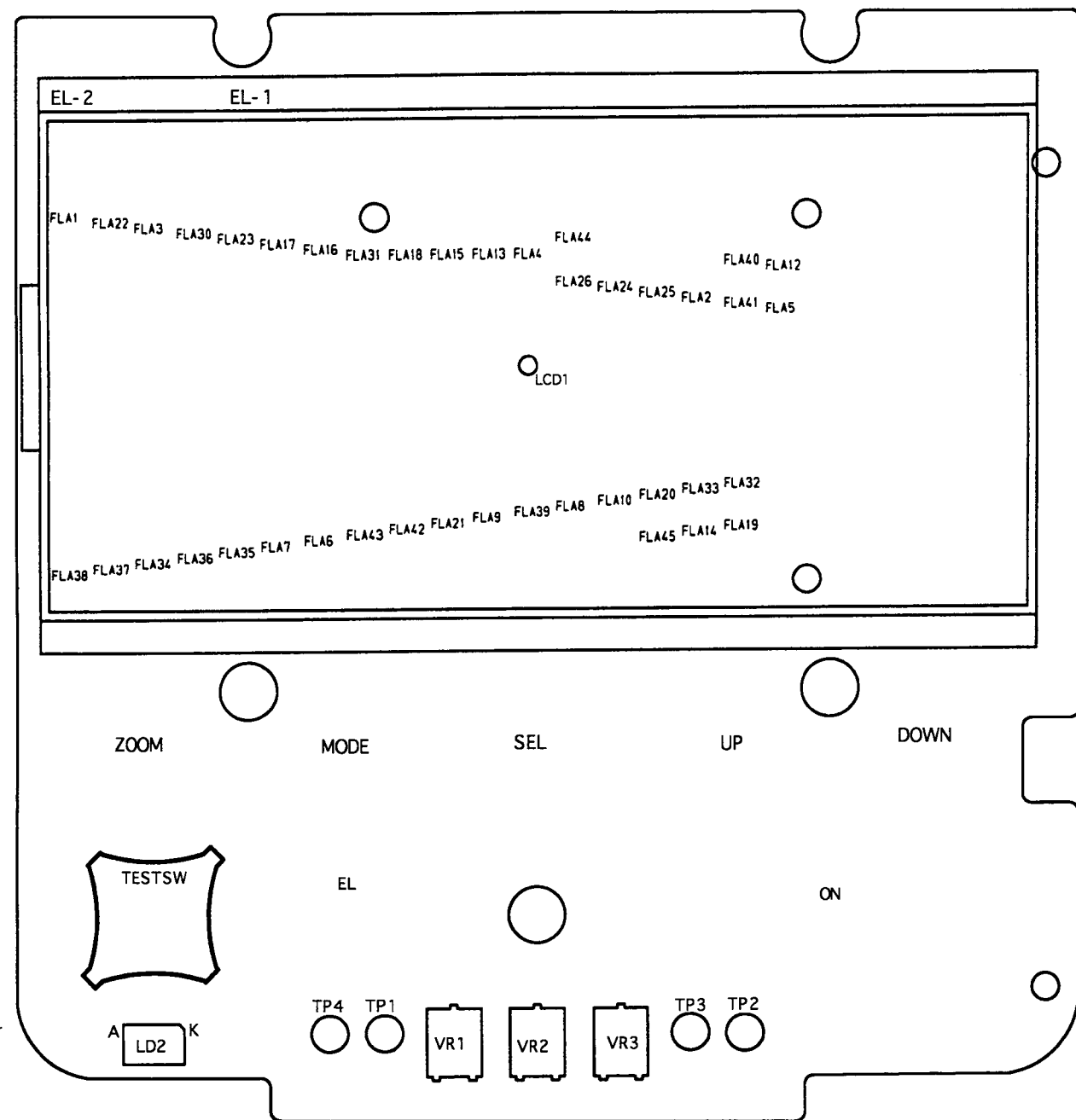


回路图 (欧州向) CIRCUIT (For European countries)

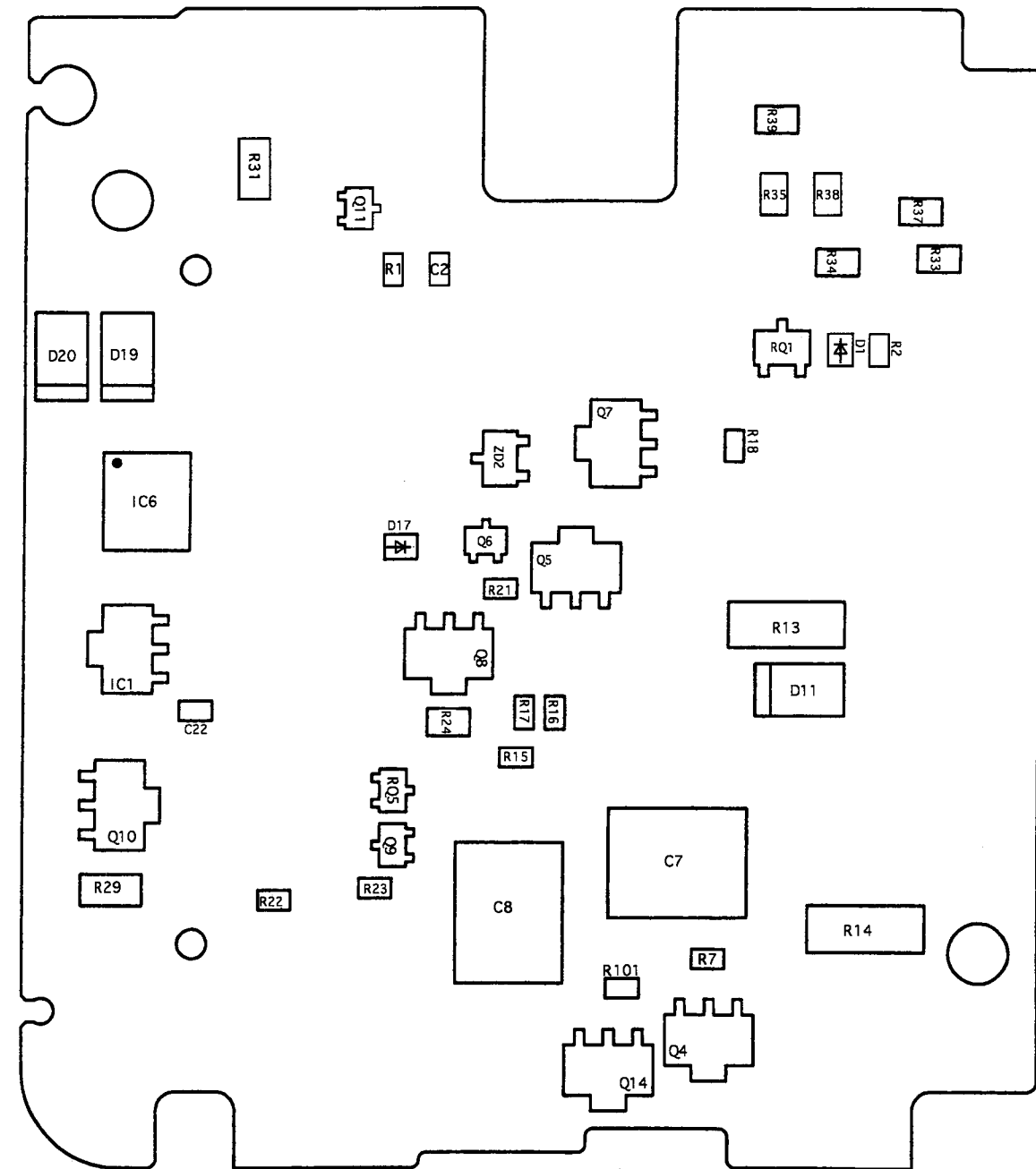
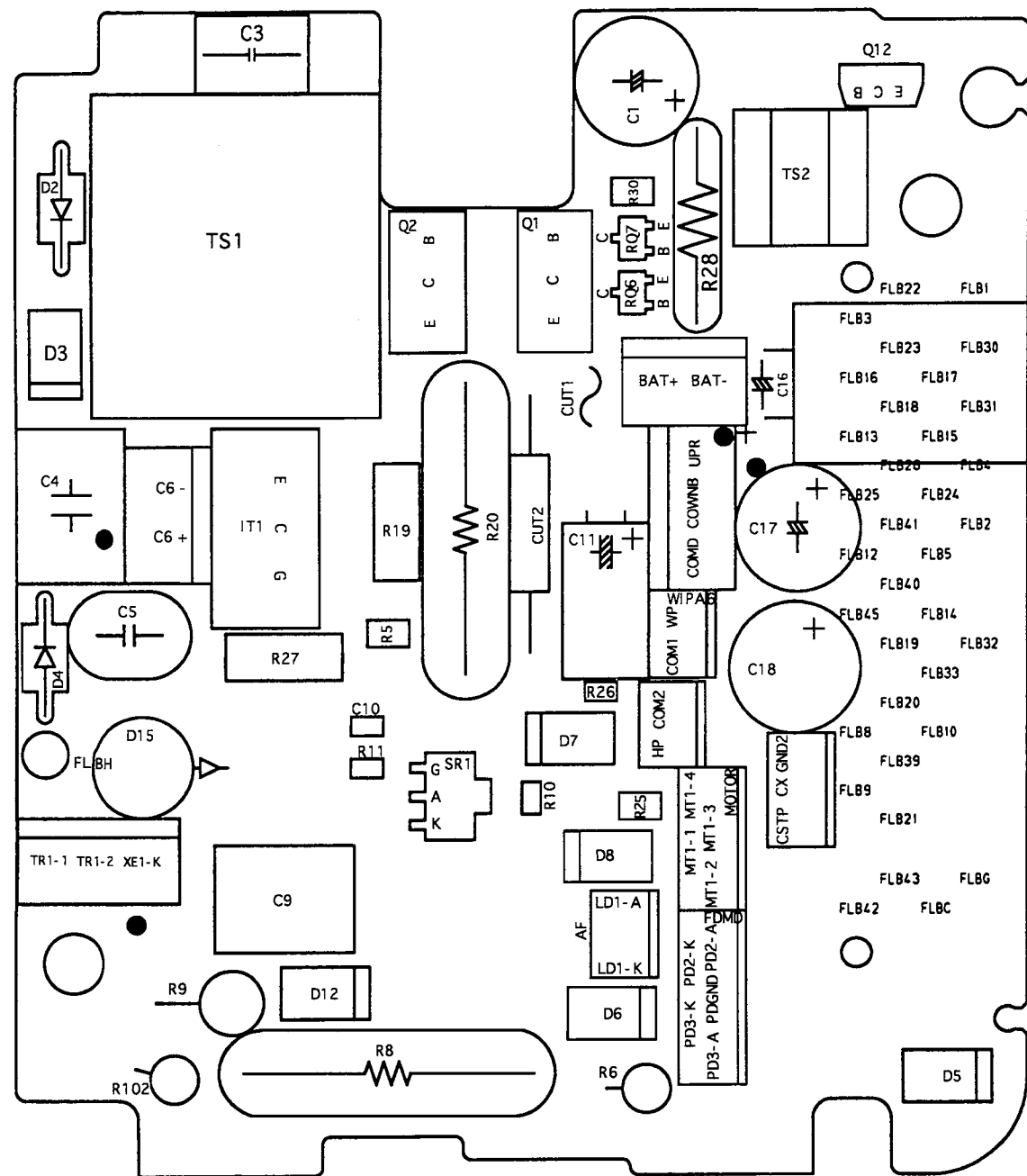




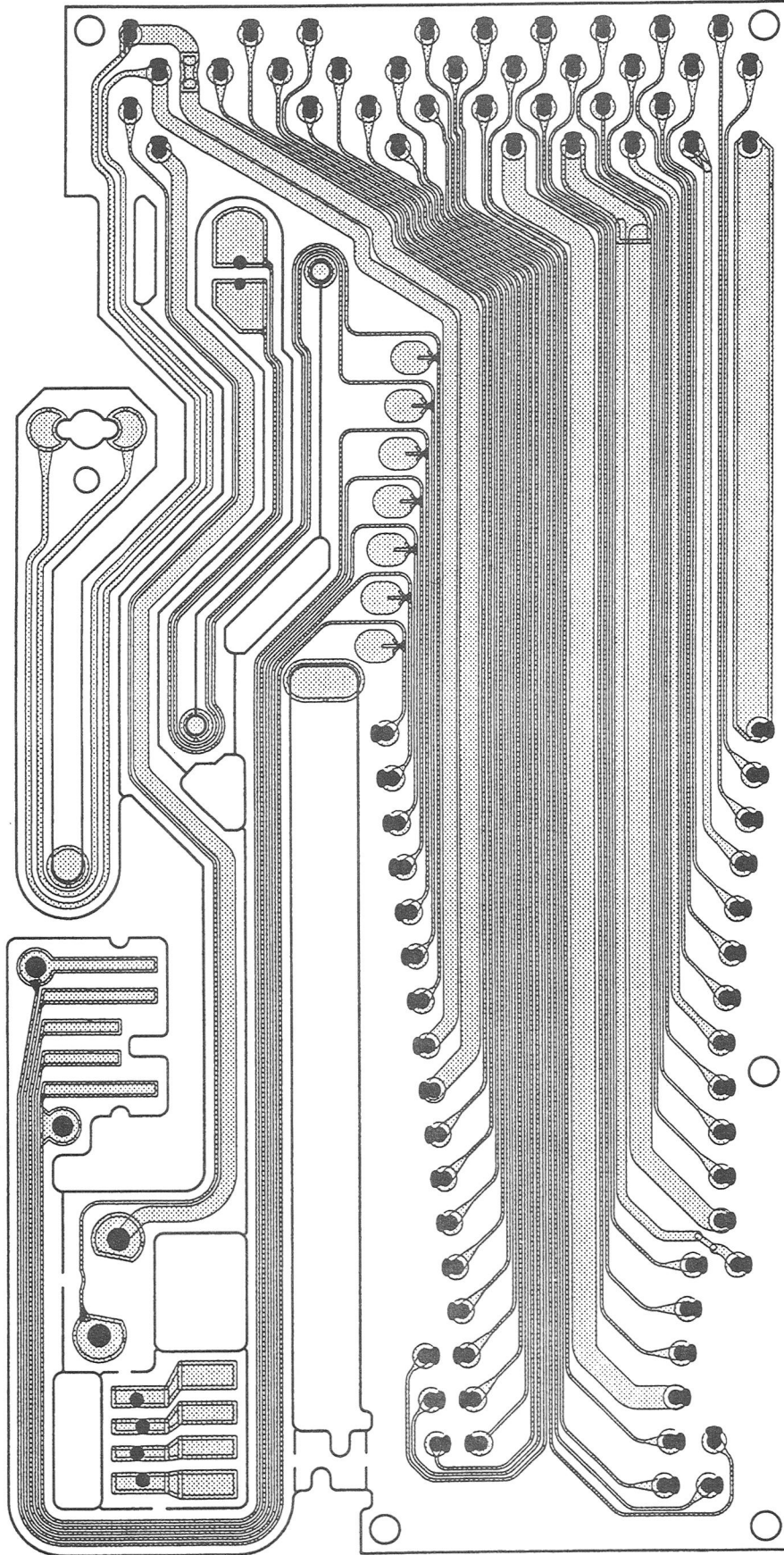
A 基板
A-PCB



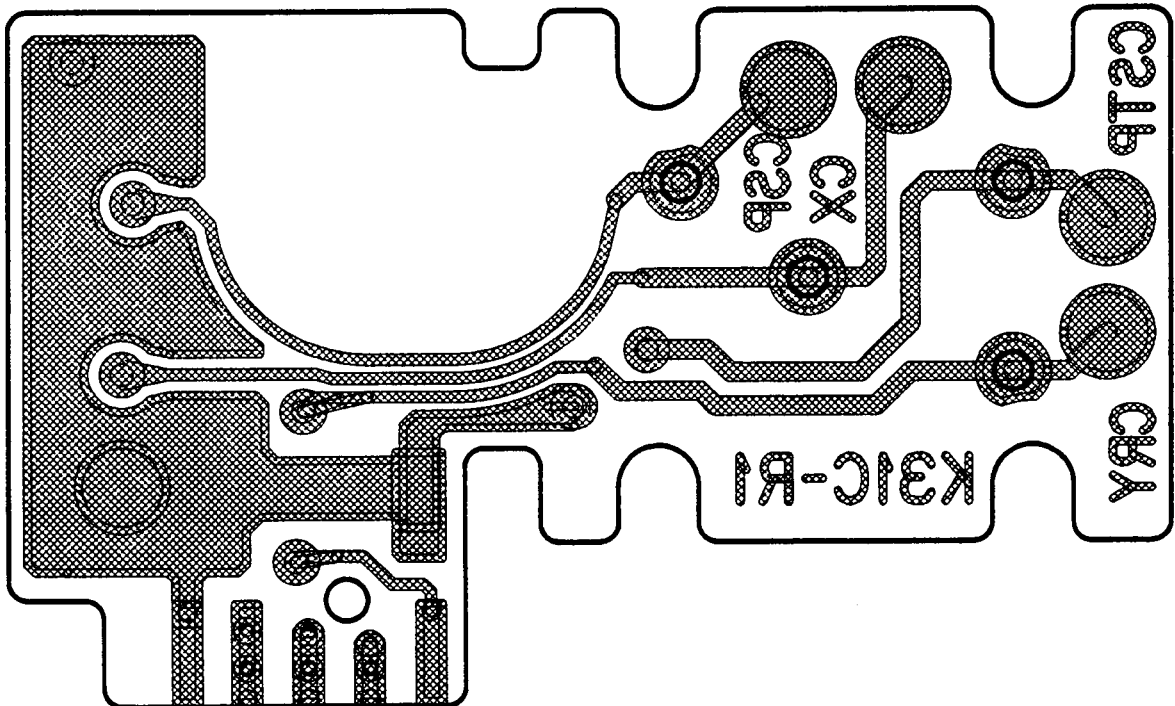
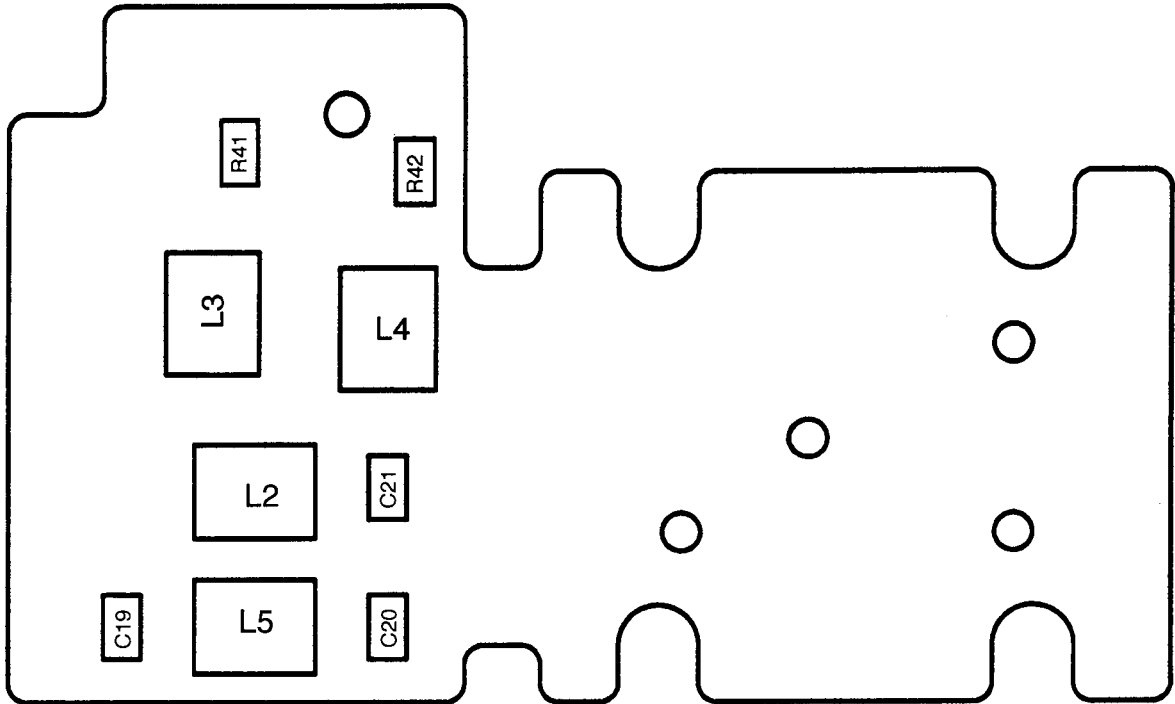
B基板
B-PCB



K-FPC

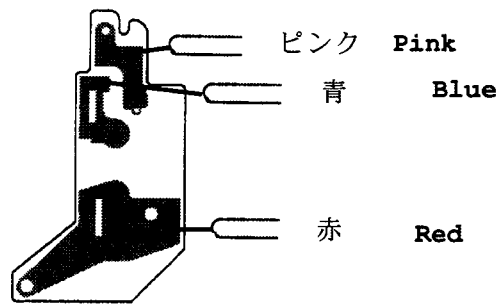


C基板
C-PCB

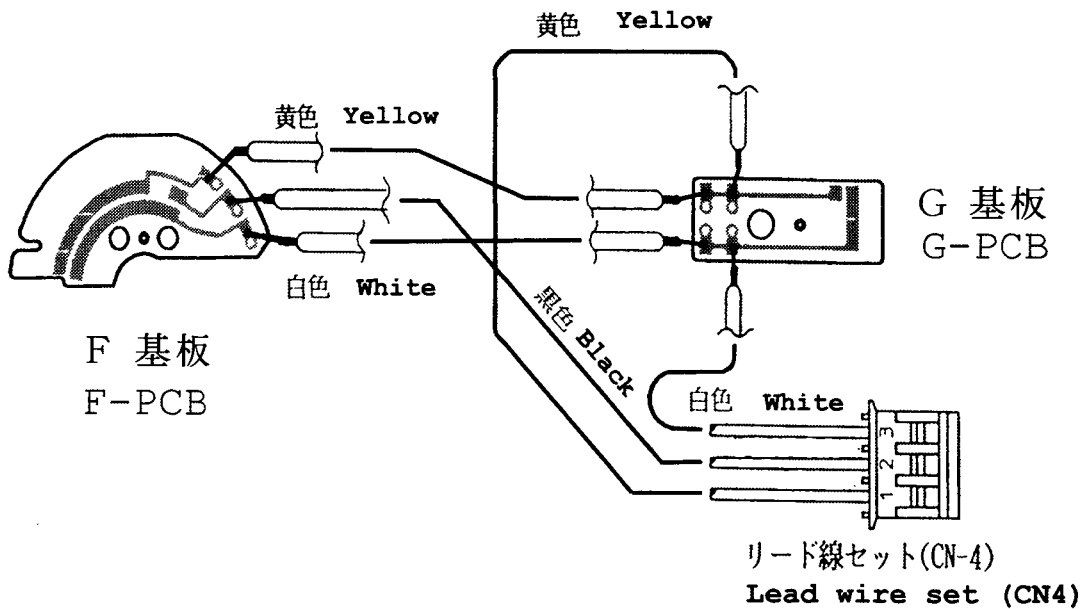
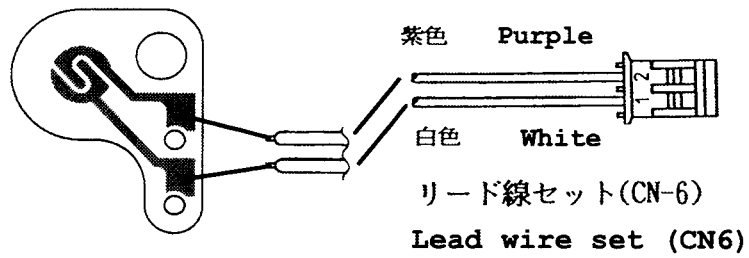


他基板
Other PCB

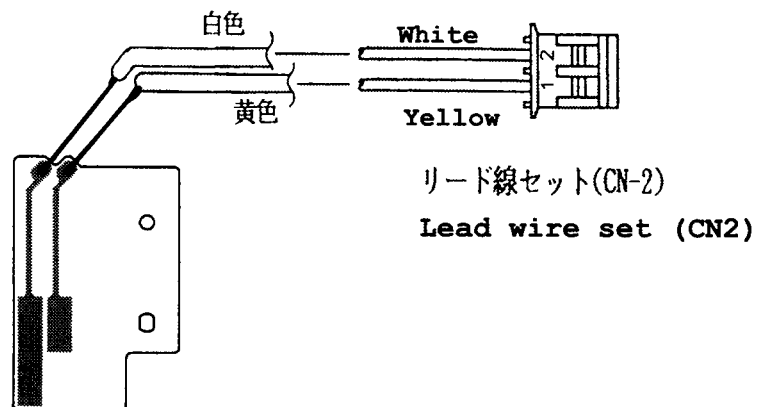
D 基板
D-PCB



E 基板
E-PCB



H 基板
H-PCB

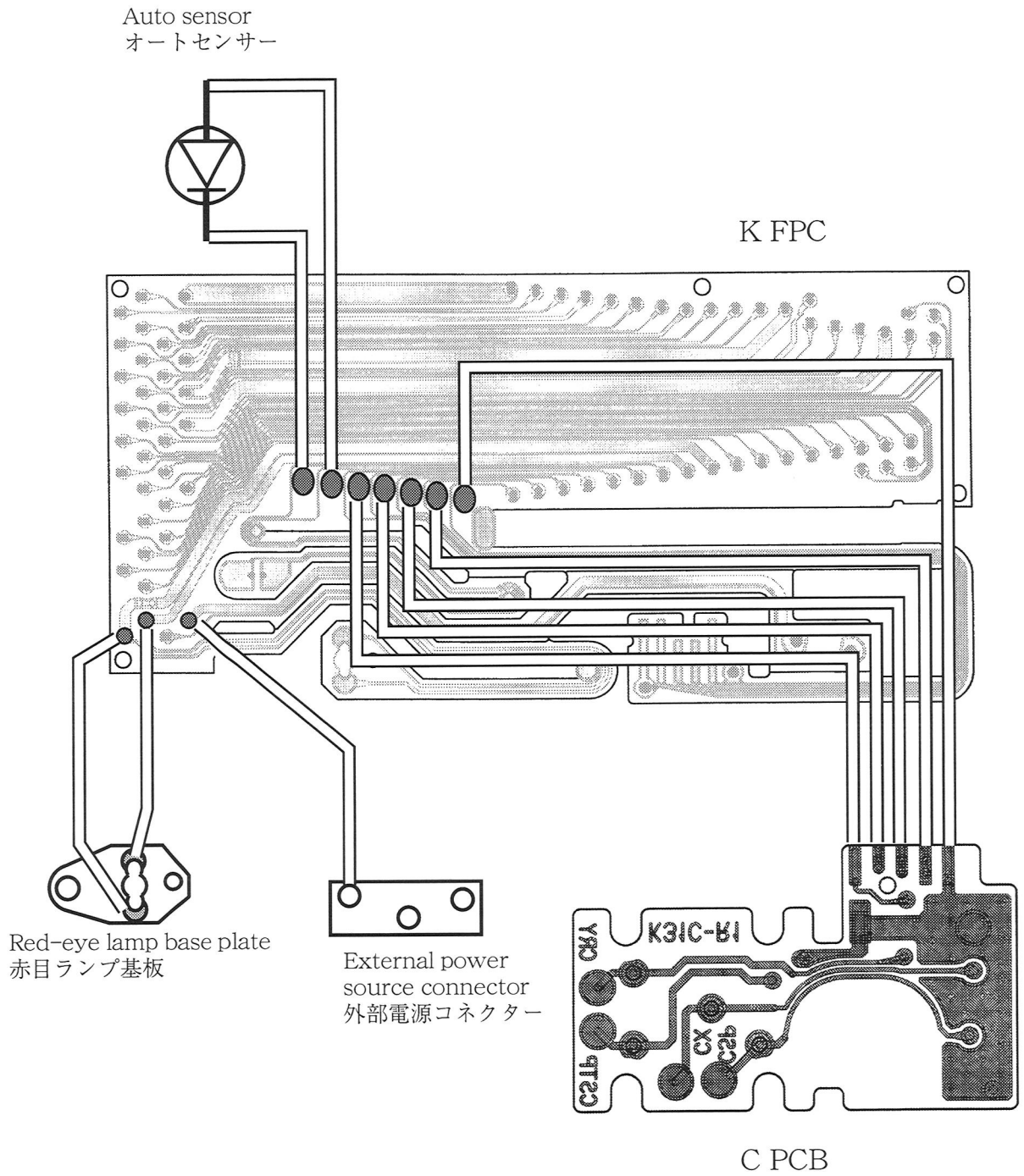


E²PROM DATA

SB-28

Address	Data	Address	Data
0	Check SAM data	32	
1		33	
2		34	
3		35	
4		36	
5		37	
6		38	
7		39	
8		40	
9		41	
10		42	
11	M mode Gain Adjustment	43	
12	A mode Gain Adjustment	44	
13		45	
14	330V Adjustment / 290V Adjustment	46	
15	265V Adjustment /	47	
16		48	
17	Zoom Reference Position	49	
18		50	
19		51	
20		52	
21		53	
22		54	
23		55	
24		56	
25		57	
26		58	
27		59	
28		60	Flash Times (×10)
29		61	
30		62	
31		63	

※ The place without the description is the data for the SB control.

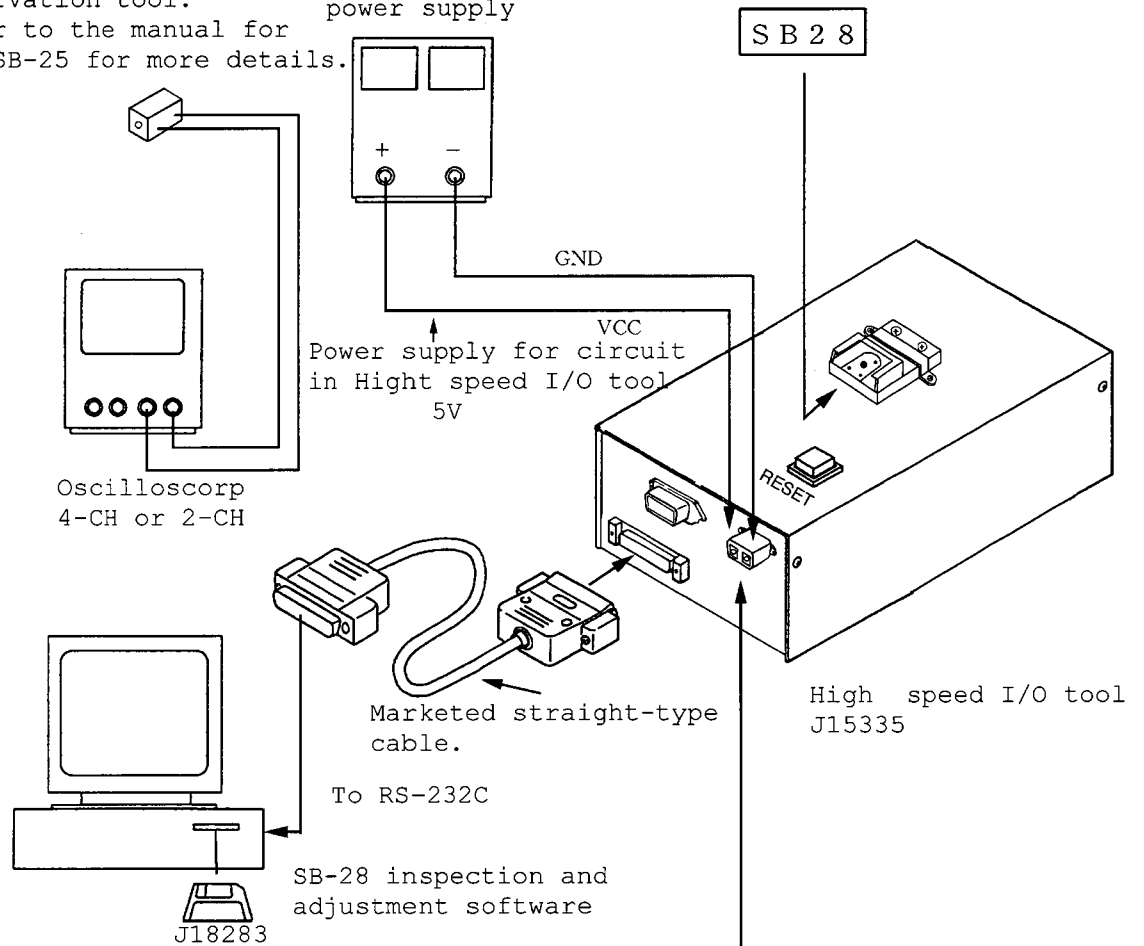


Tool

1.SB-28 inspection and adjustment system

Self-made SPD waveform observation tool.
Refer to the manual for the SB-25 for more details.

DC regulated power supply



This sdspter is necessary for a computer with 9-pin RS-232C terminal. RJ is not available.

Caution:

If the 5V input from the stabilized power supply were reversely connected, it causes to damage the internal circuit(s) of Hight-Speed I/O tool(s). So,properly connect them with each other in accordance with the instruction.

2. Specified tool

Tool number	Name		
J15335	High speed I/O tool		
J18283A	SB-28	Inspection and adjustment software	NEC 5 inch
J18283B	SB-28	Inspection and adjustment software	NEC 3.5 inch
J18283C	SB-28	Inspection and adjustment software	IBM 5 inch
J18283D	SB-28	Inspection and adjustment software	IBM 3.5 inch

3. Other tools

- 1) DC regulated power supply 0 - 6V 4A output
- 2) Oscilloscope
- 3) Digital meter
- 4) SPD waveform observation tool (Self made)
- 5) Flash- meter
- 6) Standard reflection board
- 7) Check-up chart (Self-made)