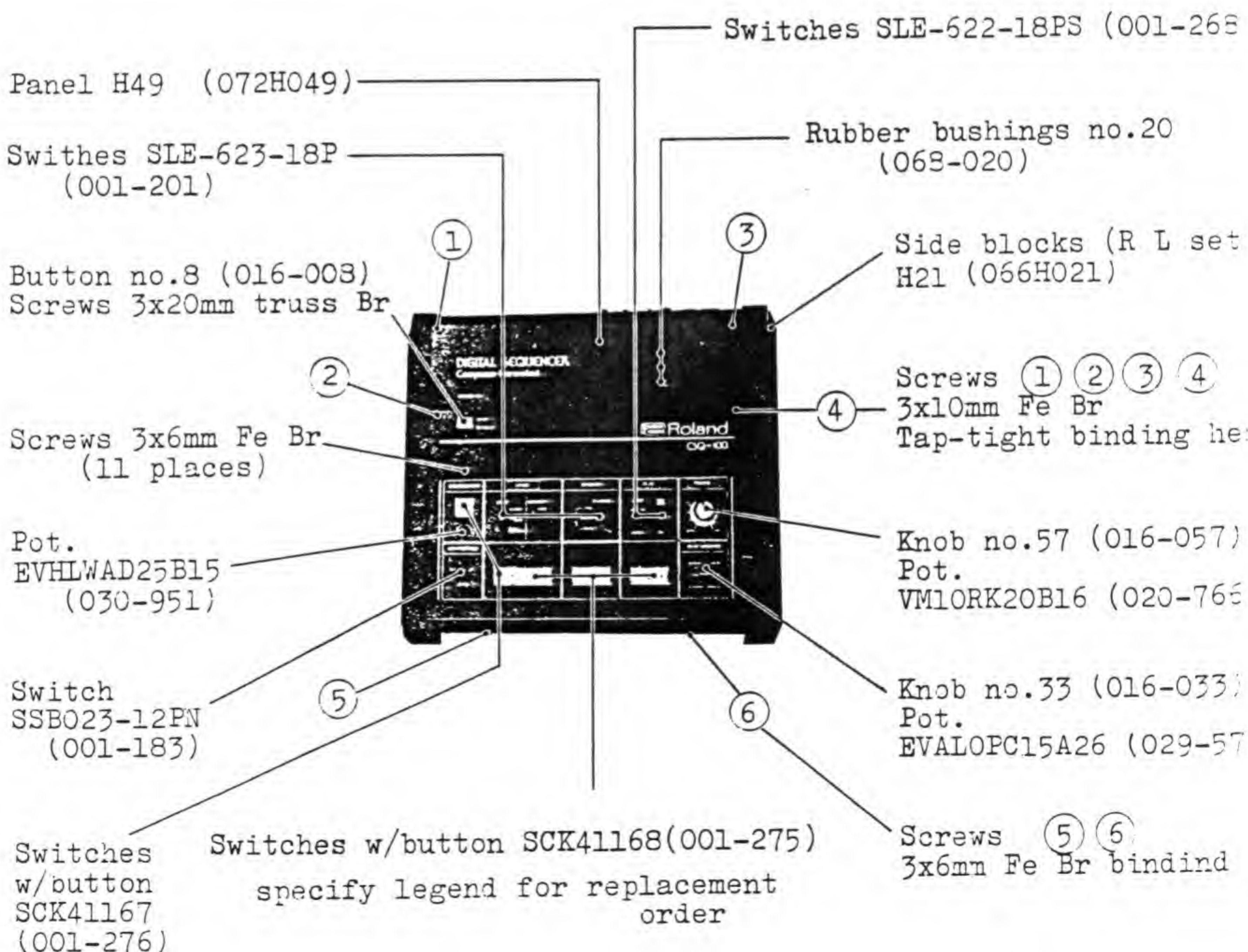


# CSQ-100 SERVICE NOTES

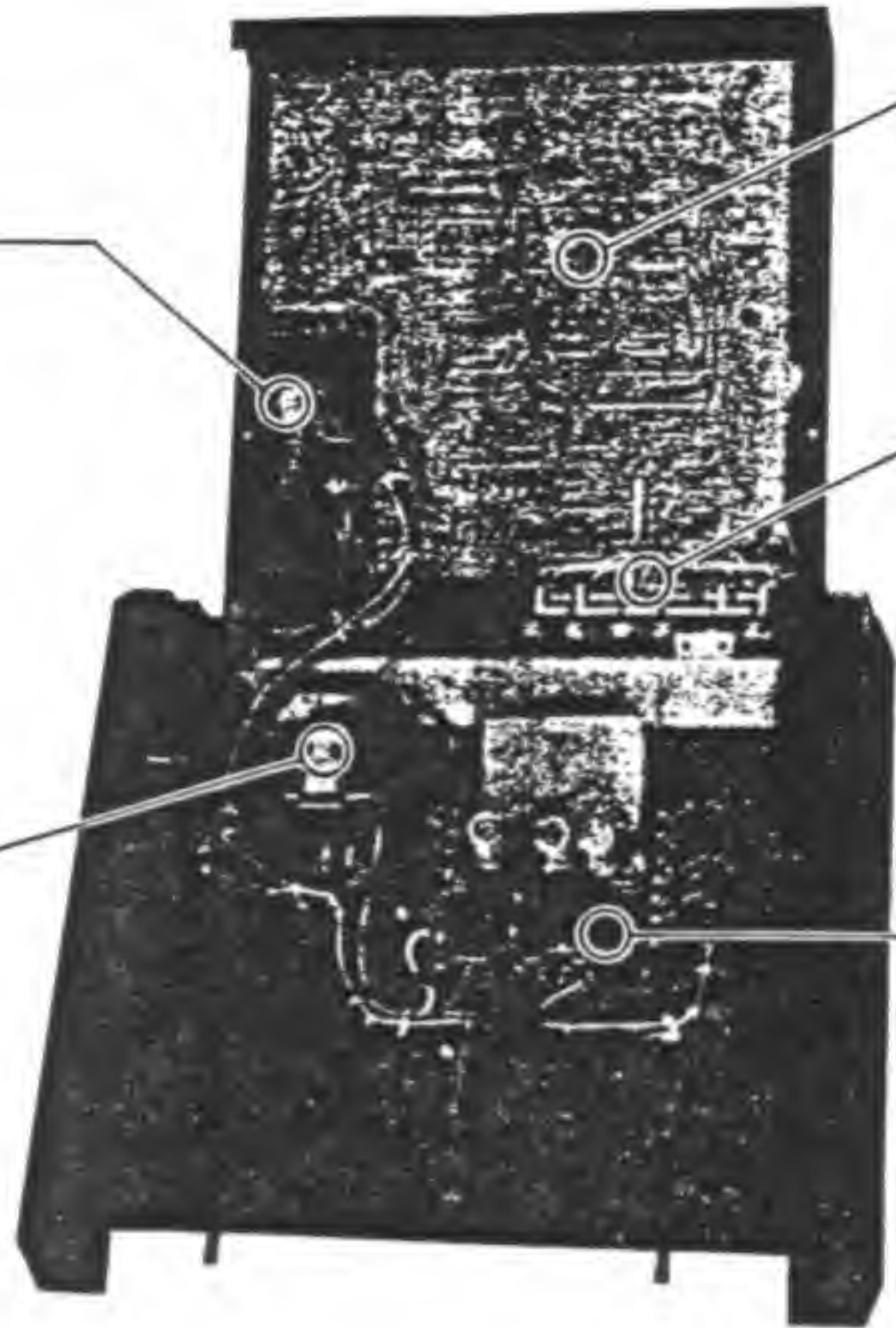
- Memory capacity ---- Up to 168 notes (84 notes/channel) 2 channels
- CV output ----- 1V/oct:     -2V to +8V
- CV input ----- 1V/oct:     0V to +5V
- Gate output ----- Off: 0V     On:   +15V
- Gate input -- ----- Off: 0V     On:   +15V (threshold +2.5V)
- EXT Start input ---- With switch: normally close, open to start  
                          or pulse: +15V
- EXT Step input ---- +15V pulse
- Power consumptions-- 8 watts
- Dimensions ----- 345W x 305D x 95H mm (13.6 x 12.0 x 3.7 in)
- Weight ----- 2.7 kg (5.94 lbs)

PANEL REMOVAL SCREWS: (1) through (8) ( (7) (8) on the rear)



Switch

- SDG5P 001-1 (001-215)  
100V
- SDG5P 001-2 (001-216)  
117V
- SDG5P-502 (001-217)  
220/240V



OPH31

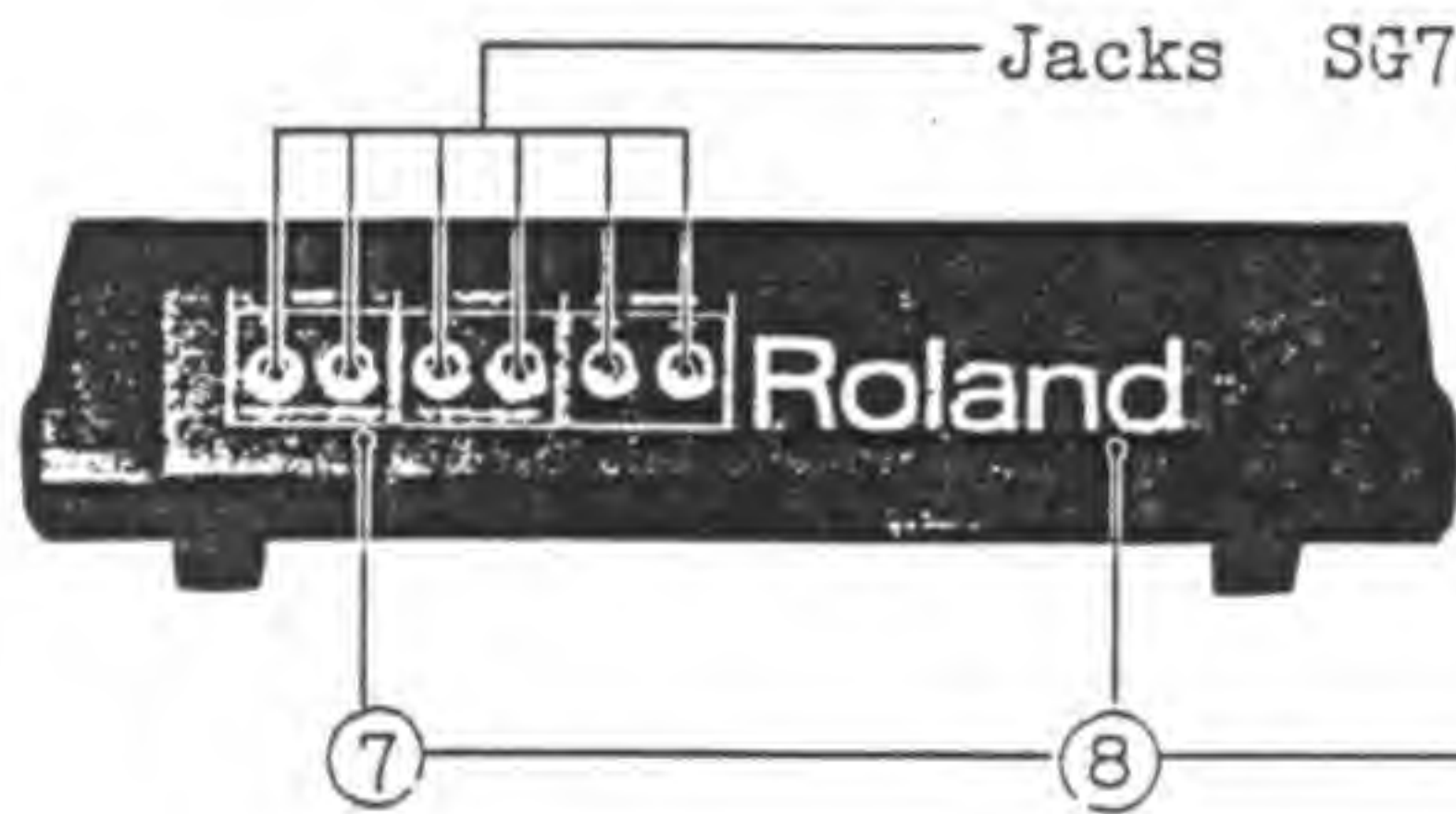
OPH70

Power transformer

- O22H024C 100/117V
- O22H024D 220/240V

Power supply board

- PSH39 100V
- PSH40 117V
- PSH41 220/240V



Jacks SG7622 (009-012)

Screws  
3x6mm Bl Fe Br  
self tapping  
binding head



Rubber feet G-5 (111-021)

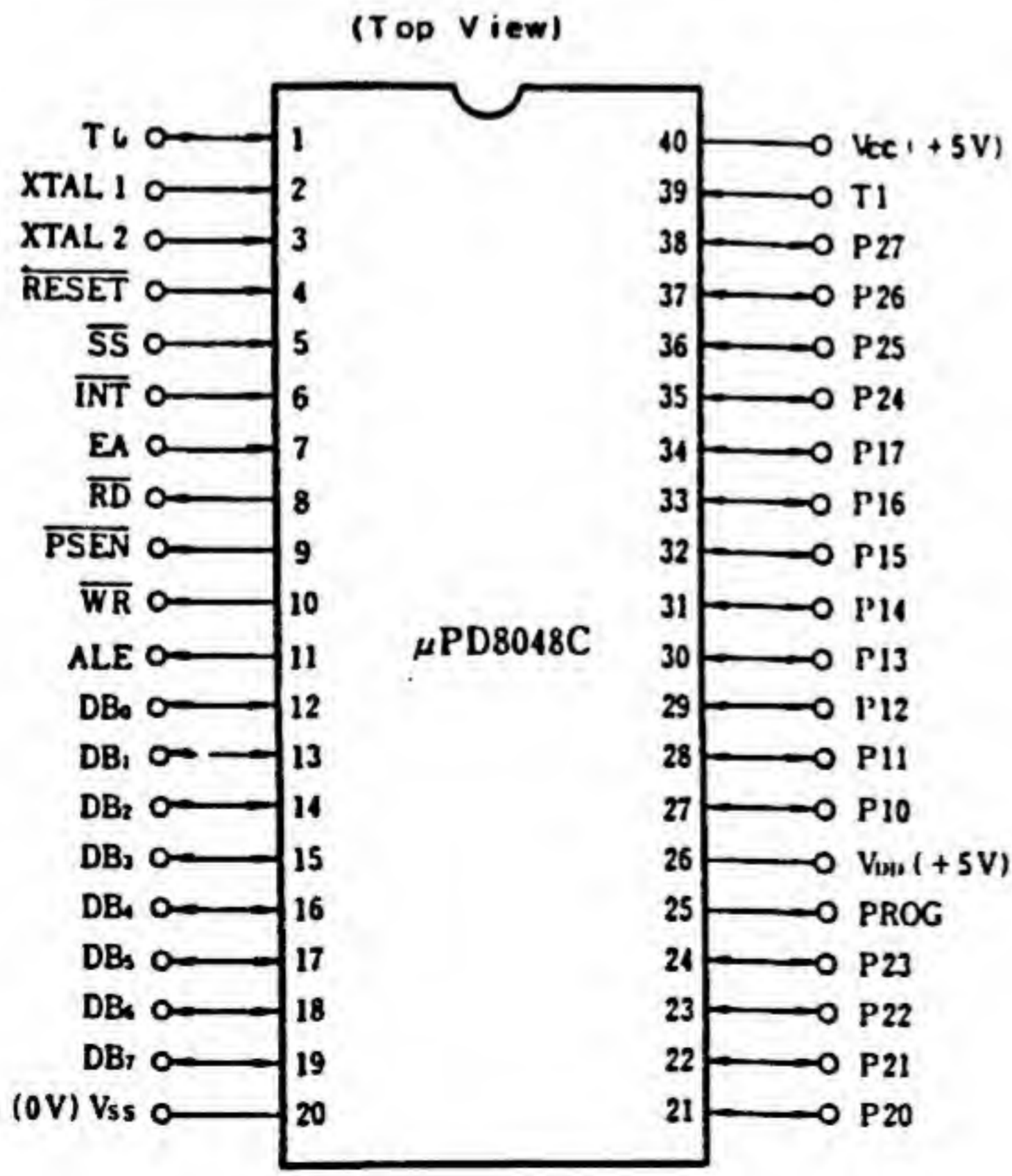
Screws  
3x12mm Fe Br tap-tight B  
binding head

Rubber feet G-7 (111-023)

Screws 3x10mm Fe Br (8 pcs)  
tap-tight B binding head

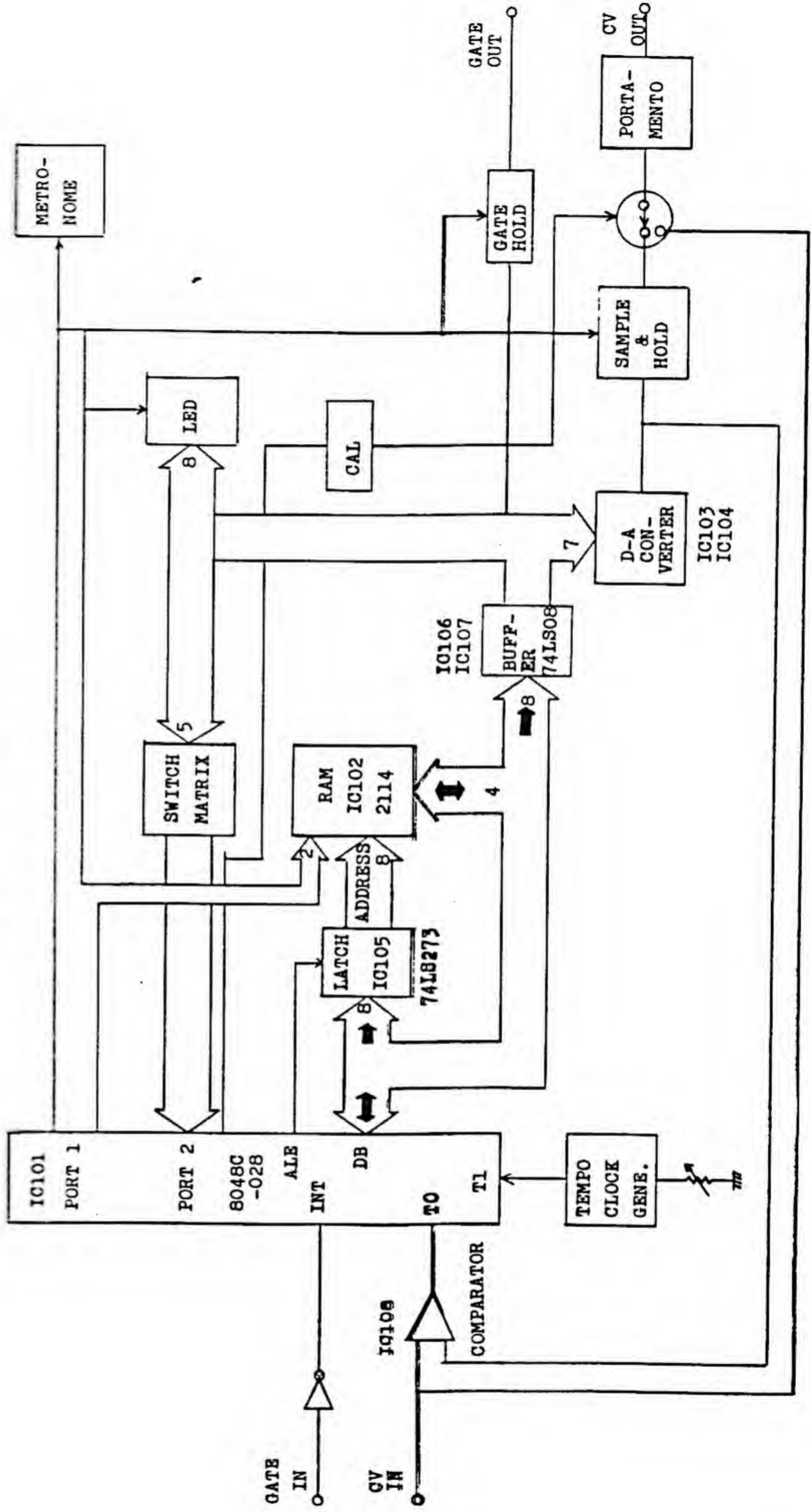
μ PD8048 Pin Description

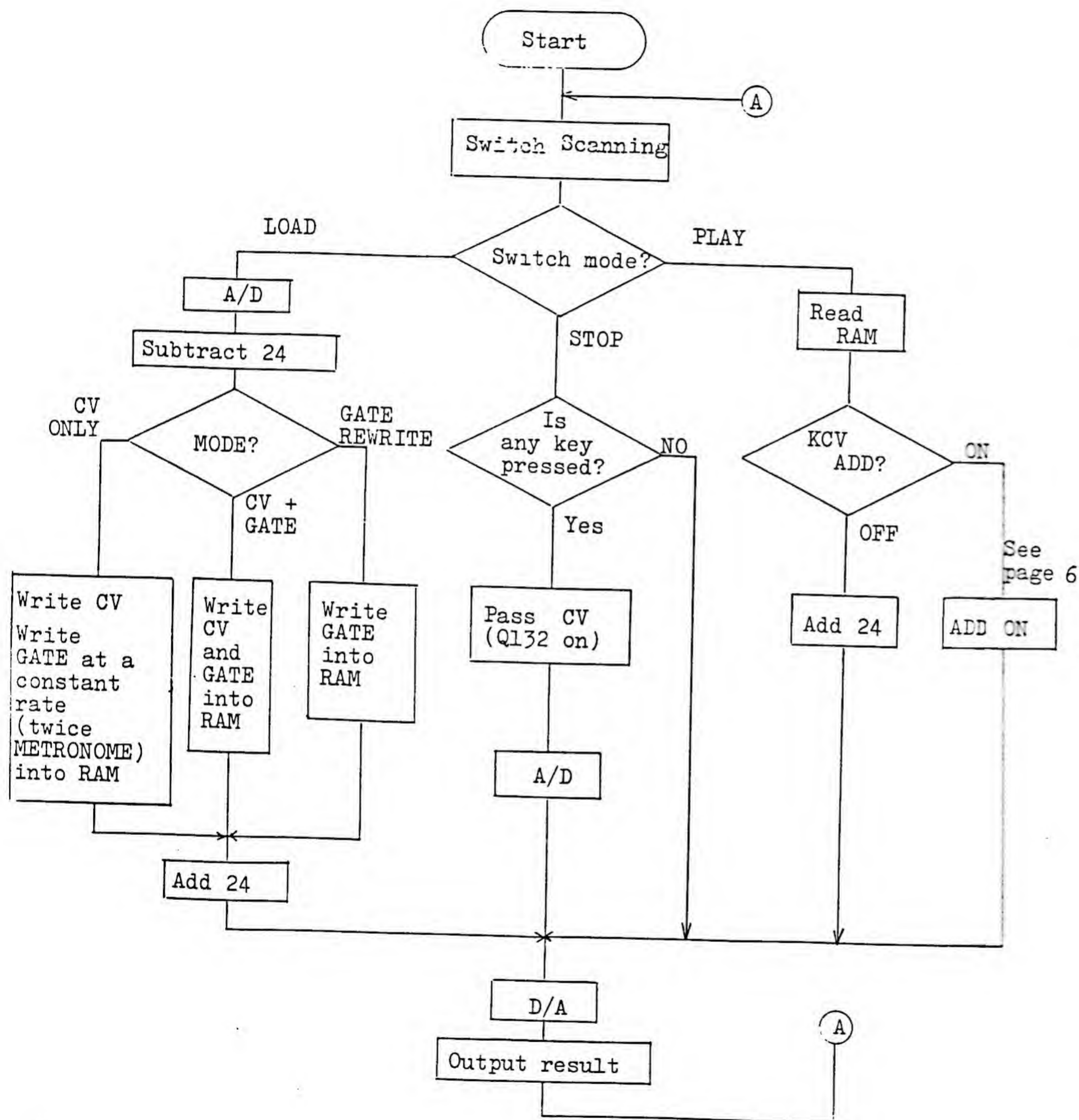
Designation	Pin No.	Function
DB (Data bus)	DB0	12
	1	13
	2	14
	3	15
	4	16
	5	17
	6	18
	7	19
P1 (Port 1)	P10	27
	11	28
	12	29
	13	30
	14	31
	15	32
	16	33
	17	34
P2 (Port 2)	P20	21
	21	22
	22	23
	23	24
	24	35
	25	36
	26	37
	27	38
RESET	4	Input to reset the 8048 when power is on
INT	6	External gate input
TO	1	Digital data input suting A-D conversion
T1	39	Accepts TEMPO clock output
XTAL 1	2	External source inputs for internal oscillator
XTAL 2	3	



The uPD8048 is an 8-bit parallel computer fabricated on a single silicon chip. The 8048 contains a 1k x 8 ROM program memory, 27 I/O lines, an 8-bit timer/counter and clock circuits. Used in the CSQ-100 is a uPD8048C-028 version in which program and data dedicated to the CSQ-100 are stored in the program memory.

BLOCK DIAGRAM





## CIRCUIT DESCRIPTION

This description is divided into parts: the general description which explains roughly the functions of CSQ-100, and the detailed description which centers around A/D and D/A converters since these are practically the heart in this instrument.

Complete understanding of A/D and D/A conversion circuits will aid in performing adjustments in Section II.

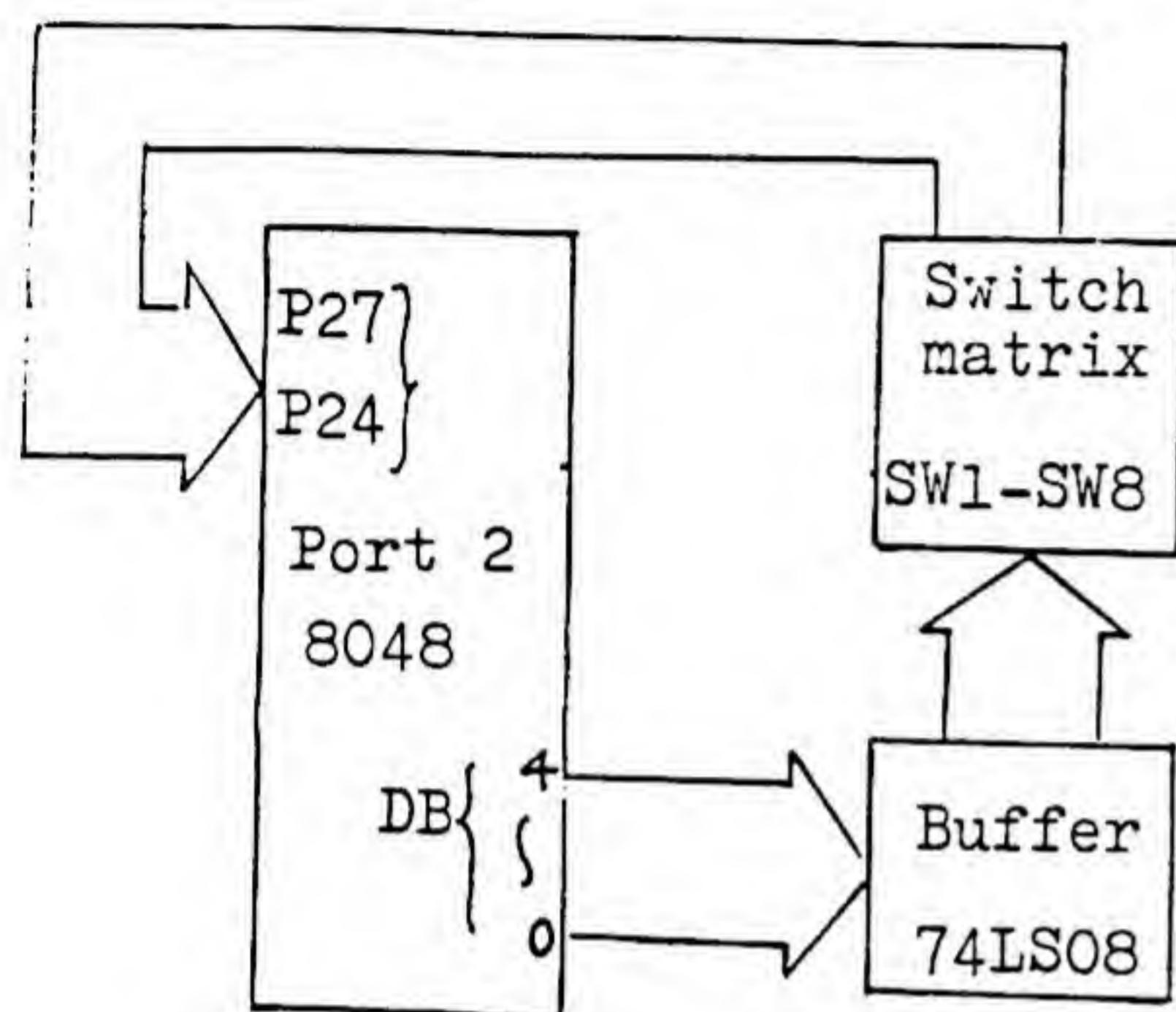
### Function of "One chip computer" uPD8048

CSQ-100 performs its functions with uPD-8048 at the center position for all, including the following in its performance cycles:

1. Switch Scanning
2. D/A Conversion
3. A/D Conversion
4. Write/Read of Data to or from External RAM
5. Timing for lighting LED Indicator
6. Triggering of METRONOME
7. Holding of GATE OUT

GENERAL

1. SWITCH SCANNING

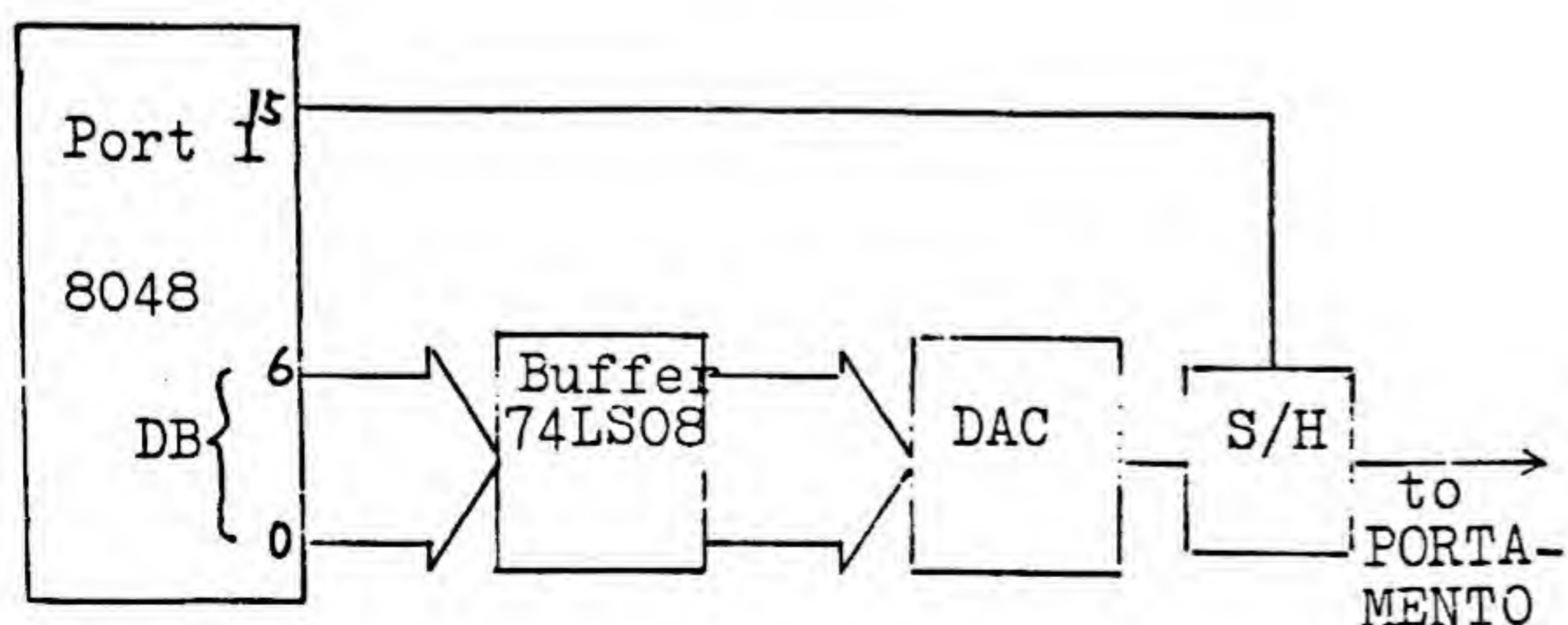


μPD8048 starts its running cycles beginning with switch scanning. Into DBO-DB4 (Data Bus) of 8048, 5-bit signals are being output according to the internal program, which are then brought to the switch matrix through the buffer. At first, L is output from DB4 while having H from other DBO to DB3.

At the next instant, DB3 becomes to L while others change to H; and still next L on DB2 and so on, repeating such output changes 5 times on these bit signal combinations.

Depending on which key is depressed or in what position the switches are, corresponding signals are fed back through P24-P27 on Port 2.

2. D/A CONVERSION - Digital to Analog -

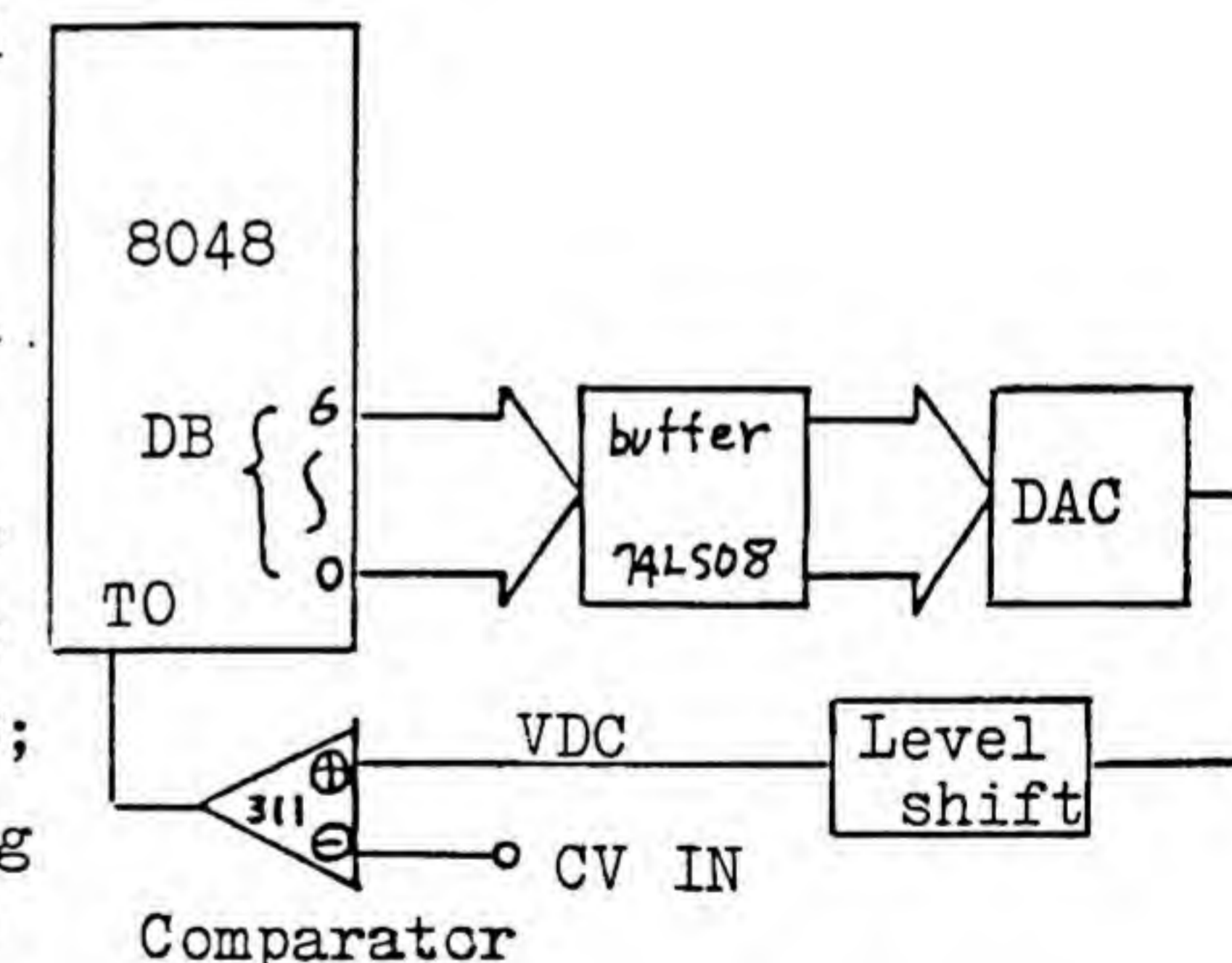


The D/A converter transforms the sequential data (switch scanning, RAM address, CVs, etc.) which are being output from the 8048 through internal programming, into analog voltages. Since the D/A converter (DAC) employed here is a summing type, with a weight-resistor-tree connected to an inverting input of an OP amp, each bit in the digital data is converted to an analog voltage in value to double the one immediately subordinate to each. When CV data are on output, pulses synchronized to CV data are supplied from P15 of Port 1 onto the Sample and Hold (S/H) circuit, and the analog CV voltage equivalent to the data are held on C124. (details discussed later)

3. A/D CONVERSION (Analog to Digital)

Since the CV IN is an analog voltage, it must be converted to digital data for making the storing in RAM possible.

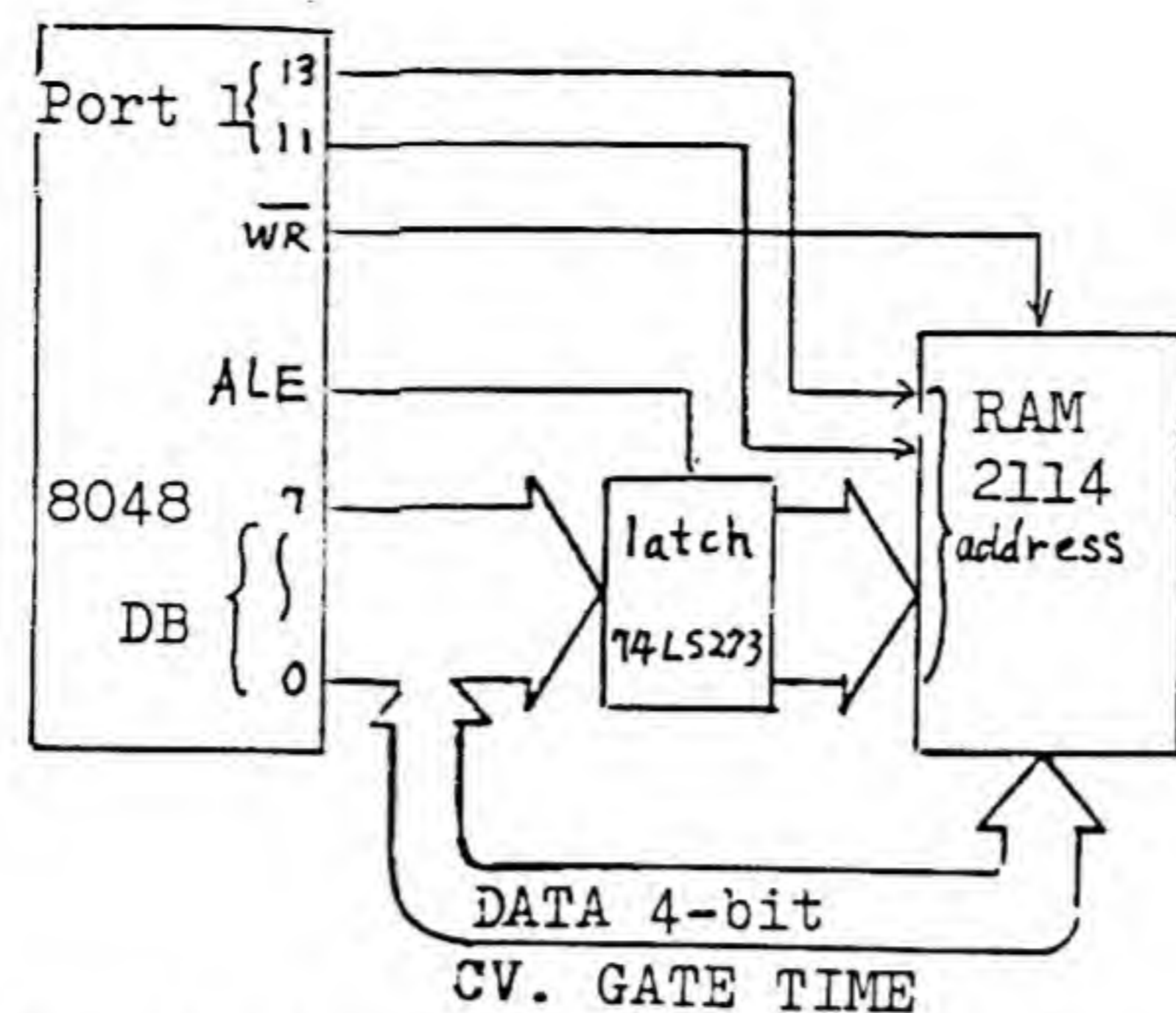
The method employed in the CSQ-100 is called "successive approximation conversion" where each bit, from DB6 (for MSB; most significant bit) to DBO (for LSB; least significant bit), is being set successively to output "1"



which, after being D/A converted, is to be compared with CV IN at the comparator (311). The comparator will then output "0" (low) if CV VDC, or "1" (high) if CV VDC, onto TO. When H is output to TO, the corresponding digital data is "reset" and becomes 0. Such set and "reset" is repeated 7 times for bits from DB6 to DBO and with the resultant value from such "set" "reset" the digital data of the CV IN is produced.

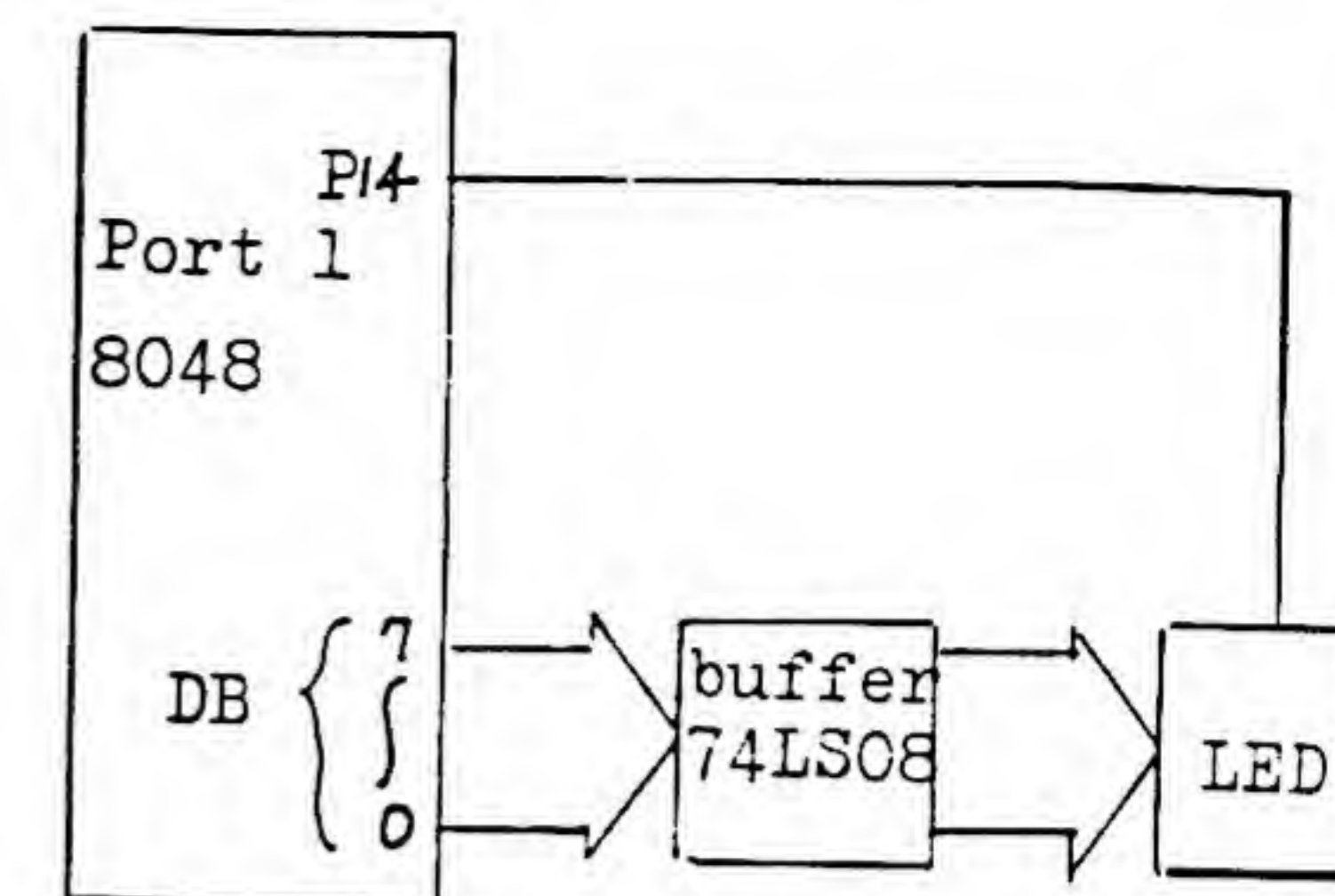
4. DATA (CV and GATE TIME) WRITE/READ to RAM

In the external RAM, memory cells are selected by the signal made in combination of the address signals latched on 74LS273 by the instruction signal from ALE (Address Latch Enable) and those from P11 and P13. The data (CV and GATE TIME) are written when  $\overline{WR}$  is "low" and are read when it is "high".



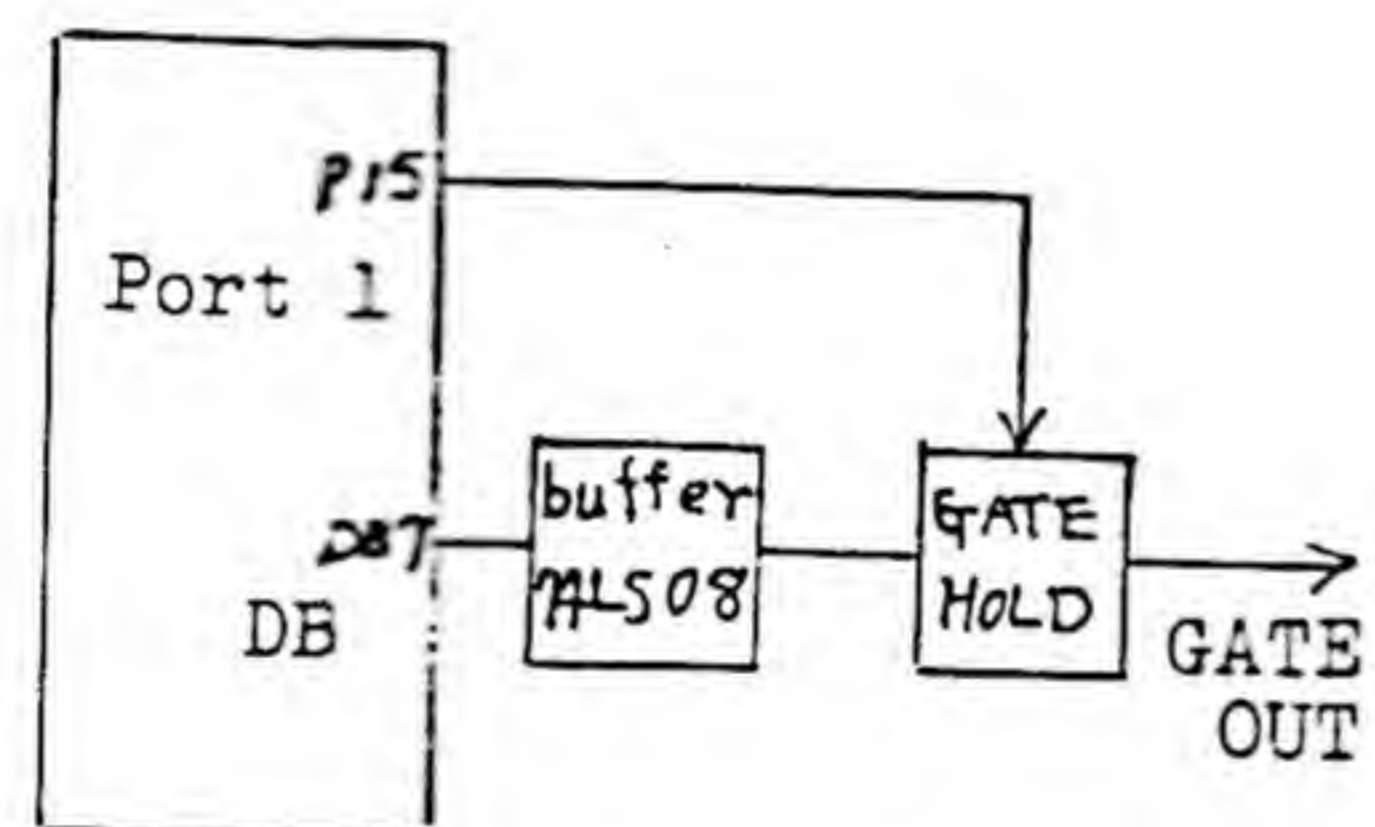
Although the data are in 8-bit format, they are written/read in two times separated to one-word-4-bit groups of lower and higher bits.

The pulses are synchronized with those of TEMPO CLOCK GENERATOR and are output at the time rate one pulse for every eight CLOCK pulses. Because of this, lighting on/off cycling rate is also changed along with change in TEMPO, but the current amount to LED is still being kept unchanged through a means to maintain the duty ratio constant.



5. GATE HOLD

From DB7, the GATE signals are also being output. They are held by the signal (the same as for S/H) to become output of GATE signal.

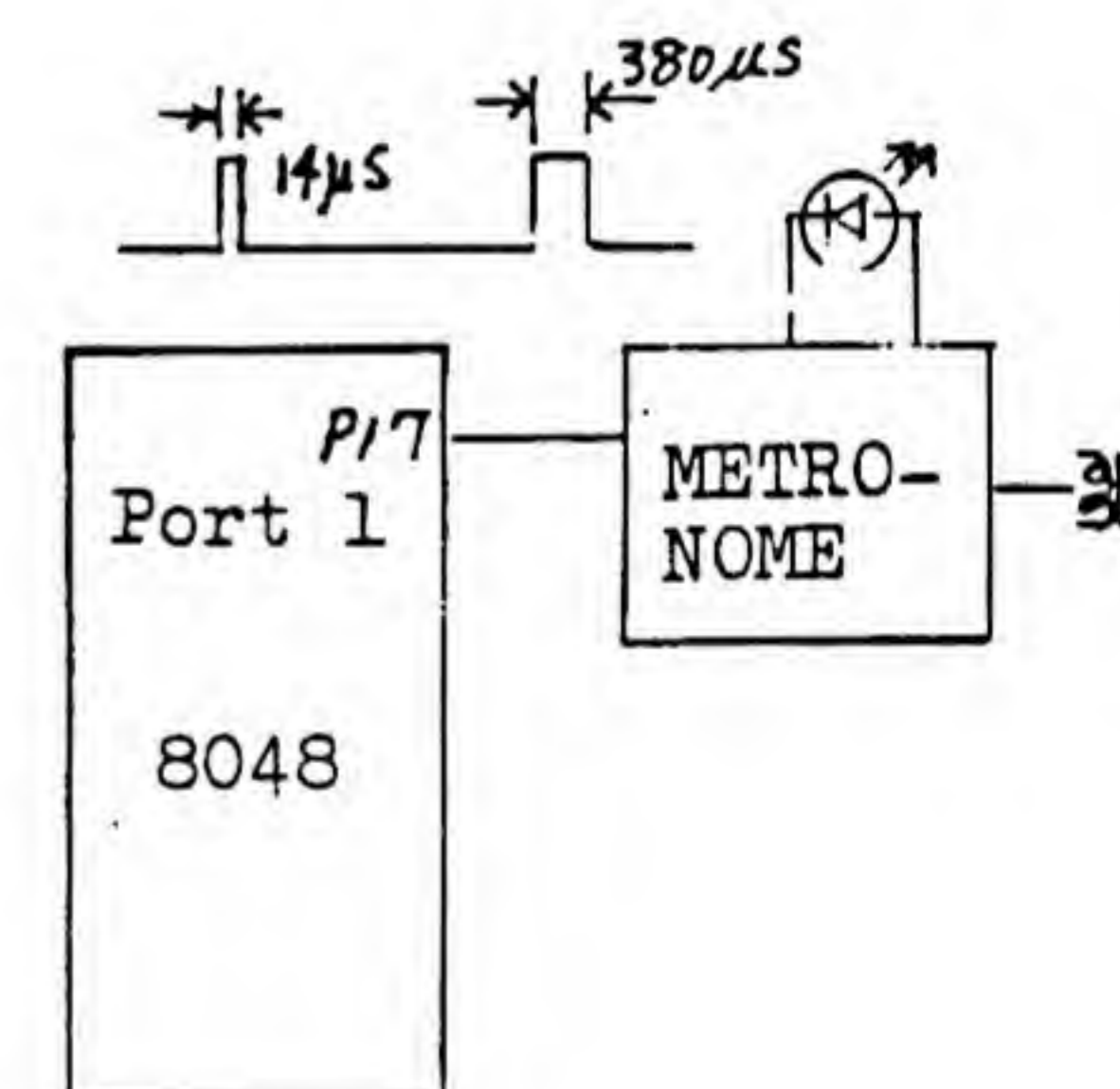


6. LIGHTING of LEDs

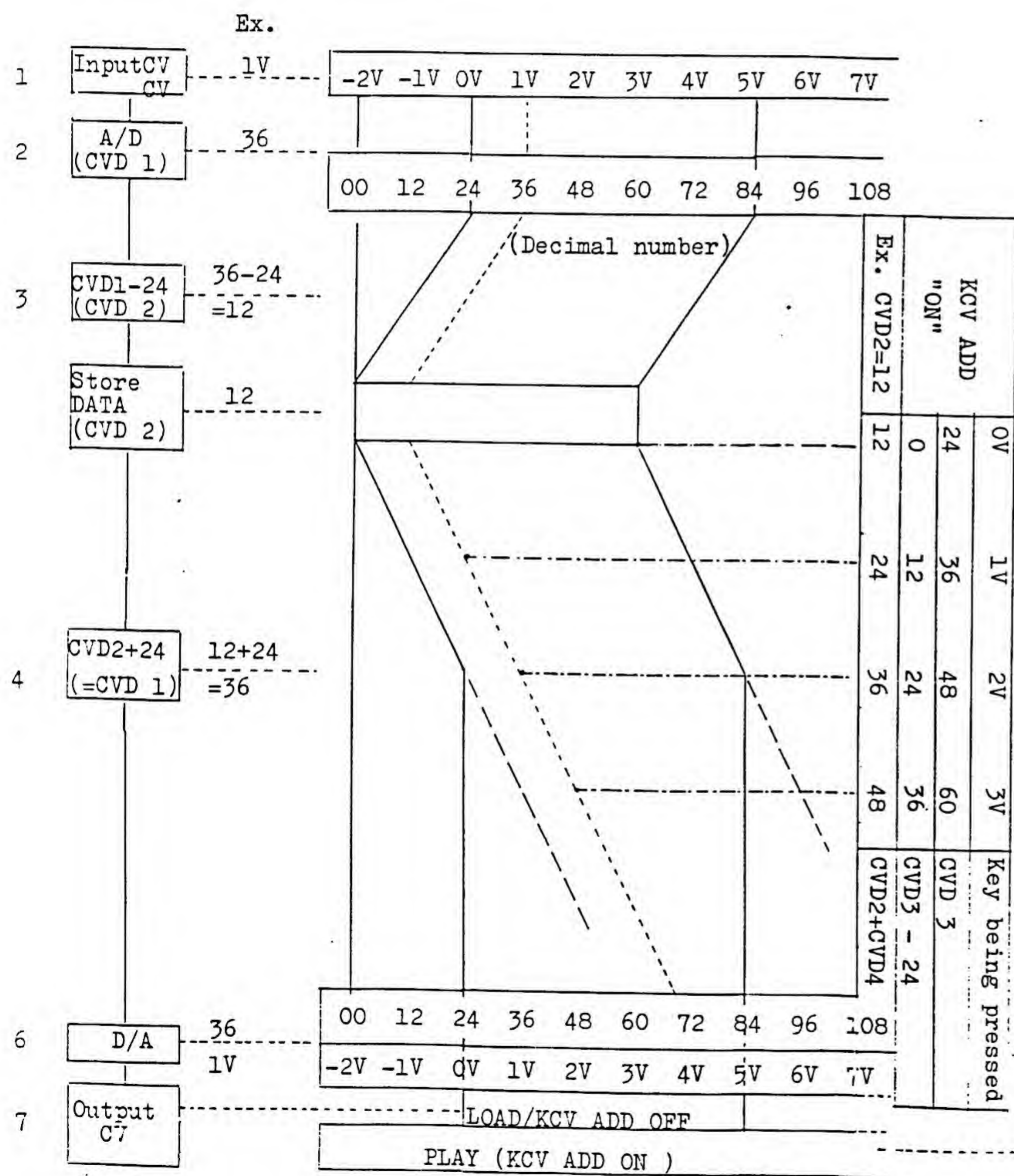
Signals for lighting LEDs (except TEMPO) are supplied from DB. However, because there are many signals on DB at every instance, timing pulses are given from P14 to control the LED circuits being fed only when there are output lighting signals.

7. METRONOME DRIVE

In LOAD mode, two pulses synchronized to TEMPO are being output (in period 480 times the CLOCK pulse, in pulse widths of 14μs and 380μs for alternate output). METRONOME amp is driven by both pulses but since the shorter pulses of 14μs are filtered out by the integration circuit of R147 and C115 before arriving at LED, the longer pulses of 380μs only are used for lighting the TEMPO LED.

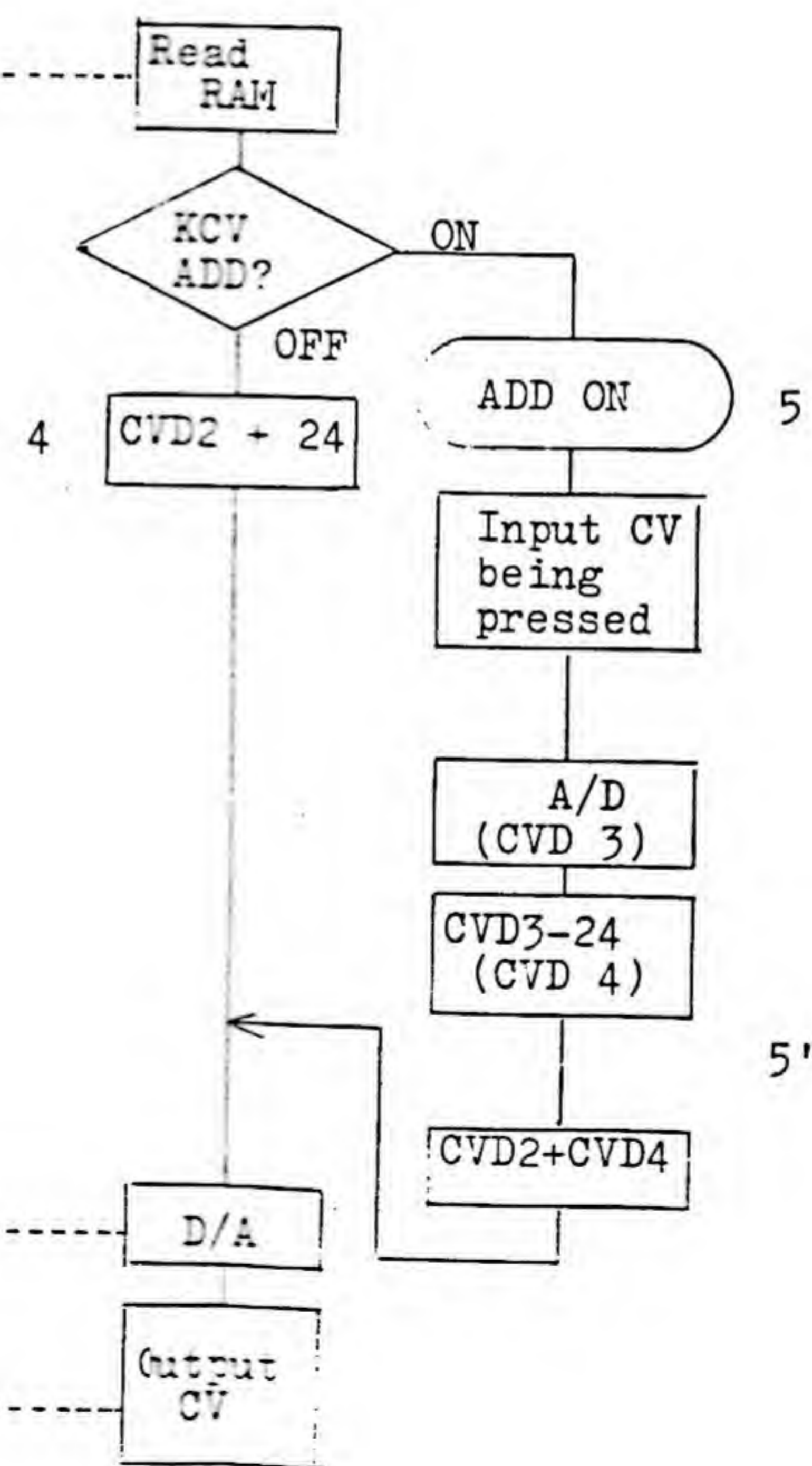


**LOAD**



Note:  
The digital data in this manual are expressed in Decimals.

**PLAY**



DESCRIPTION of CIRCUIT FUNCTION  
DETAILS

Since in the CSQ-100, the key voltage which are analog quantum are first converted to digital for storing in RAM and again afterward are converted to analog for CV OUT, these A/D and D/A conversions are just as important as the heart is to man.

It might be said that without understanding of these conversion principles and pertinent analog vs digital data relationship, all adjustment services which are related to key voltage circuits become difficult to perform correctly.

With this in mind, our description will proceed along with the line as numbered in the figure on the left page.

1. In the CSQ-100, the CV storage range runs from 0V to +5V, or 61 notes.
2. Due to the reason to be touched on later, the lowest CV which is provided by this CSQ-100 is -2V. Therefore the digital data are made to correspond to 00 = -2V.
3. The voltages that can be stored in RAM are 0 to -5V, which makes the number of pitches to be 61 if taken in the ratio of 1V/oct. Although, in handling them, 6 bits ( $2^6 = 64$ ) are enough, 7 bits would become necessary for the key voltage on the upper range if started from 0V = 24. For this reason, numbers 24 are being subtracted after conversion to digital form to make 0V = 00. (in decimal)  
The key voltage to correspond to the decimal value "1" is about 83.3mV.

4. Reproduction of CV in "----- 1  
- LOAD or PLAY . ADD "off" ) -

When D/A conversion is done after addition of 24, which is the same as subtracted before storing, into the data of RAM, the same digital analog voltage can be reproduced after D/A conversion.

5. Reproduction of CV in Memory -----2  
- Transpose under PLAY mode, with KCV ADD "on"

CSQ-100 has the function to have a desired transposition of notes in PLAY mode by adding an external key voltage to the CV in memory. But, if transposition is required up or down, KCV must be varied also up or down from the center referenced by the key which produces on this mode the same original tones in pitch from the Memory.

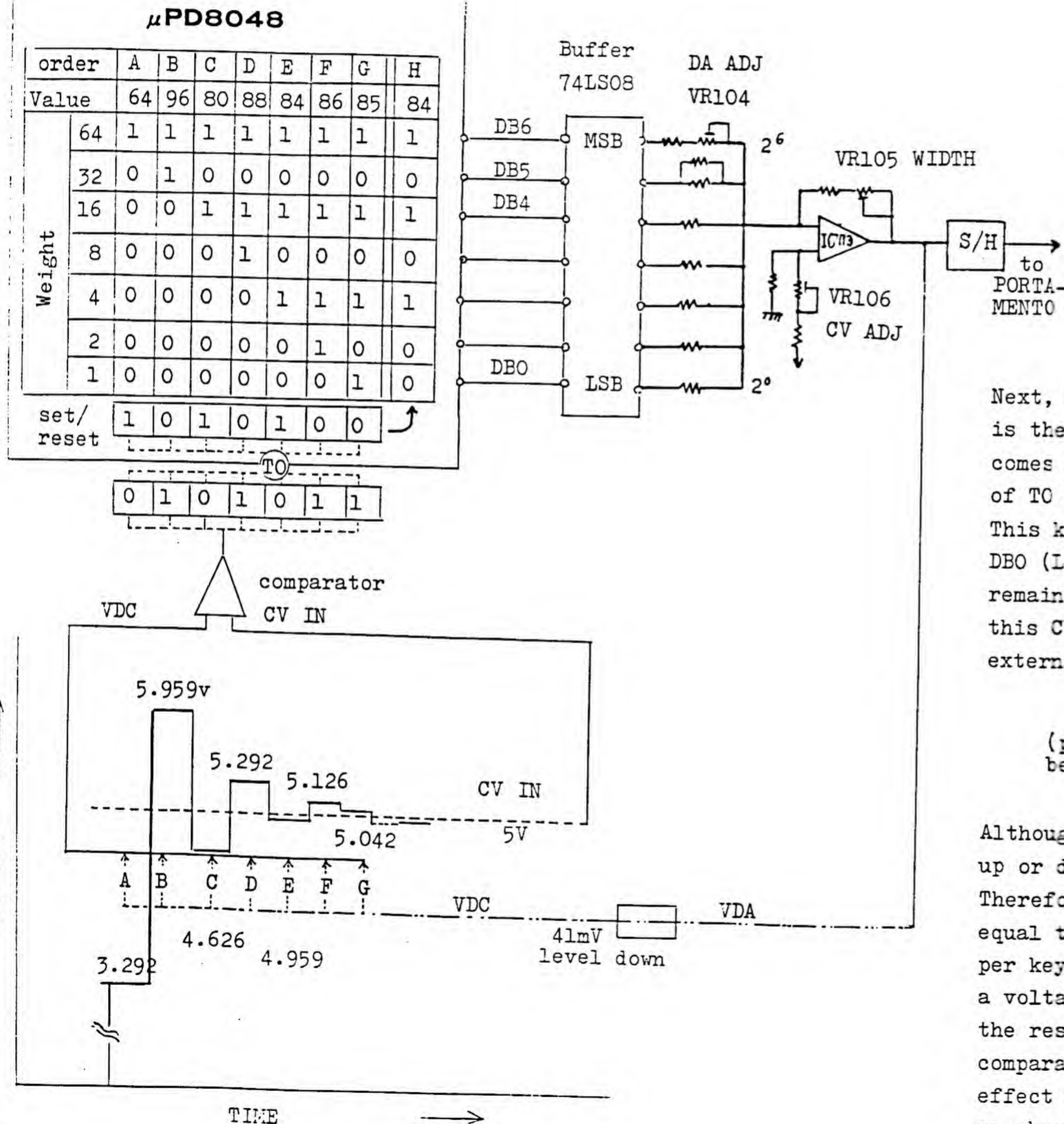
Also, because the CSQ-100 has set this shift down range to be within 2V, the key to produce KCV=2V is made the reference key. For instance, when 0V is stored in Memory, pressing a 0V key, the lowest, will produce transposed output voltage -2V. For this, the following must be true:

$$\begin{aligned} & \text{Digital data for 0V stored in RAM (CV2 = 00 )} \\ & + \text{KCV digital data of 0V (CVD3 = 24 )} \\ & \qquad \qquad \qquad = 00 ( -2V) \end{aligned}$$

To satisfy the above, "  $CVD2 + CVD3 - 24 = \text{output data}$  "



A/D and D/A CONVERSION - details-



When MSB is first set on, the signal "1" is output to DB6. When D/A converted, the analog voltage (VDA) here must be 3.333V which, after shifted down by 41mV, becomes 3.392V (VDC). This time VDC goes into noninverting input of the comparator and is compared with CV IN.

In the case shown in figure left, this CV is 5V, so CV IN > VDC bringing the comparator's output to L (0), to have DB6 remained as has been set to "1".

Next, DB5 is set to "1". This time the digital data is the sum of DB6 and DB5, and the comparison becomes CV IN < VDC, to output H and to "reset" signal of TC and to have DB5 return to "0".

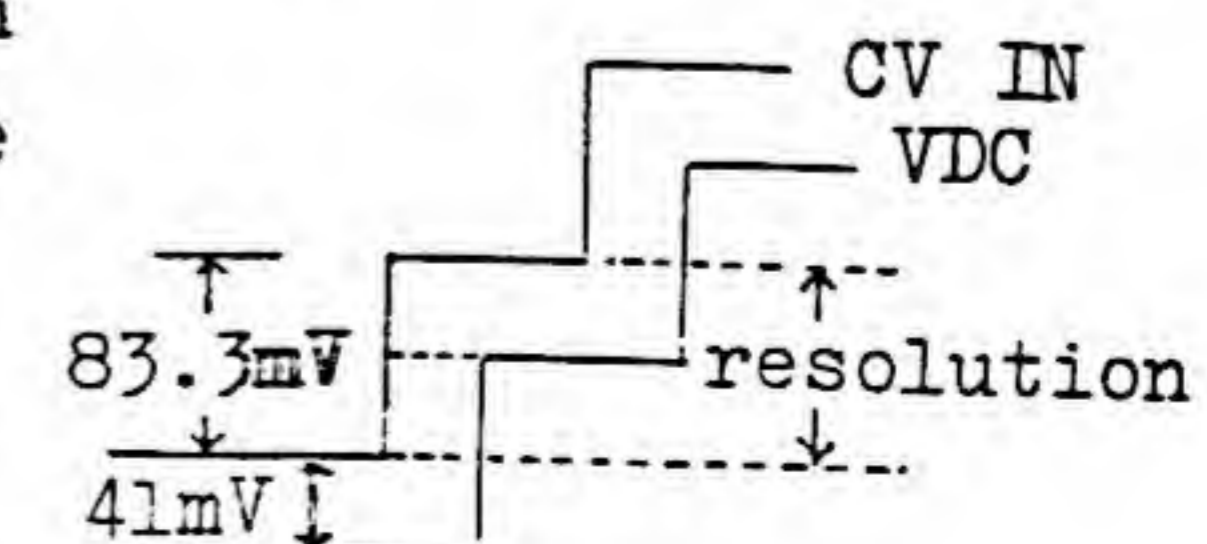
This kind of comparison is repeated 7 times down to DBO (LSB). The sum of the digital data of the bits remained "unreset", then, is made to be the data of this CV IN, with which the CV IN is stored in the external RAM.

$$VDC = VDA - 41mV$$

(precisely, 41.7mV, and voltage differences between notes are 83.3mV or 84mV in turn)

Although CV IN is in fact an analog voltage, steps up or down like a staircase wave as the note changes. Therefore, if VDC is shifted down by an amount equal to about one-half of the voltage difference per key (step rate or resolution),

a voltage fluctuation within the resolution value of the comparator does not bring effect on the digital data, as shown in the figure.



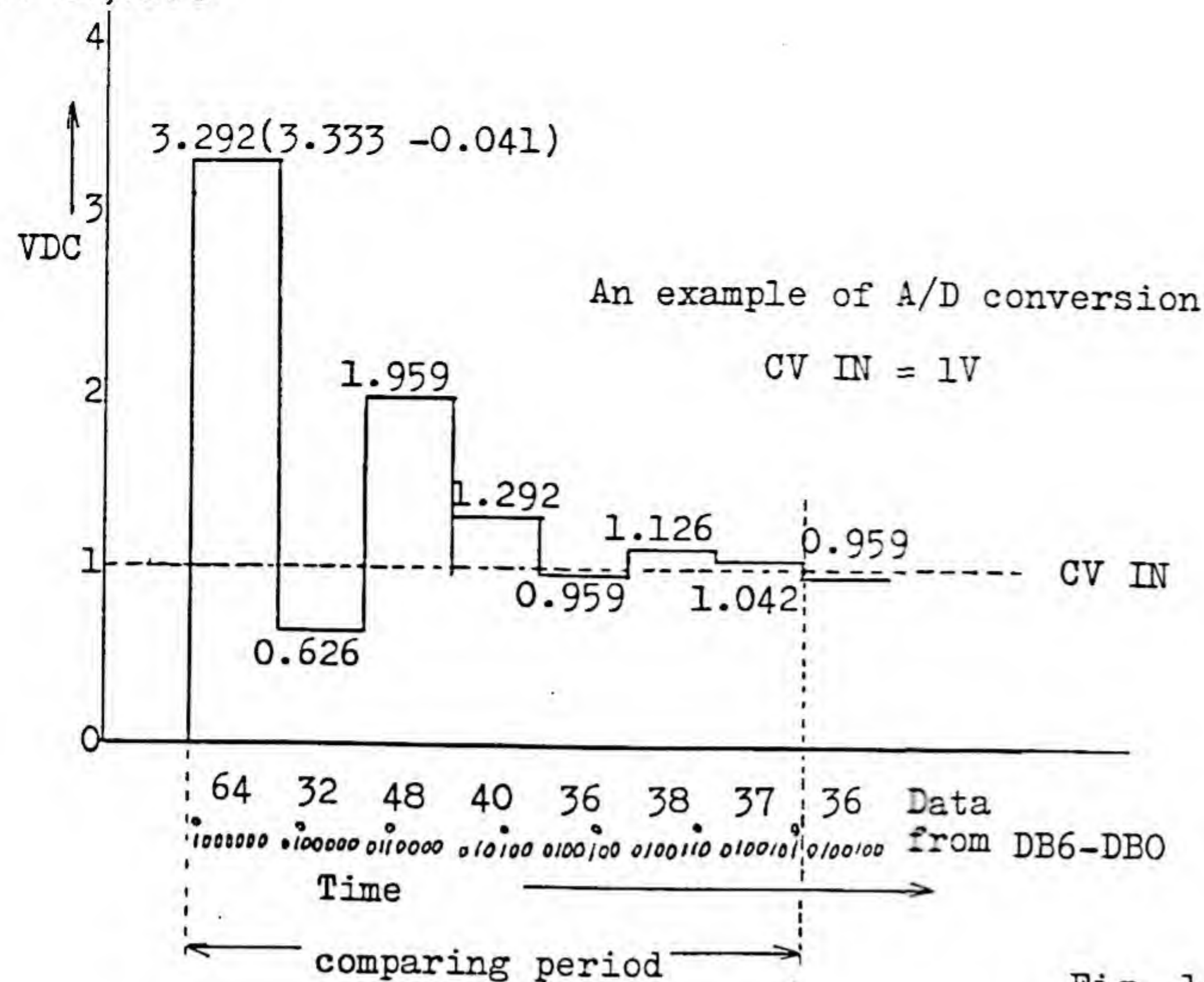


Fig. 1

RELATIONSHIP BETWEEN CV ADJ (VR106) and CV DATA

In LOAD mode and with the converter that is correctly adjusted, suppose that we turn VR106 (CV ADJ) slowly clockwise while holding 1V key depressed on the keyboard. Then you can observe VDA (i.e. CV OUT) increases gradually, and likewise VDC (VDA - 41.7mV) ascends along the dotted area as shown in Fig. 3. That is to say, although the digital data is unchanged, the voltage for that data is increased. But, still kept on turning VR106 to have VDC overcome 1V line for the digital data 36 as shown in Fig. 4, it causes the output of the comparator to be turned to "H" and the digital data re-written to 35. Fig. 5 shows that state as being adjusted by turning VR106 clockwise to have CV OUT again to 1.000V. Still turning VR106 further will repeat the same as above and to rewrite to 34. But, when turned counterclockwise, the data will be rewritten to a larger number each time.

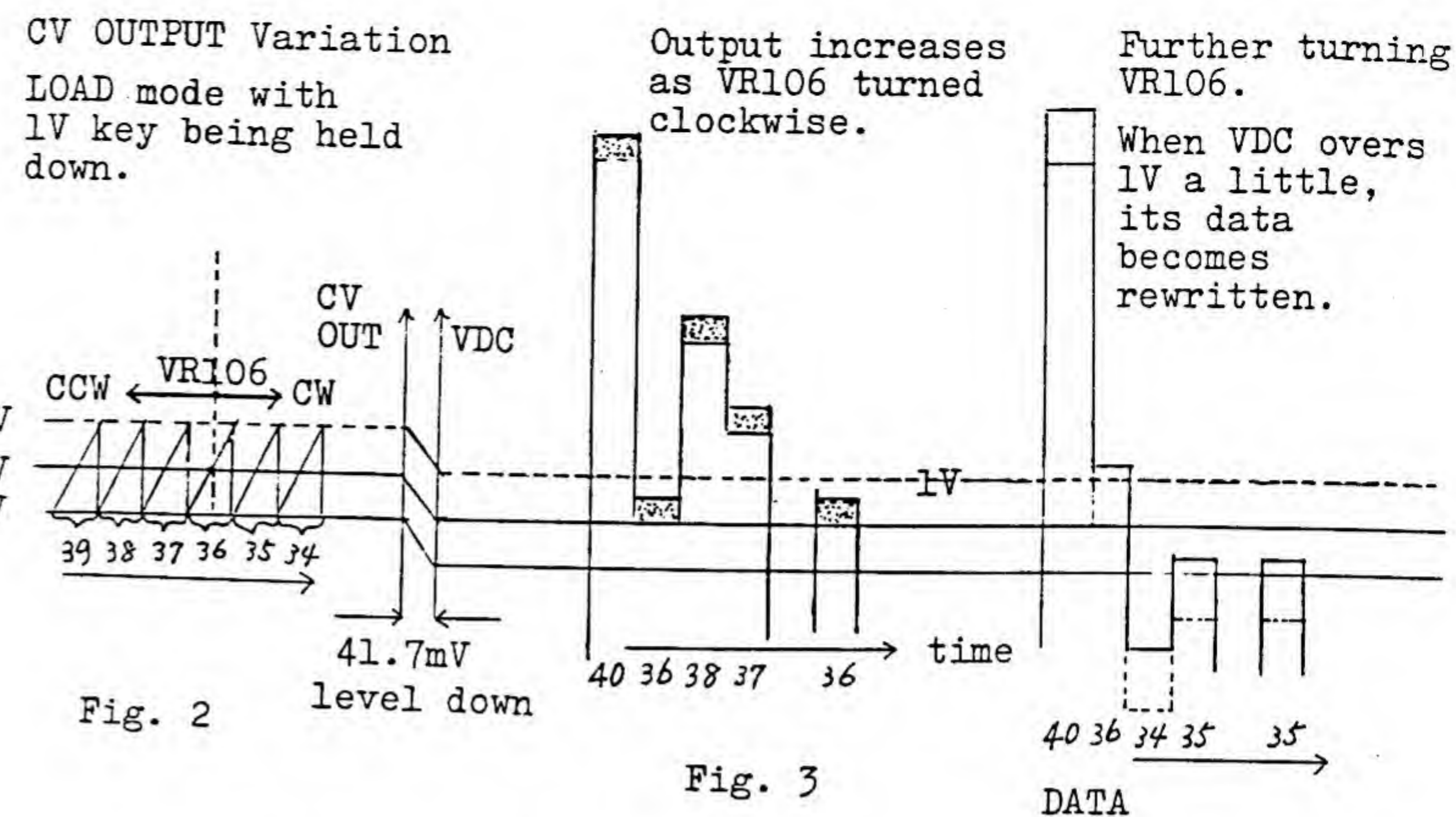


Fig. 2

Fig. 3

Fig. 4

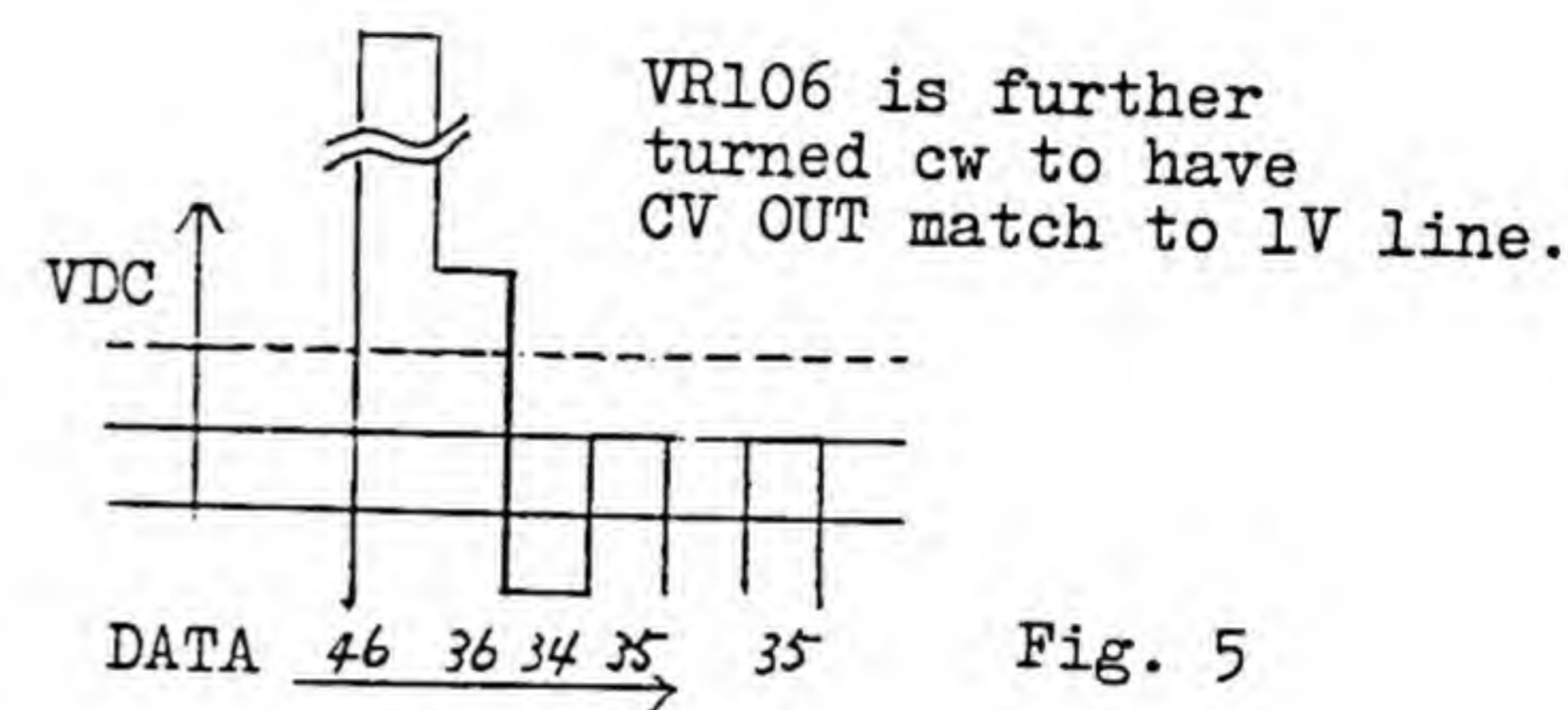


Fig. 5

When watching this on a digital voltmeter connected for observation, the display will be as illustrated in Fig. 2. Now, suppose that we have turned VR106 a little too far to have the digital data 35 for CV IN of 1V (as in Fig. 5). It is all right and causes no problem as long as we have KCV ADD turned off, because under these circumstance, any shortage or excess of voltage could be compensated for by biasing thru this CV ADJ. potentiometer. But once we have turned KCV ADD on, the whole matter would become different, to be explained on next page.

## CSQ-100

WHEN DIGITAL DATA IS INCORRECT, ERROR WILL BE PRODUCED on CV OUT. with KCV ADD "ON"

Taking for instance the case of each having CV IN 1V converted into digital 35 ( B and C, table below) in place of 36, we will explain as follows:

Note: The topmost numbers in the table refer to those on page 6.

MODE	2	3		4, 5'	6	7
	CVD1	subtraction	CVD2	addition	D/A INPUT	CV OUT
A LOAD (normal)	36	24	12	24	36	1V
B KCV ADD "off"	35	24	11	24	35	1V
C KCV ADD "on"	35	24	11	*(CVD-24) 47-24=23	34	0.9167V

\* This is when the 2V key is depressed so as to have the same pitch on CV OUT with CV IN in memory

Case B is when VR106 is adjusted to reproduce CV OUT of 1V even if in earlier stage the digital data lacks 1. In this case, since the numbers in preceding subtraction, and subsequent addition are both the same (24), the analog amount at the output receives no effect to differ after A-D-A conversions.

In C, however, despite the fact that the KCV (being pressed) is converted to digital data number short of 1, it is added to RAM-stored-data after subtracting 24. This means that there is a double shortage, bringing after all the shortage by 2 before D/A conversion prior to CV OUT. Through this D/A once again, 1 out of these 2 can be compensated for by VR106, but there is still remained of 1, which brings lack in pitch of a semitone ("1" in digital data) on tone reproduction. Thus, a maladjustment of VR106 produces a deviation on reproduction when played with KCV ADD "on". Or, it can be said conversely that, through finding such deviation on analog voltage, it is possible to check digital data errors.

MAY 31,1979

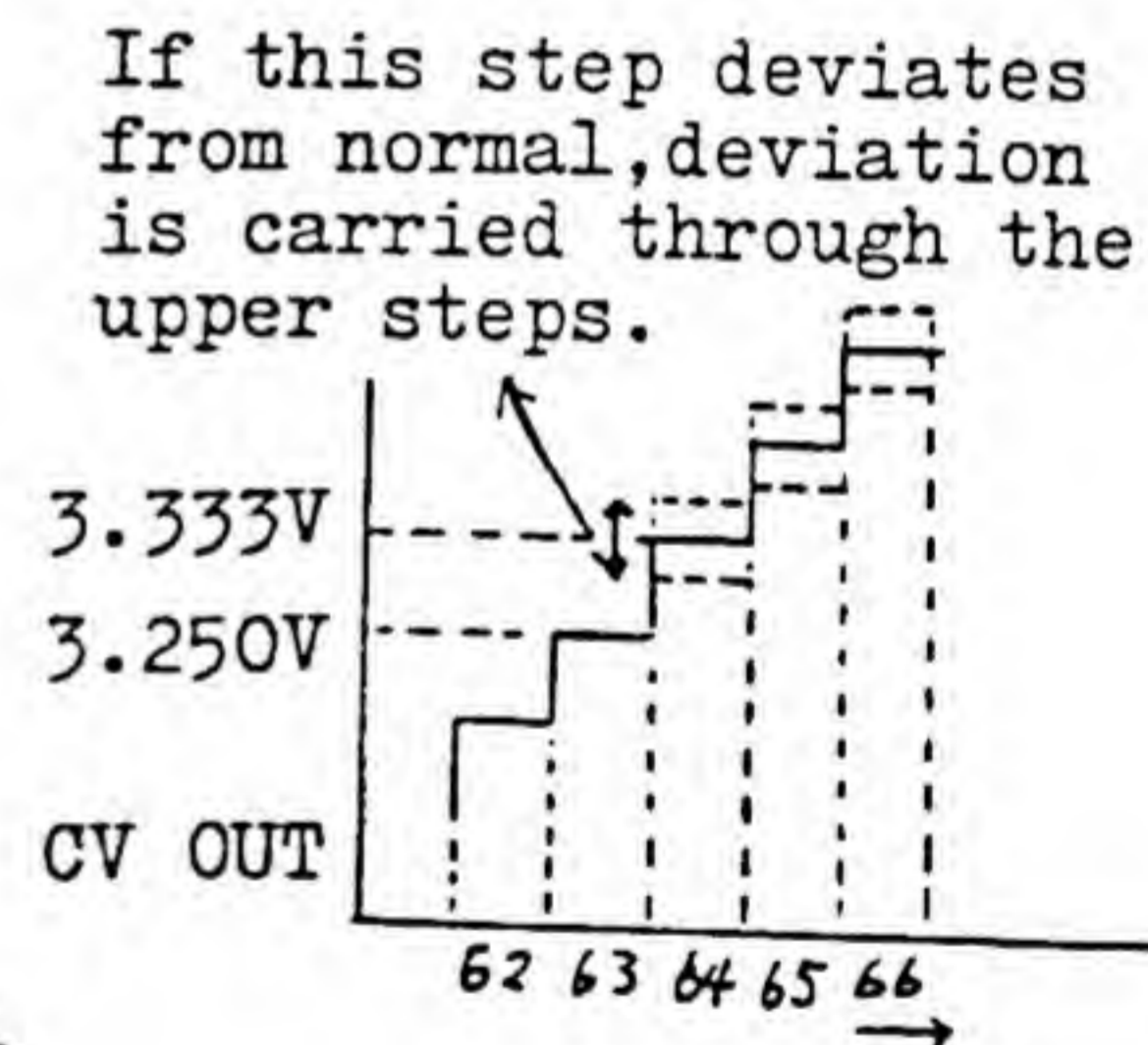
## WIDTH ADJUSTMENT with VR105

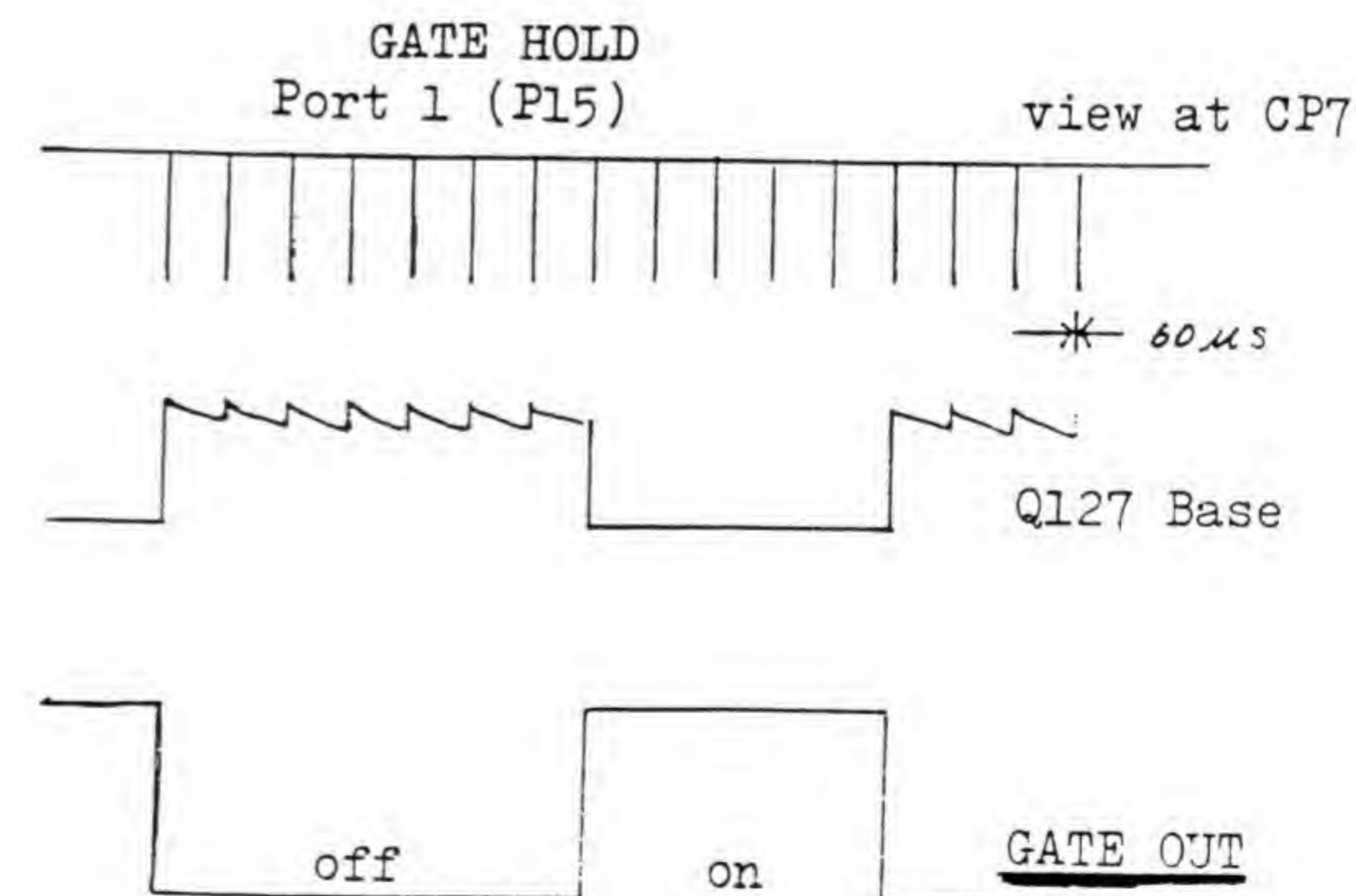
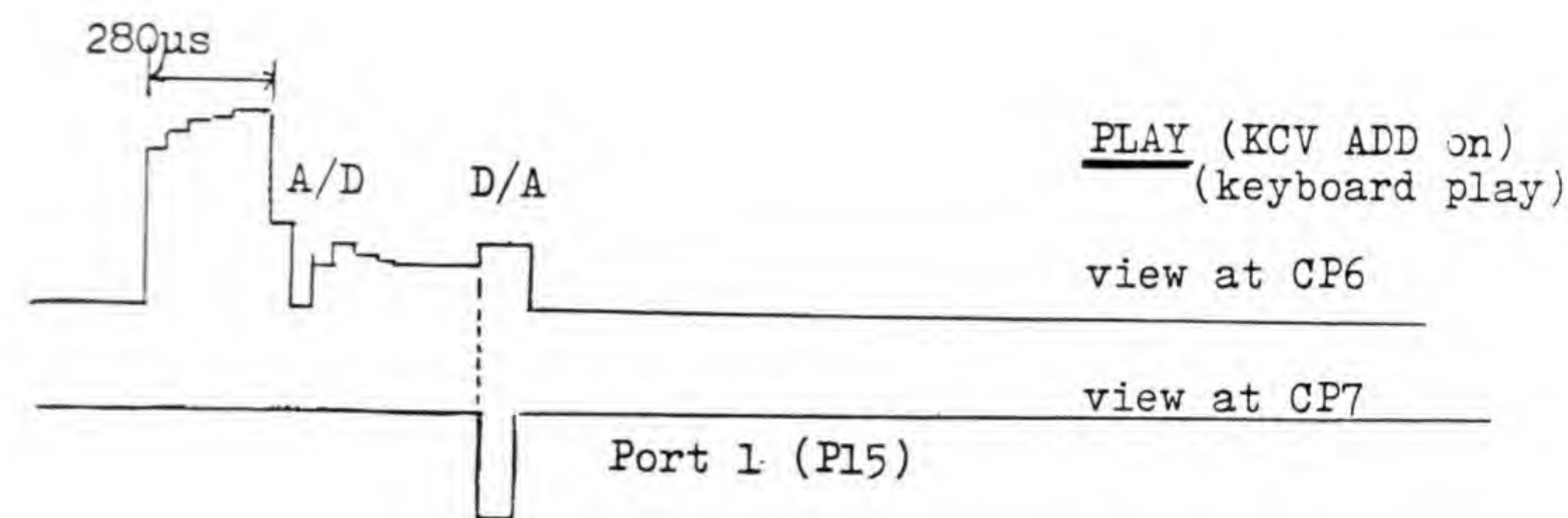
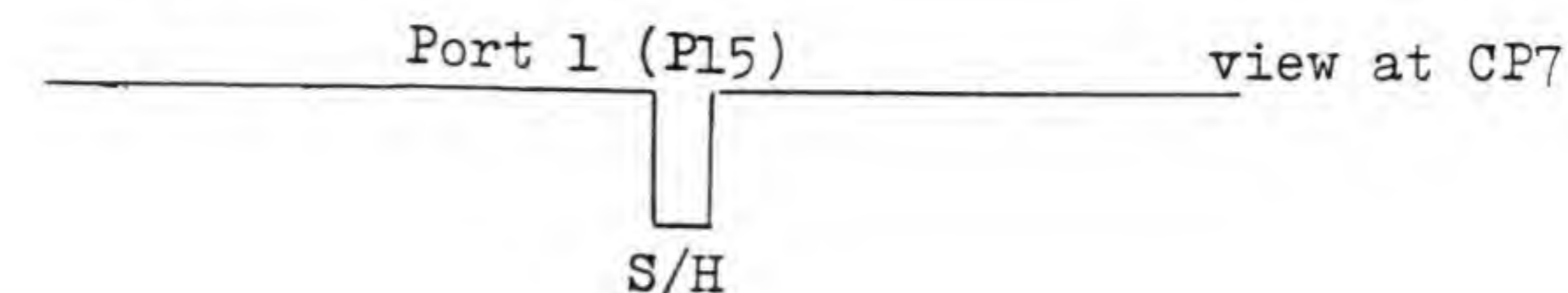
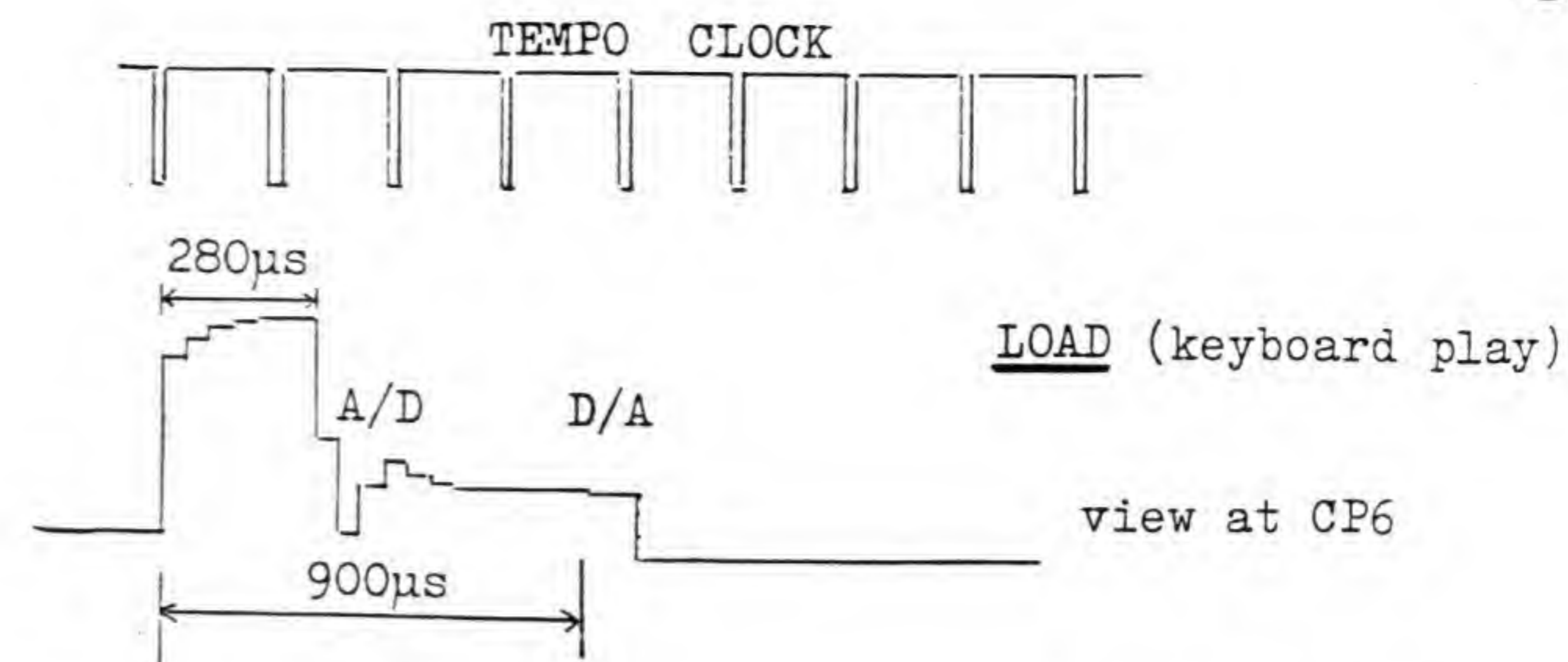
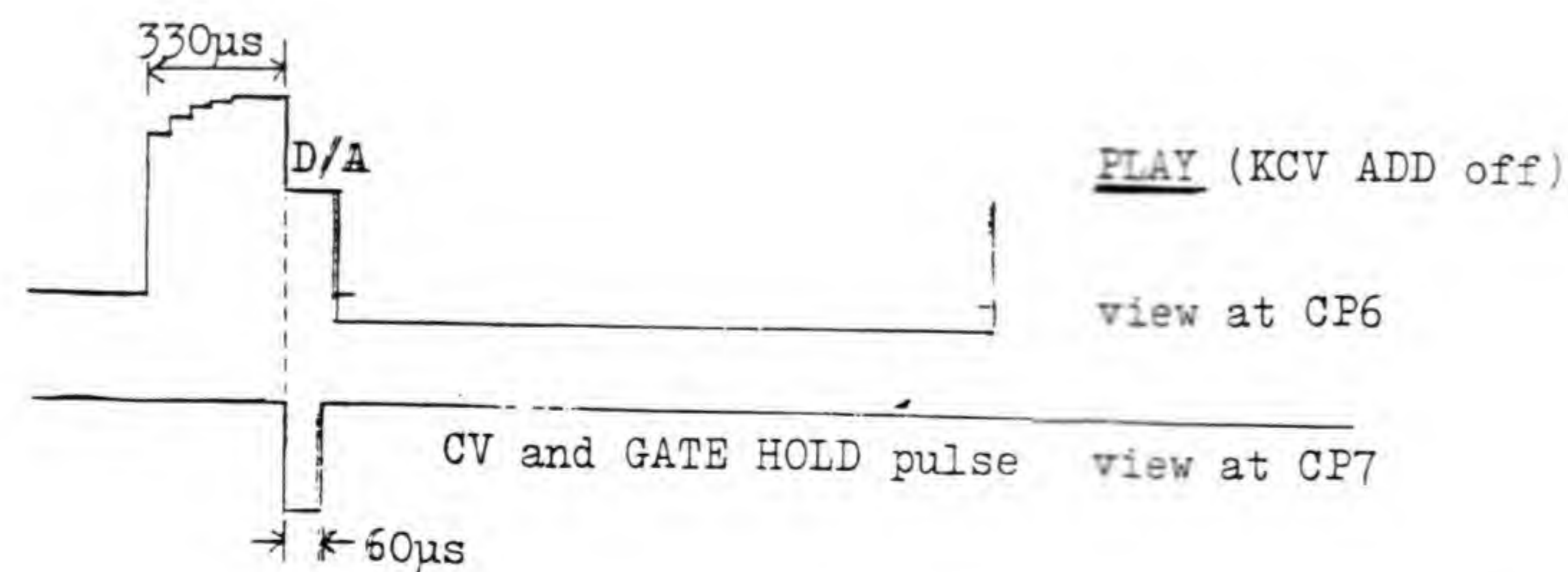
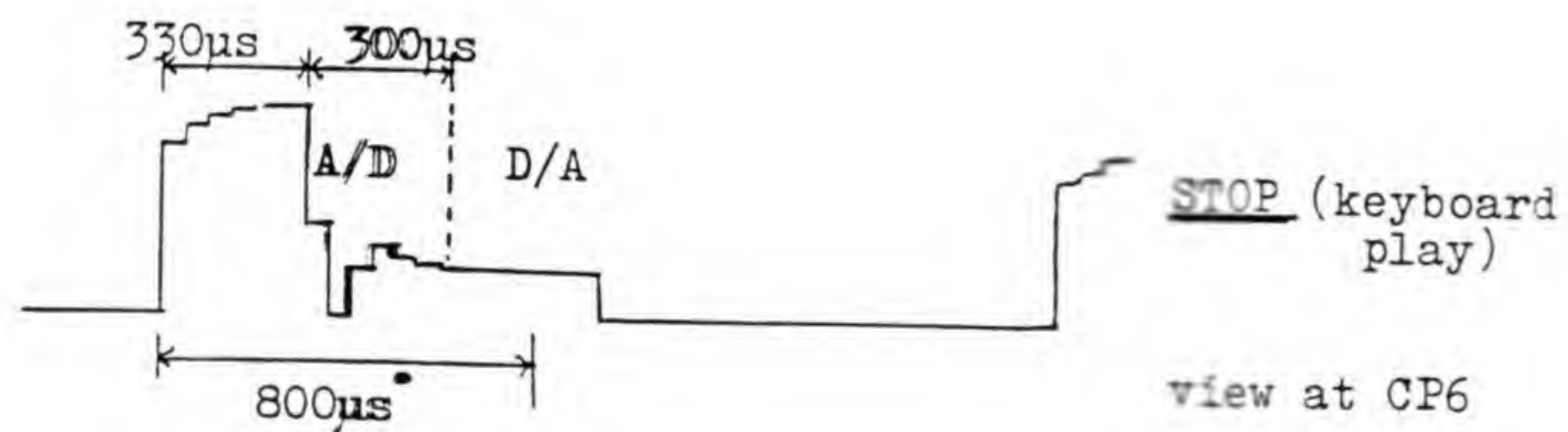
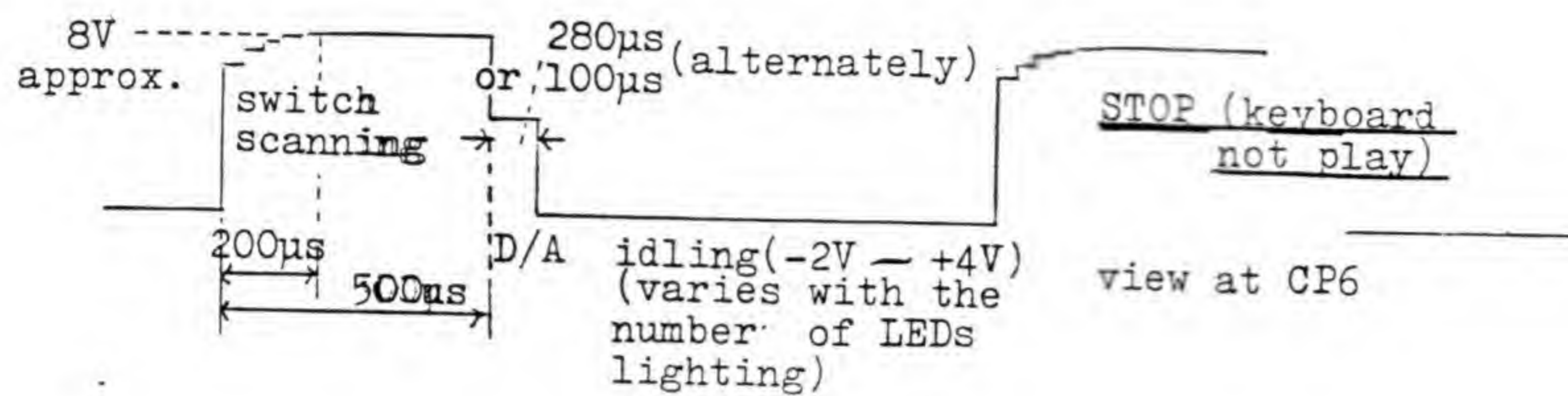
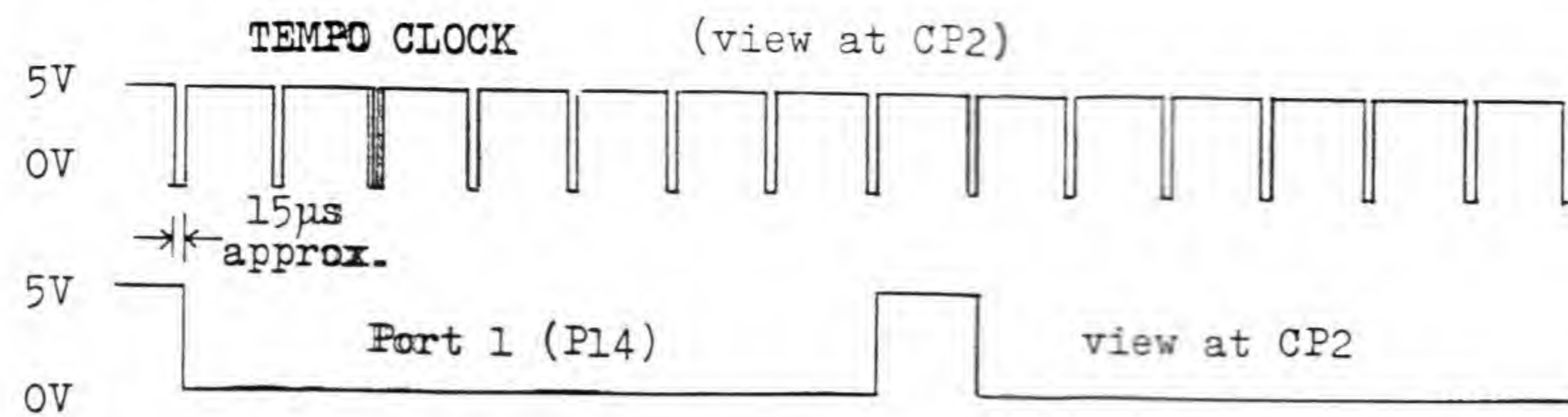
This potentiometer VR105 is for use to correct the gain of IC113 so as to have D/A in proper relation of 1V/oct, that is, when the data changes by 1, CV OUT changes by 83.3mV. When VR105 is required for readjustment, it may also be necessary to readjust VR106, since turning either VR results in interaction between adjustments, therefore, both VRs need to be adjusted in turn.

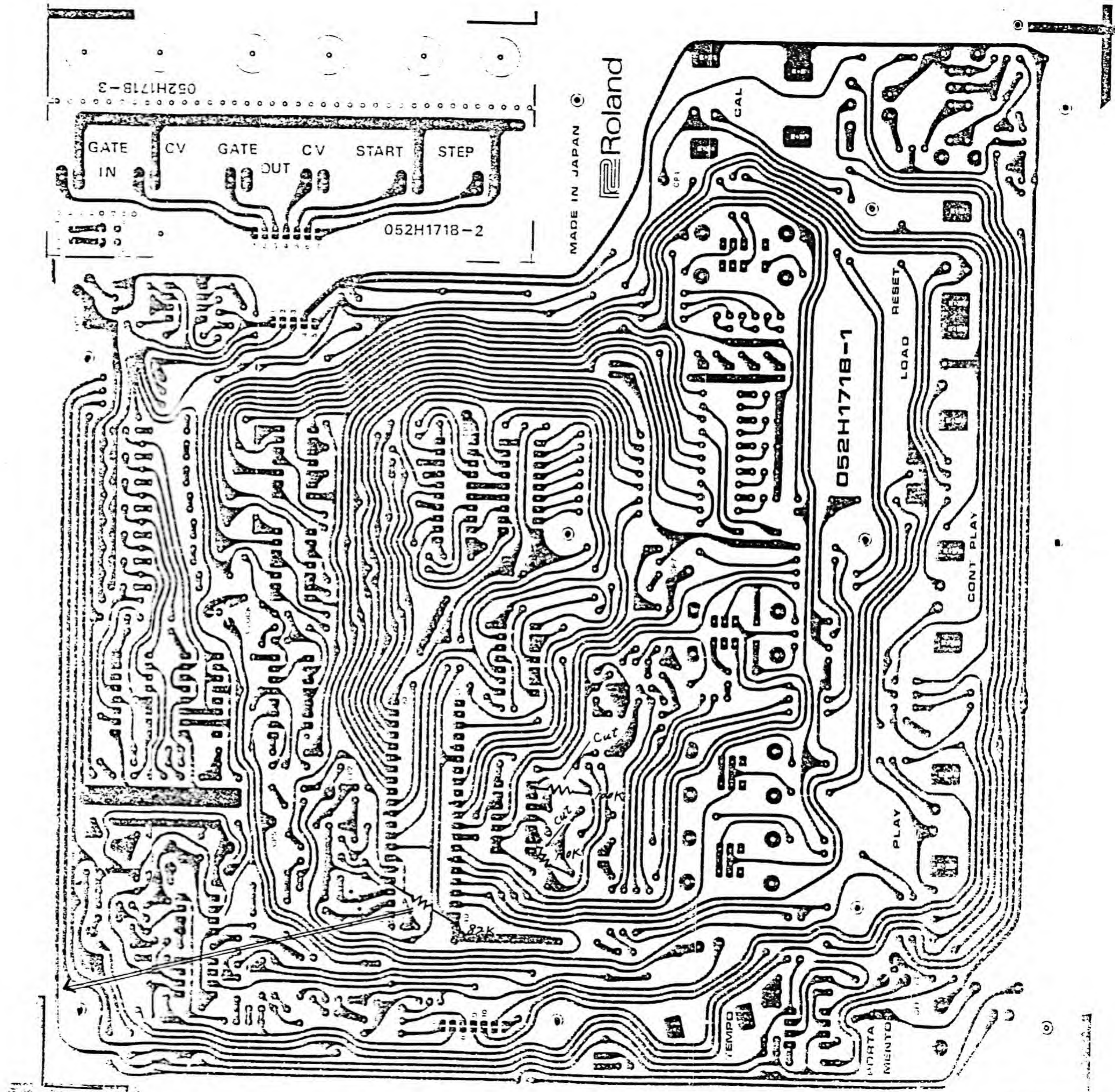
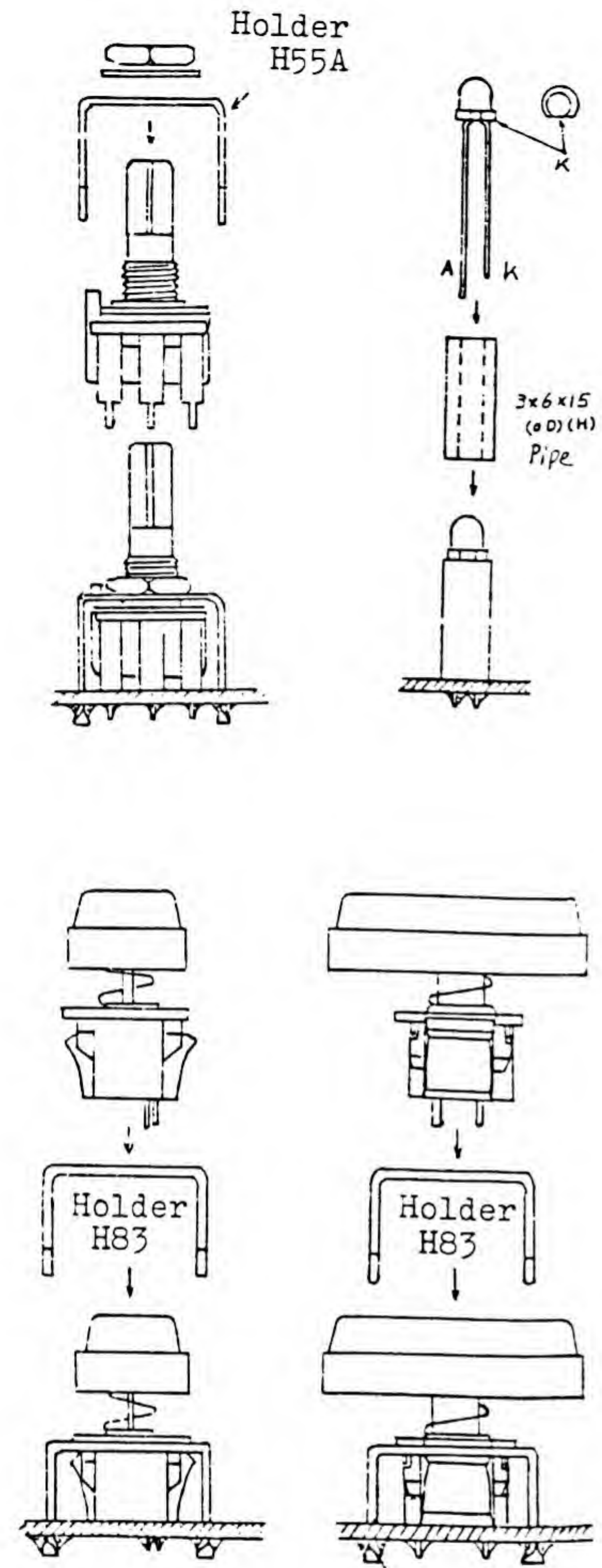
Also care must be exercised to avoid an excessive turn of the VRs which will bring difficulty in performing this adjustment.

## D/A ADJUSTMENT with VR104

This potentiometer is for the gain adjustment of the D/A amp, and it is in particular for DB6. This DB6 is for the data weighing the most significant bit, so its adjustment is the most critical one and warrants the careful attention. Sources of fluctuation and deviation such as those coming from the preceding stage of IC103, IC104, on impedance or on output voltage, and resistance variation in resistor, etc. are to be compensated for by this VR104. Since the digital data that makes DB6 active is in number over 64 or 3.333V in CV, fluctuation brought through DB6 data will effect all CV of higher voltages as shown in the figure. In practice, it will be best to adjust VR104 as follows: Set the LOAD mode and complete both CV ADJ and WIDTH ADJ, then, holding down the key for 4V. Set VR104 so that CV OUT equals 4.000V.







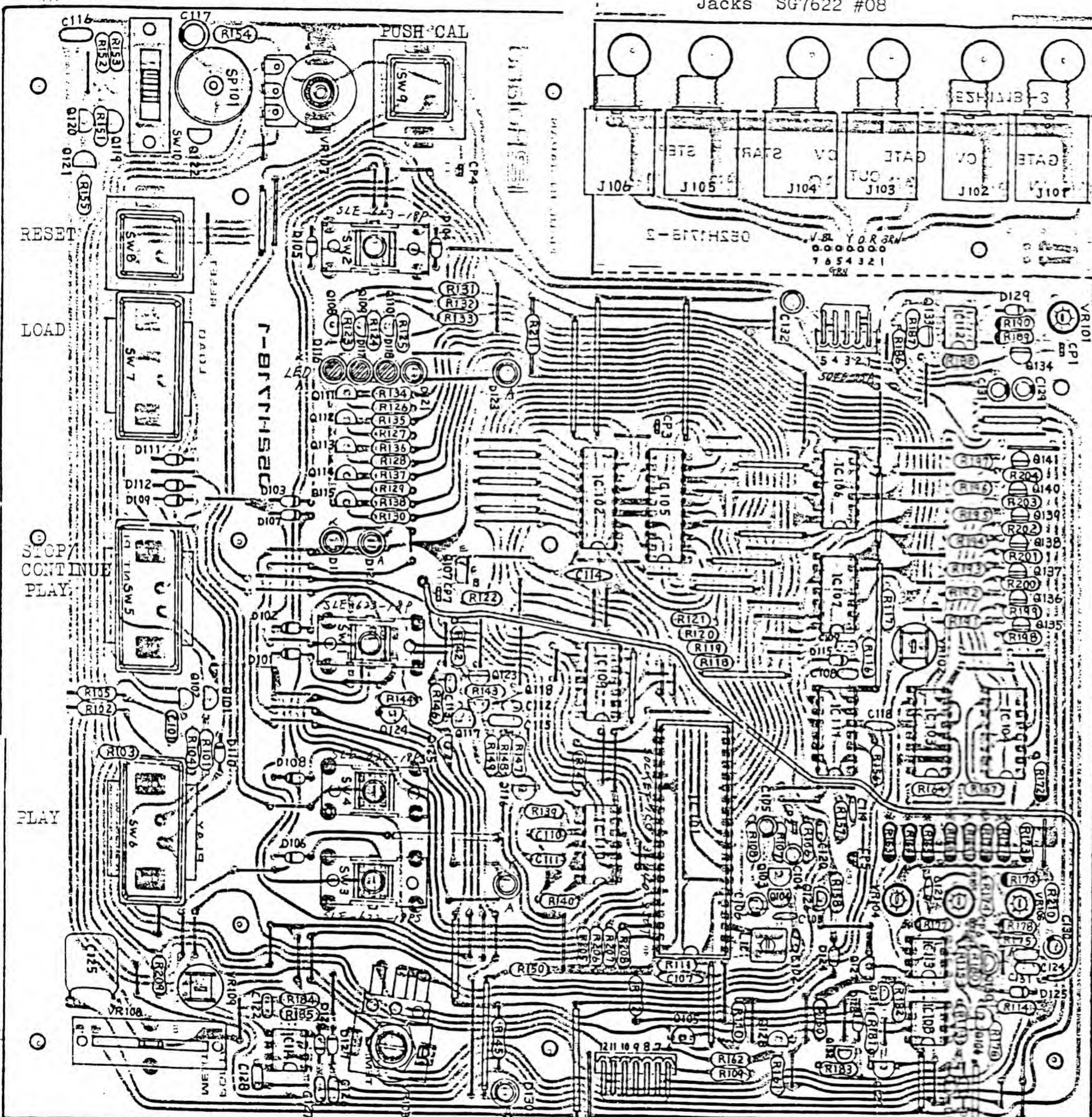
Improvement on RESET SENSE

Increasing C104 capacitance from 1 mfd to 10 mfd may make RESET pulse more stable.

Note: 82k is unnecessary when existing C106 is 0.47/50.

SP101  
EAF-  
-12PN 16R02C  
EVH-  
LWAD25B15

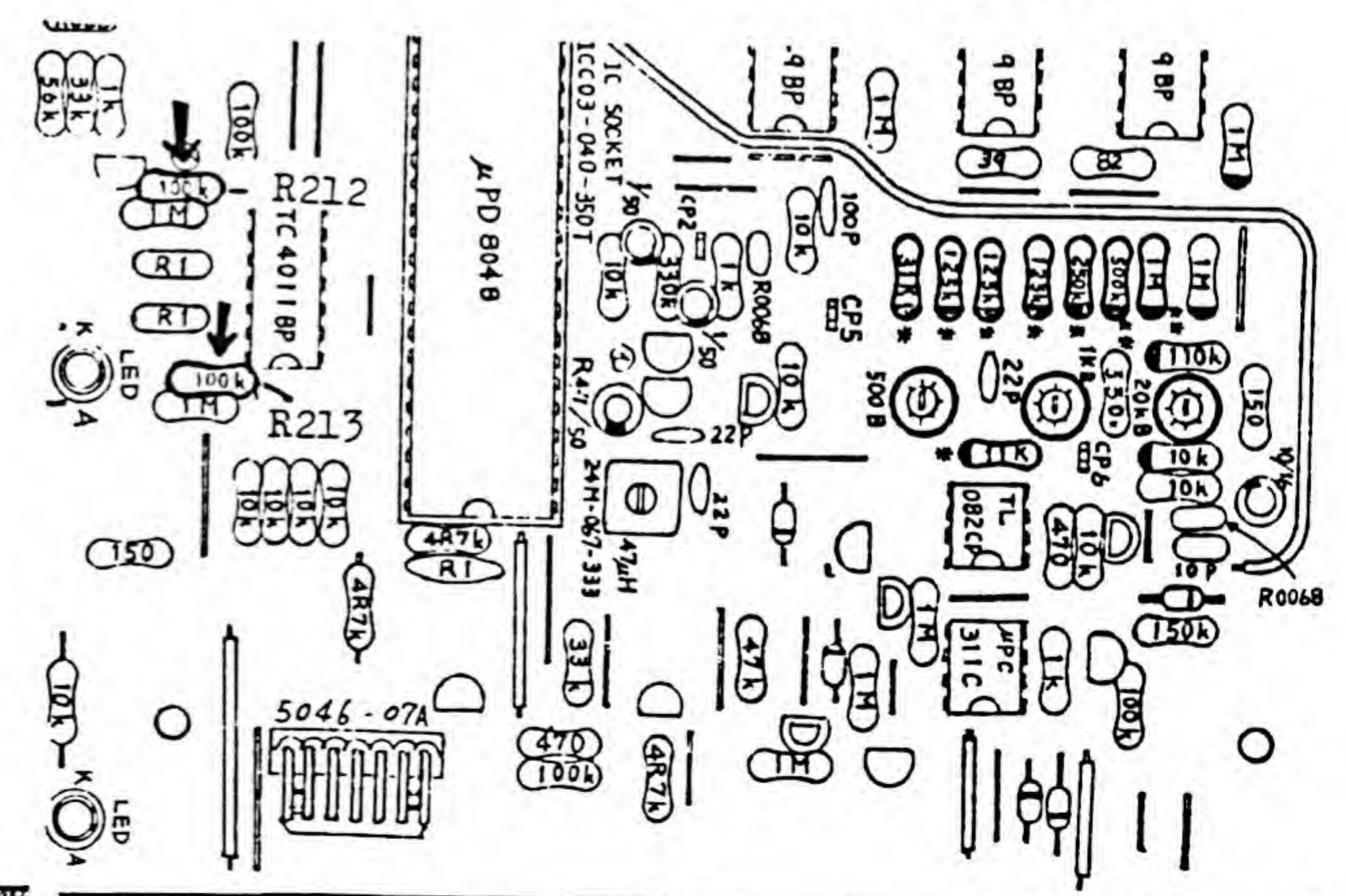
Jacks SG7622 #08



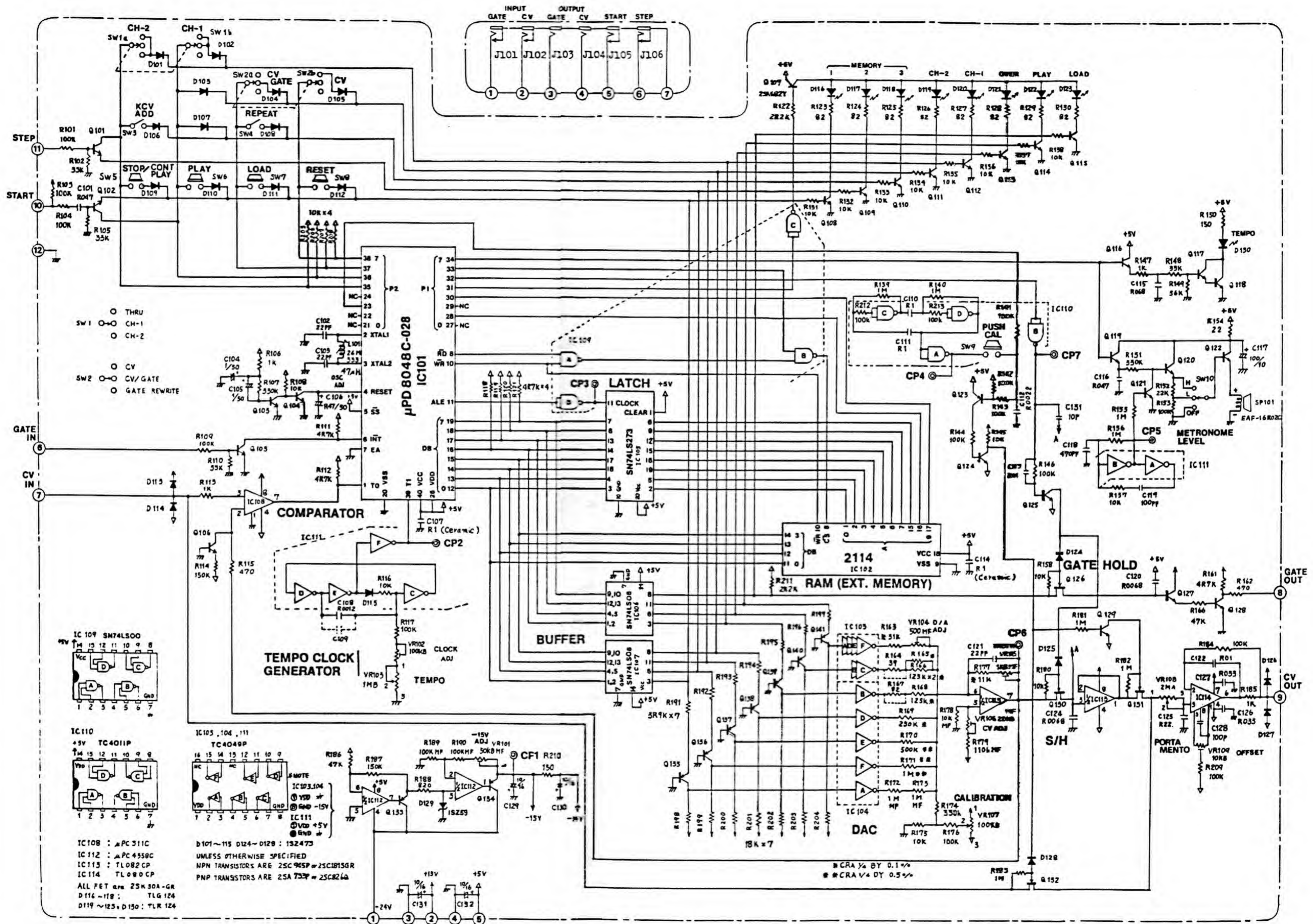
**OPH31B(149H031B) (052H171B-1)**  
**OPH70B(149H070B) (052H171B-2)**

- R-25J
- CRA $\frac{1}{2}$ FX (1% 100PPM)
- CRB $\frac{1}{2}$ FX (1% 100PPM)
- \* CRA $\frac{1}{2}$ BY (0.1% 50PPM)
- \*\* CRA $\frac{1}{2}$ DY (0.5% 50PPM)
- SR-19R
- RJ-6P
- 2SA733-P or 2SA826-Q
- 2SC1815GR or 2SC945P
- 2SK30A-GR
- TLR124 (RED)
- TLG124 (GREEN)

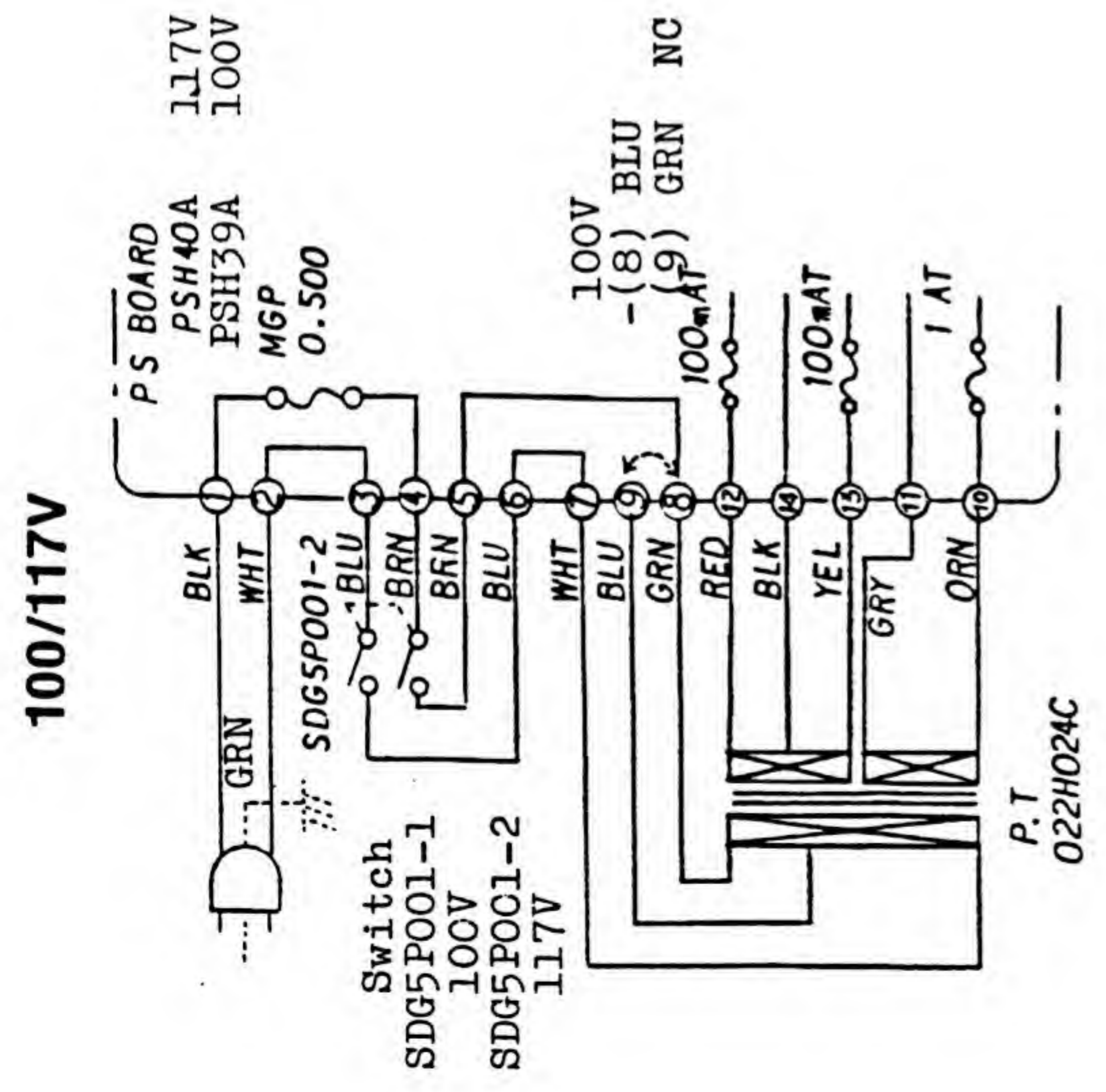
Difference between OPH31's:  
OPH31D - R212, R213 (100K) are mounted on the component side with the pattern provided  
OPH31B - Both 100Ks are attached on the foil side with pertinent pattern cut



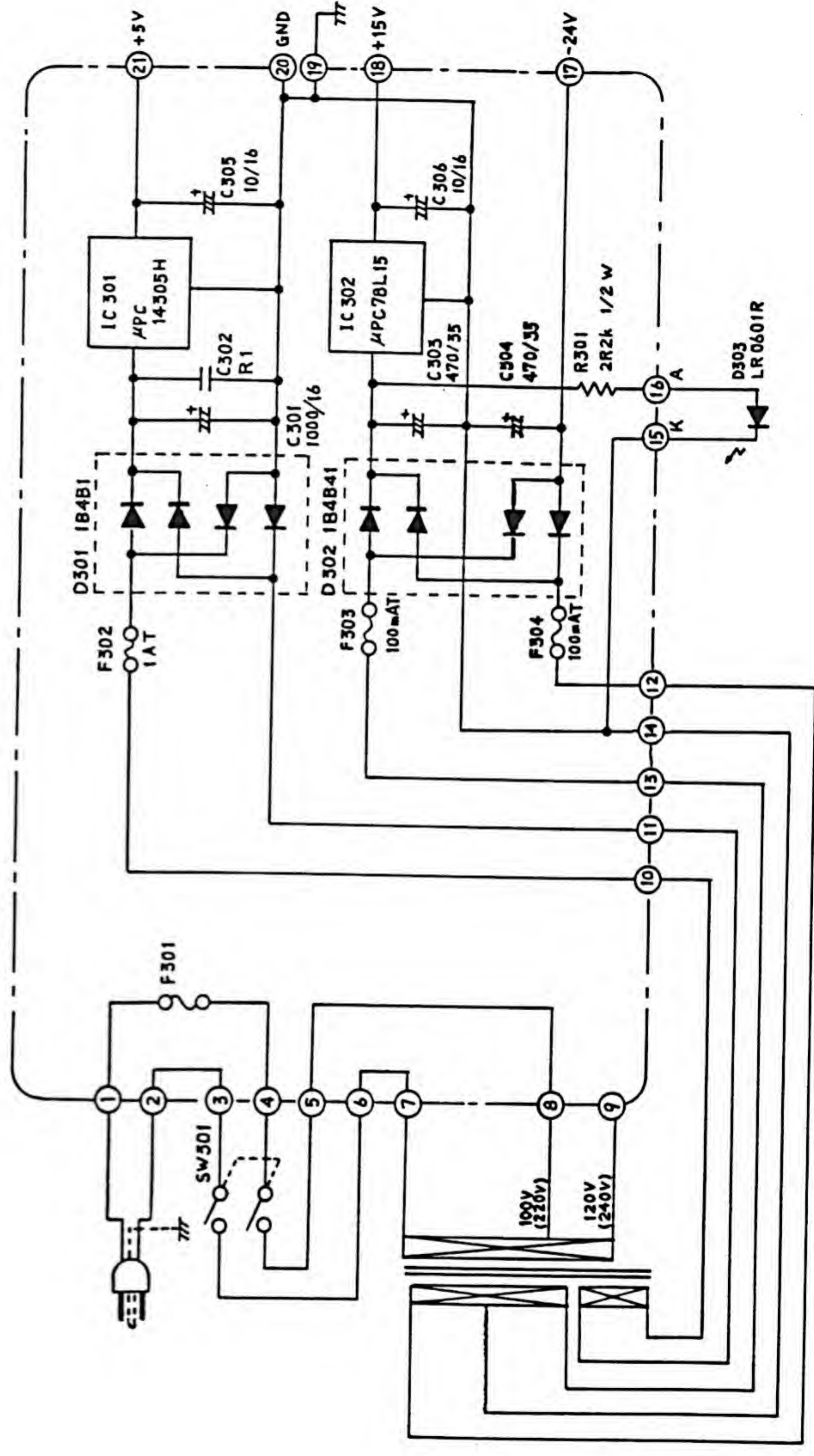
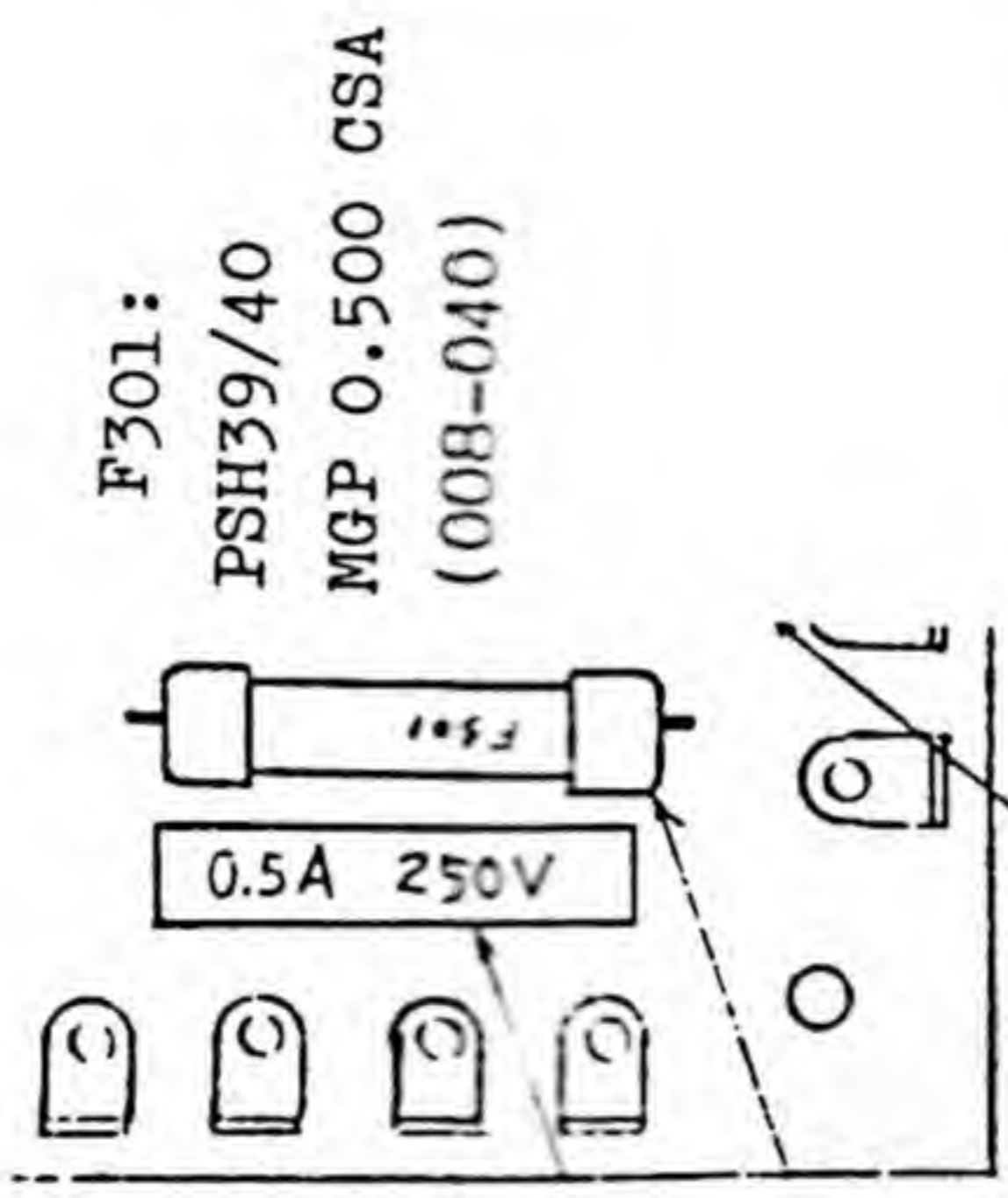
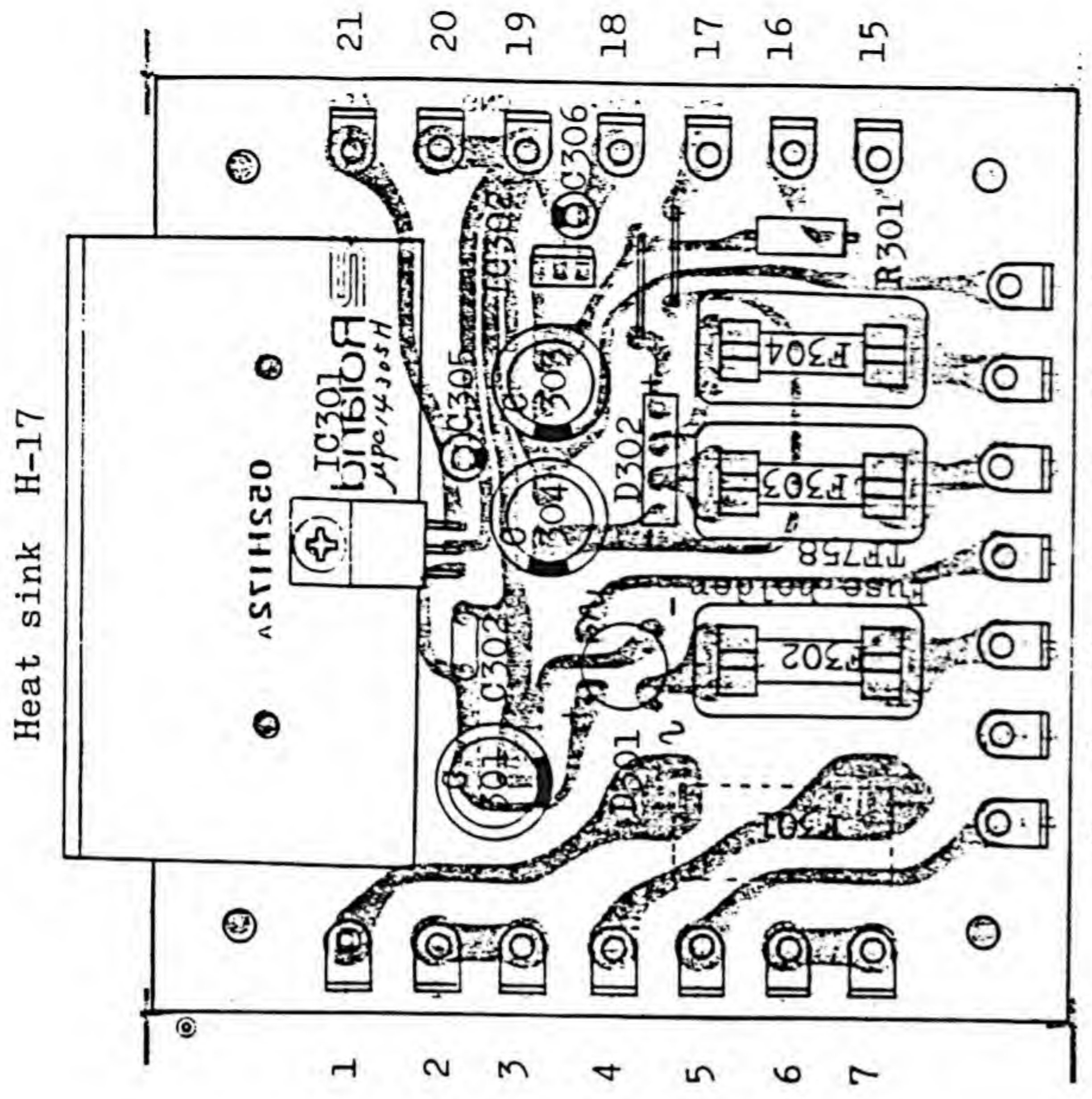
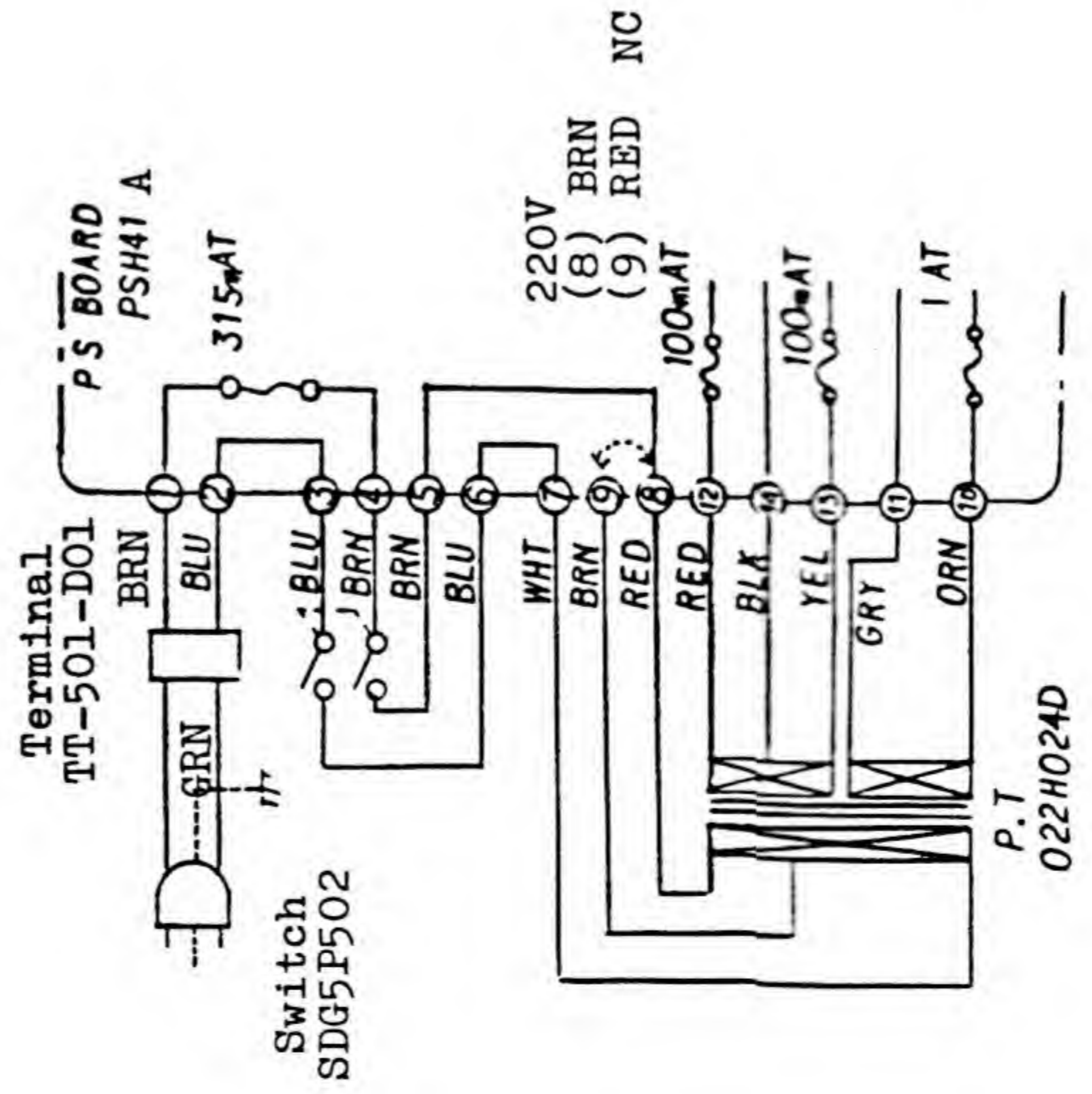
EVA-LOPC15A26      VM10R      5046-07A  
K20B16



**POWER SUPPLY BOARD**  
**PSH39A (146H039A) 100V**  
**PSH40A (146H040A) 117V**  
**PSH41A (146H041A) 220/240V**  
**(Etch mask 052H172A)**



**220/240V**





## ADJUSTMENTS

The adjustment is composed of 2 parts: Section I and Section II. It is recommended that the adjustment which is necessitated after the replacement of failing component or others are, as a rule, to be conducted as described in Section I.

## Definitions

In this adjustment, the following terms have following meanings,

DVM	-----	Digital Voltmeter
<u>LOAD</u> , <u>PLAY</u> , etc.	-----	Key on the CSQ-100 control panel
2V key, 3V key, etc.	-----	A key on the synthesizer being used, which provides that KCV
TEMPO, CAL, FAST, etc. (capital letters)	---	Control, switch, jack, legend on the CSQ-100
SCOPE	-----	Oscilloscope
CP1, CP2, etc.	-----	Check point on the PCB.

Note: Before attempting adjustment, warm-up period for no less than 10 minutes should be given.

CAUTION: Care must be taken not to turn the adjusting potentiometers excessively.

## SECTION I

Adjustment is usually necessary only after replacing parts.

CALIBRATION PROCEDURES

After replacement of	Connect,- to	Adjust or Check	for (remark)
IC101 (μPD8048) L101 (47uH)	1. Frequency counter, CP3	L101	365kHz ± 10kHz (8048 Clock frequency)
IC110 (TC4011P)	2. Scope, CP4		(waveform check)
IC111 (TC4049P,	3. Frequency counter, CP2	VR102 Clock Adj.	(Tempo clock frequency) 4.7kHz ± 5% with TEMPO at FAST
<p>Check that frequency is 0.7kHz + 5% - 10% with TEMPO set at SLOW.                      If this range deviates, readjust VR102 with TEMPO at FAST within the range of 4.7kHz ± 5%.                      Or, vary the capacitance of C109.</p>			
IC114 (TL080CP)	4. No connection at CV IN jack ----- CV OUT, DVM	VR109 Offset	(Depress <u>RESET</u> )  0 ± 0.5mV
IC112 (μPD4558) D129 (1SZ59)	5. DVM, CP1	VR101 -15V Adj.	-15V ± 2mV
<p>Note: Since any variation in the DC supplies will have the most pronounced effect on the DA converter, check CV OUT for error through the next steps (6).</p>			
IC103, IC104 (TC4049) IC113 (TL082-P)	6. CV IN, GATE IN, Synth's CV GATE out ----- DVM, CV OUT	VR106 CV Adj.	(DA Adj.) ----- CAUTION: Adjustment of the DA converter is very subtle. Always rotate ADJ. pots by slow degrees, excessive turn will bring great difficulty into the subsequent adjustment attempts,requiring a waste of time.-----
<p>Setting:</p> <p>PORTAMENT on the synthesizer ----- Off or minimum</p> <p>LOAD MODE ----- CV/GATE</p> <p>MEMORY ----- CH-1</p> <p>PLAY MODE ----- KCV ADD ON REPEAT</p> <p>TEMPO ----- center</p> <p>PORTAMENT ----- 0</p> <p>CALIBRATION (knob) ----- center</p>			

(Continuation of Step 6 from previous page)

- 6-1. Press RESET and LOAD.
- 6-2. Depress the 2V key, DVM must read  $2.000V \pm 3mV$ .  
When DVM reads within  $3mV$ , adjust CALIBRATION pot for 2V CV OUT with PUSH CAL depressed. Then proceed to 6-3, 6-4.  
If reading is outside  $\pm 3mV$  range, set CALIBRATION pot at center, and adjust VR106 (CV Adj.) for  $2.000V \pm 3mV$  reading.
- 6-3. Verification of KCV ADD function  
While depressing the 2V key, push PLAY. DVM must read the same.
- A. If reading changes, it means that VR106 (CV Adj.) has been set at incorrect point. Proceed to Section II
- B. When the reading is steady, make sure that DVM readings are within the ranges in the table shown below with respective key depressed. (RESET-LOAD-2V key-PLAY-2V key-3V key-4V key)

key being depressed	DVM reading (CV OUT)
2V	$2.000V \pm 2mV$
3V	$3.000 \pm 2mV$
4V	$4.000V \pm 2mV$

If any of the readings exists outside the limit, make asjustment under SECTION II, 1-6.

- 6-4. Press RESET and LOAD.

While depressing 4V key, press PLAY.

DVM must read  $6.000V \pm 3mV$ . If not, proceed to

SECTION II, 1-7.

## SECTION II

## 1. ADJUSTING DA CONVERTER

Some procedures are the same as described under Section I.

In the following steps, adjustment should be made with specified key being depressed.

1-1. Connection and Settings: Follow the instruction "6" in Section I.

1-2. Press RESET and LOAD.

1-3. While depressing 2V key, adjust VR106 (CV Adj.) for 2.000V reading. then, press PLAY.

A. If the reading stays unchanged, proceed to step 1-6.

B. If it changes, proceed to step 1-4. (note the reading)

1-4. Press RESET, LOAD and 2V key.

While depressing the 2V key, adjust VR106 for a following "2"V according to the deviation noted at step 1-3,B.

As discussed earlier (RELATIONSHIP, CV ADJ and DATA), DVM reading will repeat the cycle of  $2V \pm 41mV$  as VR106 being turned.

Ordinal number in the right column of the table below shows number of repetition.

DVM reading at step 1-3,B (approx)	Turn VR106 in this direction	Stop turning when DVM reads 2.000V of
2.083V	clockwise	1st
2.167V	clockwise	2nd
2.250V	clockwise	3rd
1.917V	counterclockwise	1st
1.833V	counterclockwise	2nd
1.750V	counterclockwise	3rd

1-5. Press RESET, LOAD, 2V key and PLAY. ( 2V key held down)

DVM must keep the same reading.

1-6. Press RESET and LOAD.

	key to be pressed	adjust	for reading	
1-61	3V	VR105(WIDTH)	3.000V	repeat until DVM reads
1-62	2V	VR106(CV Adj)	2.000V	3.000V and 2.000V
1-63	4V	VR104(DA Adj)	4.000V	repeat until respective
1-64	2V	VR106	2.000V	voltages are displayed
1-65	3V	VR105	3.000V	on DVM

- 1-7. Press RESET, LOAD, 4V key (holding down) and PLAY.  
DVM should read  $6.000V \pm 2mV$ .
- 1-8. If DVM proves that deviation is outside this range, it may be cured by turning VR105, but this adjustment will affect steps 1-64,1-65.  
Turn VR105 within the limit of  $2.000V \pm 2mV$  and  $3.000V \pm 2mV$ .

## 2. CHECKING CV OUT

With DVM connected to CV OUT and LOAD pressed.

Check the DVM readings for 1V/oct through entire keyboard.

Note: When difficulties arise in relation to WIDTH and CV adjustment, VR104, VR105 and/or VR106 might have been set too far from their proper position.  
Reset them to the approximate positions illustrated in figure right.  
Adjust again from appropriate step.

View from  
panel side

VR106  
CV ADJ



VR105  
WIDTH



VR104  
DA ADJ



072H049	Panel H49	PCBs
066H021	Side block H21 set of L and R	149H031D OPH31D (052H171D-1)
061H080	Chassis H80	149H070D OPH70D (052H171D-2)
068-020	Bushing no.20 panel	146H039A PSH39A (052H172A) 100V
111-021	Rubber Foot G-5 rear	146H040A PSH40A (052H172A) 117V
111-023	Rubber Foot G-7 front	146H041A PSH41A (052H172A) 220/240V
016-008	Button no.8 gray power switch	048H017 Heat sink H17 PSH-
016-057	Knob no.57 TEMPO	042-039 Check point 59BS8806

016-033	Knob no.33 PORTAMENTO
063-012	Strip no.12 knob no.33

## POTENTIOMETERS

## POWER TRANSFORMERS

022H024C	100V/117V
022H024D	220V/240V
022-136	Coil 24M-067-033 47 $\mu$ H
009-012	Jack SG7622 no.8 mono
068-018	Bushing no.18 red jack
068-005	Bushing no.5 jack
121-005	Washer no.5 jack

029-577	EVALOPC15A26 2MA slide PORTAMENTO
030-951	EVHLWAD25B15 10CKB CALIBRATION
028-766	VM10RK20B16 1MB TEMPO
030-465	SR19R 10KB trimmer
030-471	SR19R 100KB trimmer
030-644	RJ-6P 500B trimmer
030-645	RJ-6P 1KB trimmer
030-646	RJ-6P 50KB trimmer

## RESISTORS

## FUSES

008-040	MGP 0.500 CSA prim 117V
008-061	SEMKO T315mA prim. 220/240V
008-056	SEMKO T100mA sec.
008-066	SEMKO T1A sec.
012-003	Fuse clip TF758

044-927	CRA $\frac{1}{4}$ BY 11K 0.1% 50PPM
044-932	CRA $\frac{1}{4}$ BY 31K 0.1% 50PPM
044-929	CRA $\frac{1}{4}$ BY 125K 0.1% 50PPM
044-930	CRA $\frac{1}{4}$ BY 250K 0.1% 50PPM
044-972	CRA $\frac{1}{4}$ DY 500K 0.5% 50PPM
044-973	CRA $\frac{1}{4}$ DY 1M 0.5% 50PPM
044-838	CRB $\frac{1}{4}$ FX 10K 1%
044-846	CRB $\frac{1}{4}$ FX 100K 1%
044-860	CRA $\frac{1}{4}$ FX 1M 1%

## SWITCHES

001-215	SDG5P 001-1 power 100V
001-216	SDG5P 001-2 power 117V
001-217	SDG5P 502 power 220/240V
001-068	SLE-622-18PS lever
001-201	SLE-623-18PS lever
001-183	SSB-023-12PN slide
001-276	SCK41167 key
001-275	SCK41168 key

## CAPACITOR

037-035	Disk seramic 0.1 mfd +80 % 12V -20
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## SEMICONDUCTORS

## LSIs

179-028  $\mu$ PD8048C-028  
8-bit microcomputer  
or  $\mu$ PD8048C-077  
can be interchanged

020-202  $\mu$ PD2114LC RAM

## ICs

020-203 SN74LS00N

020-204 SN74LS273N

020-120 SN74LS08N

020-040 TC4011BP

020-075 TC4049BP

020-199  $\mu$ PC311C

020-100 TL082CP

020-200 TL080CP

020-097  $\mu$ PC4558C

020-205  $\mu$ PC14305 +5V regulator

020-206  $\mu$ PC78L15 +15V regulator

## TRANSISTORS

017-016 2SK30A-GR FET

017-106 2SC1815-GR

017-024 2SA733-P

017-034 2SA682-Y

## DIODES

018-014 1S2473

018-097 1SZ59 zener  
temperatue compensated

018-089 1B4B41 rectifier stack

018- 1B4B1 rectifier stack

## LEDs

019-028 TLR-124 red

019-029 TLG-124 green

019-009 LR0601R red

WAFER TERMINALS, TERMINAL,  
WIRING ASSEMBLIES

010-195 Terminal 5046-05A

010-196 Terninal 5046-07A

042-032 Terminal TT 501-D01  
line cable

053H046 Wiring Assy A

053H047 Wiring Assy B

053H048 Wiring Assy C

## MISCELLANEOUS

065H050 Dust cover H50

120-001 Long nut no.1 3x10mm

120-003 Long nut no.3 3x18mm  
(stand-off or spacer)

012-043 IC Socket  
ICC030-040-350T  
( $\mu$ PD8048)

064H076 Holder H76

064H055A Holder H55A

064H083 Holder H83

Commonly available parts:

Resistors of 1/4W, 5%,  
Mylars,  
Electrolytics  
are omitted.