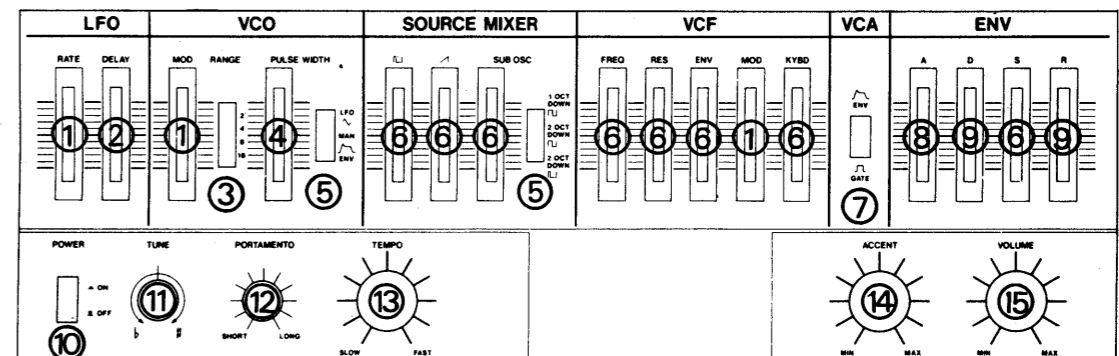
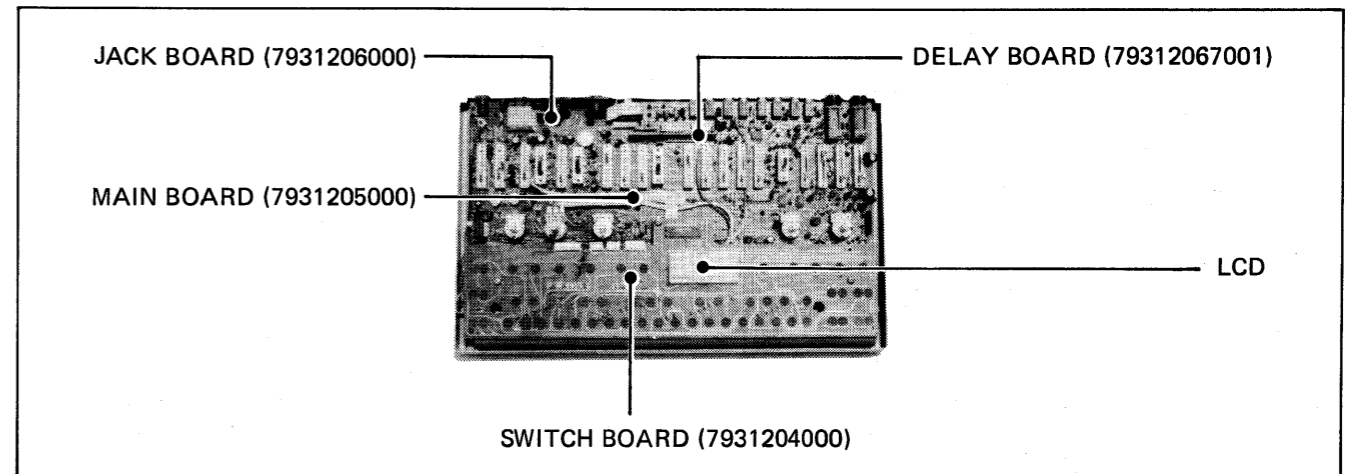
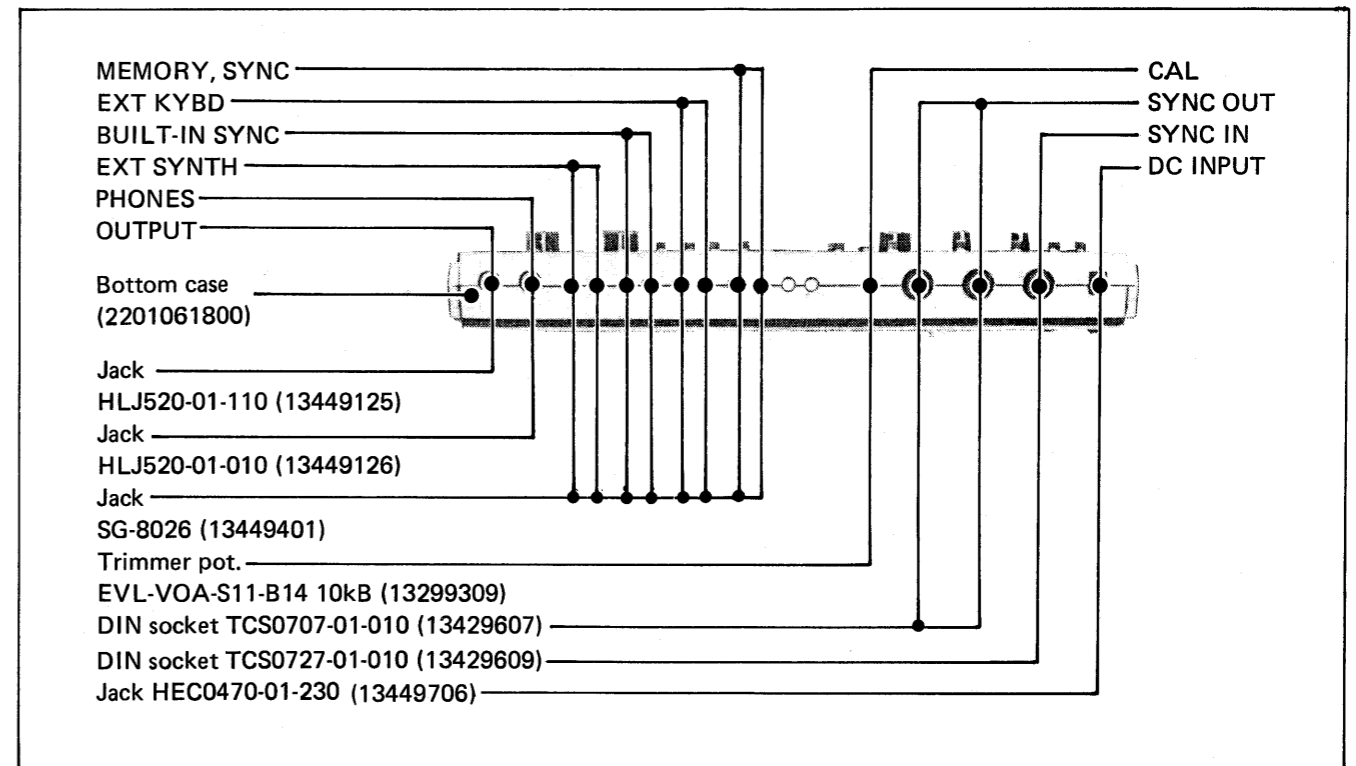
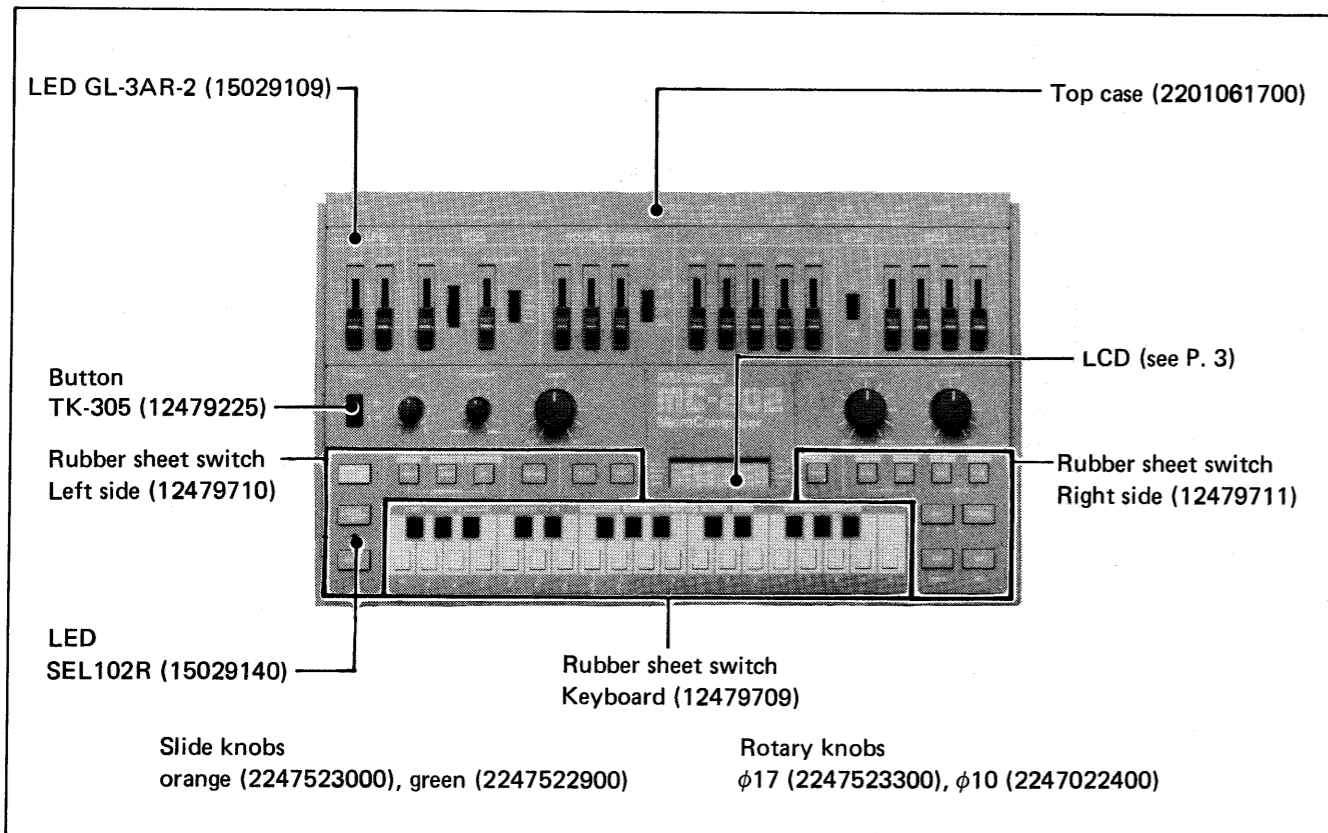


MC-202 SERVICE NOTES *First Edition*

SPECIFICATIONS

- Memory Capacity: Approx. 2600 steps
- Output: External CV Output 416.5mV to 5V, 44 steps (Built-in Keyboard) 0V to 5V, 49 steps (83.3mV/step) (External Keyboard)
External Gate Output ON: +12V OFF: 0V
- Input (Keyboard Input): CV IN 0V to 5V
GATE IN Over +3V
Calibration Trimmer ± 50mV max.
- Tempo Range: $\text{♩} = 40$ to 300
- Keyboard: 32 Key, F scale
- VCO: Range 16', 8', 4'
Pulse Width Modulation 0 to 50%
Tune ± 100 cents
- VCF: Cutoff Frequency 10Hz to 20kHz
Keyboard Follows 0 to 100%
- ENV: Attack Time 2ms to 1.5s
Decay Time 2ms to 5s
Sustain Level 0 to 100%
Release Time 1ms to 5s
- LFO: Rate 0.1Hz to 30Hz
Delay Time 0 to 1s
- PORTAMENTO: Time 0 to 2s
- Connection Jacks: Output 0dBm (max.)
Headphones Stereo, 8Ω to 150Ω
- Power Source: 9V, battery or AC adaptor
- Power Consumption: 800mW
- Dimensions: 343(W) x 55(H) x 204(D) mm
13-1/2(W) x 2-3/16(H) x 8(D) in
- Weight: 1.35kg (3 lb.) (including batteries)

TOP VIEW



1 Pot.	S2018P405-100kA	(13339328)	9 Pot.	S2018P405-1MA	(13339332)
2 Pot.	S2018P405-500kΩ	(13339333)	10 Switch	SUT-111	(13129324)
3 Switch	SQPR24-12P	(13159503)	11 Pot.	EVH5XAP20-10kΩ	(13219277)
4 Pot.	S2018P405-10kΩ	(13339330)	12 Pot.	EWK77AP20-1MA	(13219779)
5 Switch	SSB-02335	(13159304)	13 Pot.	EVH5XAP20-1MC	(13219279)
6 Pot.	S2018P405-100kΩ	(13339329)	14 Pot.	EVH5XAP20-100kΩ	(13219280)
7 Switch	SSB-02242	(13159103)	15 Pot.	EVH5XAP20-100kA	(13219278)
8 Pot.	S2018P405-250kA	(13339331)			

PARTS LIST**CASE**

2201061700 Top Case
 2201061800 Bottom Case
 2202064000 Battery Cover
 2202064100 Battery Holder

PCB

7931205000 Main Board (pcb 2291055500)
 7931204000 Switch Board (pcb 2291055600)
 7931206000 Jack Board (pcb 2291056600)
 7931207000 Delay Board (pcb 2291058600)
 SN up to 303900
 7931207001 Delay Board (pcb 2291077200)
 SN 304000 and up

RUBBER SHEET SWITCH

12479709 Keyboard
 12479710 Left Side START, STOP/CONT, SHIFT etc.
 12479711 Right Side TAP, BAR, ENTER etc.

SWITCH

13129324 SUT-111 (push) POWER SW
 13159304 SSB-02335 (slide) VCO(PWM)
 13159103 SSB-02242 (slide) VCA(ENV/GATE)
 13159503 SQPR24-12P (slide) VCO(RANGE)

KNOB

2247523000 Slide Pot(orange) ALL EXCEPT SOURCE MIXER
 2247522900 Slide Pot(green) SOURCE MIXER
 2247523300 Rotary Pot(orange) TEMPO, ACCENT, VOLUME
 2247022400 Rotary Pot(orange) TUNE, PORTAMENTO

BUTTON

12479225 TK-305(black) power switch

JACK

13449125 HLJ520-01-110 mono, ϕ 6.5 OUTPUT
 13449126 HLJ520-01-010 stereo, ϕ 6.5 PHONES
 13449401 SG-8026 3.6 ϕ CV, GATE IN/OUT etc.
 13449706 HEC0470-01-230 DC input DC IN
 13429607 TCS0707-01-010 DIN OUT
 13429609 TCS0727-01-010 with Switch DIN IN

IC

15179139 μ PD78C06G-024-11 CMOS CPU
 15159101H0 HD14001BP Quad 2-input NOR gate
 15159104H0 HD14011BP Quad 2-input NAND gate
 15159105H0 HD14013BP Dual D flip-flop
 15159128H0 HD14050BP Hex Buffer
 15159114H0 HD14052BP Dual 4ch Multiplexer
 15159115H0 HD14066BP Quad Analog Switch
 15159306H0 HD14503BP Hex 3-state Buffer
 15159301H0 HD14520BP Dual Binary Up Counter
 15159303H0 HD14584BP Hex Schmitt Trigger
 15159110T0 TC4030BP Quad 2-input Exclusive NOR

15159312H0 HD14519BP Quadruple 2ch Data Selector
 15159137H0 HD14015BP Dual Shift Resistor
 15179313 M5K4164 P-20 64K D-RAM
 15189115 TL022CP Low-power OP-AMP
 15189119 TL062CP Low-power Bi-FET OP-AMP
 15189118J0 NJM082DR OP-AMP
 15189136 M5218L OP-AMP
 15189138 AN6562 OP-AMP
 15229802 BA662A VCA
 15229801 IR-3109 VCF
 15229810 CEM3340 VCO
 15169509 MN1252B LCD Driver

TRANSISTOR

15119105 2SA733(P)
 15119602 2SB647(C)
 15129108 2SC945(P)
 15129602 2SD667(C)
 15129412 2SC1384(Q)
 15139101 2SK30ATM-Y

DIODE

15019557 RD15EB3
 15019303 RD5.6JB2
 15019630 1SZ46A
 15019125 1SS-133
 15019208 1SR35-200
 15029109 GL3AR-2 (LED) LFO
 15029140 SEL102R (LED) START

POTENTIOMETER

(SLIDER)
 13339330 S2018P405-10K(B) VCO(PWM)
 13339328 S2018P405-100K(A) LFO(RATE), VCO(MOD), VCF(MOD)
 13339329 S2018P405-100K(B) SOURCE MIXER, VCF(FREQ, RES, ENV, KYBD), ENV(S)
 13339331 S2018P405-250K(A) ENV(A)
 13339333 S2018P405-500K(B) LFO(DELAY)
 13339332 S2018P405-1M(A) ENV(D, R)
 (ROTARY)
 13219277 EVH5XAP20-10K(B) TUNE
 13219278 EVH5XAP20-100K(A) VOLUME
 13219280 EVH5XAP20-100K(B) ACCENT
 13219279 EVH5XAP20-1M(C) TEMPO
 13219779 EWK77AP20-1M(A) PORTAMENTO

TRIMMER

13299558 RVS0707V101-3-301 thermet(blue) 300
 13299554 RVS0707V101-3-502 5K
 13299562 RVG0707V101-10-503 thermet(black) 50K
 13299141 RVF8P01-204 carbon 200K
 13299142 RVF8P01-504 500K
 13299136 RVF8P01-503 50K
 13299309 EVL-VOA-S11-B14 10K (CAL)

RESISTOR (Metal Film)

13769154T0 1.69K MR25 1% 100ppm
 13769167T0 5.6K MR25 1% 100ppm
 13769256T0 28K MR25 1% 100ppm
 13769187T0 39K MR25 1% 100ppm
 13769197T0 100K MR25 1% 100ppm
 13769204T0 200K MR25 1% 100ppm
 13769207T0 270K MR25 1% 100ppm
 13769215T0 560K MR25 1% 100ppm
 13769257T0 1.5M MR25 1% 100ppm

RESISTOR ARRAY

13919121 RNSA09P473 47K x 8

OTHERS

2345012500 Terminal Board Battery + side
 2345012600 Terminal Spring Battery - side
 15029408 EDD063M04B3 LCD Display Panel
 2219031400 LCD Display Panel Holder
 2343051300 Rubber strip
 2345090500 Rubber strip (conductive)
 12449513 LC-14 DC/DC CONV.
 12389710 FCR-5M Ceramic Resonator
 12389711 PKM24-4A0 Piezo Alarm
 15229908 SDT-1000 Thermister

DISASSEMBLY

1. Remove 7 screws from the bottom and remove the lower case. Most of troubleshooting can be made with the foil sides of the PCBs exposed. The PCB layouts viewed from the foil side are provided on this manual just for this purpose. When need arises to expose the component sides:
2. Remove all knobs on the top panel.
 - small but useful hints -
 - Rotary knob -- by finger, with a rubber sheet wrapped around the knob face.
 - Slide knob -- with pliers. Insert a cloth between the jaws and the knob faces.
3. Remove the top case.
4. Peel the switch sheets off the top case and place them on the switch board.

CAUTION

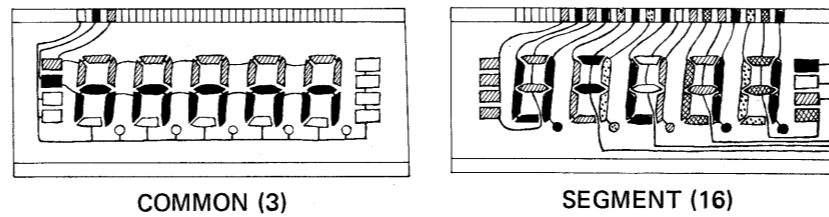
When separating Switch board from Main board, do not remove any screw on Switch board, instead extract PCB spacers from Main board by releasing the locks at the foil side of Main board.

REASSEMBLY

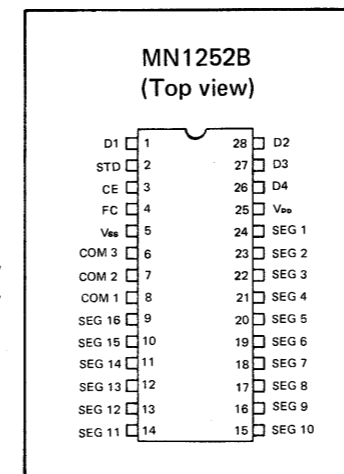
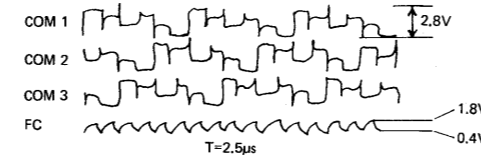
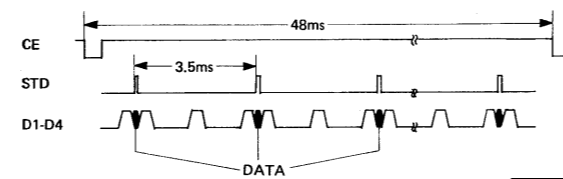
1. Place PCB assemblers into lower case.
2. Clean contact pads on Switch board with an alcohol.
3. Install top case.
 - It is advisable to confirm all switch functions before mounting knobs.

LIQUID CRYSTAL DISPLAY (LCD)

EDD063M04B3 is a field effect type Liquid Crystal Display. Each segment is composed of two electrodes placed on the opposite sides of the liquid crystal fluid. One electrode group is divided into three subgroups (Common) and the other into 16 (Segment) as shown in the figure below. They make up a 3 x 16 matrix.

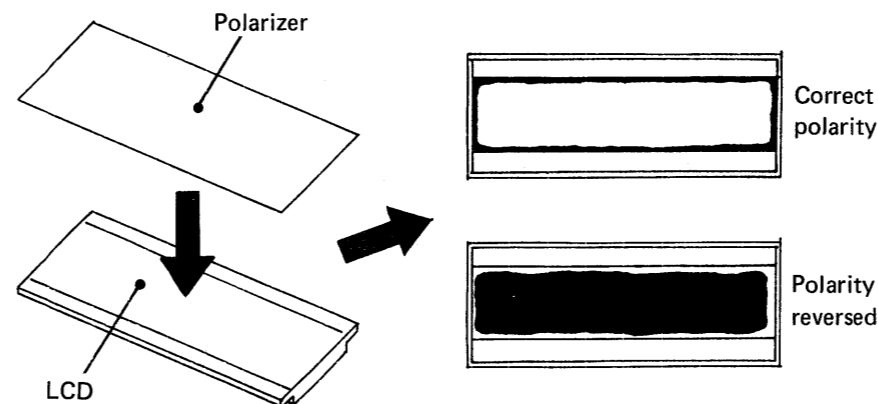


IC29 latches character codes (D1-D4) into buffers on STD pulse and drives LCD in dynamic method at the frame clock rate.



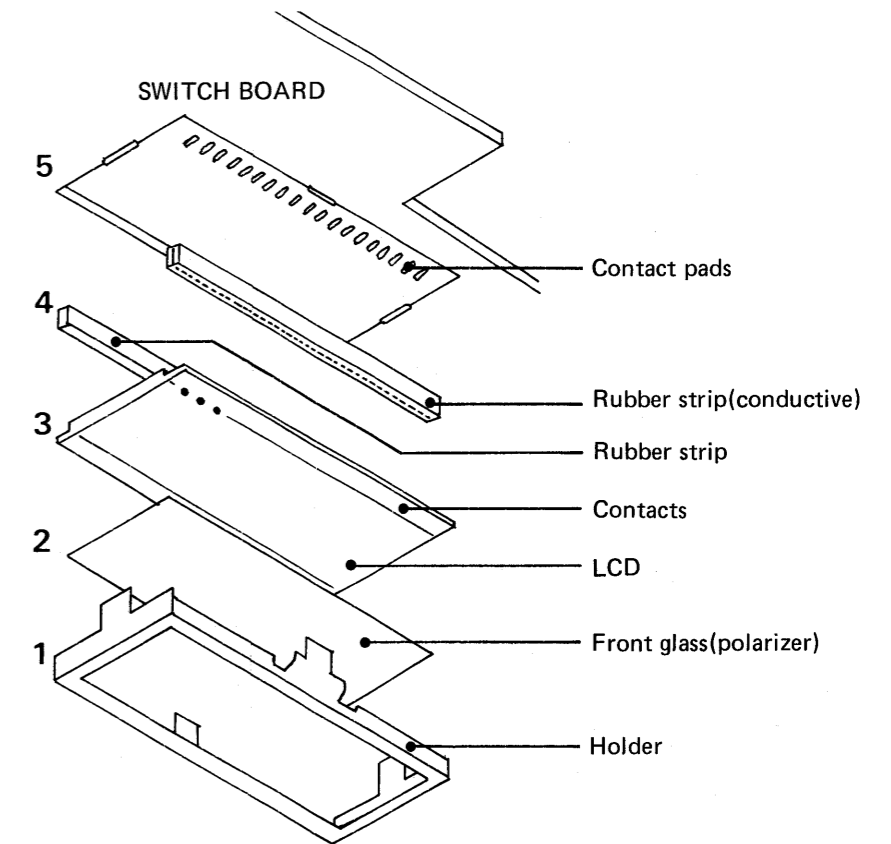
ASSEMBLING LCD UNIT

Assembling is better done by following the order numbered in the figure.



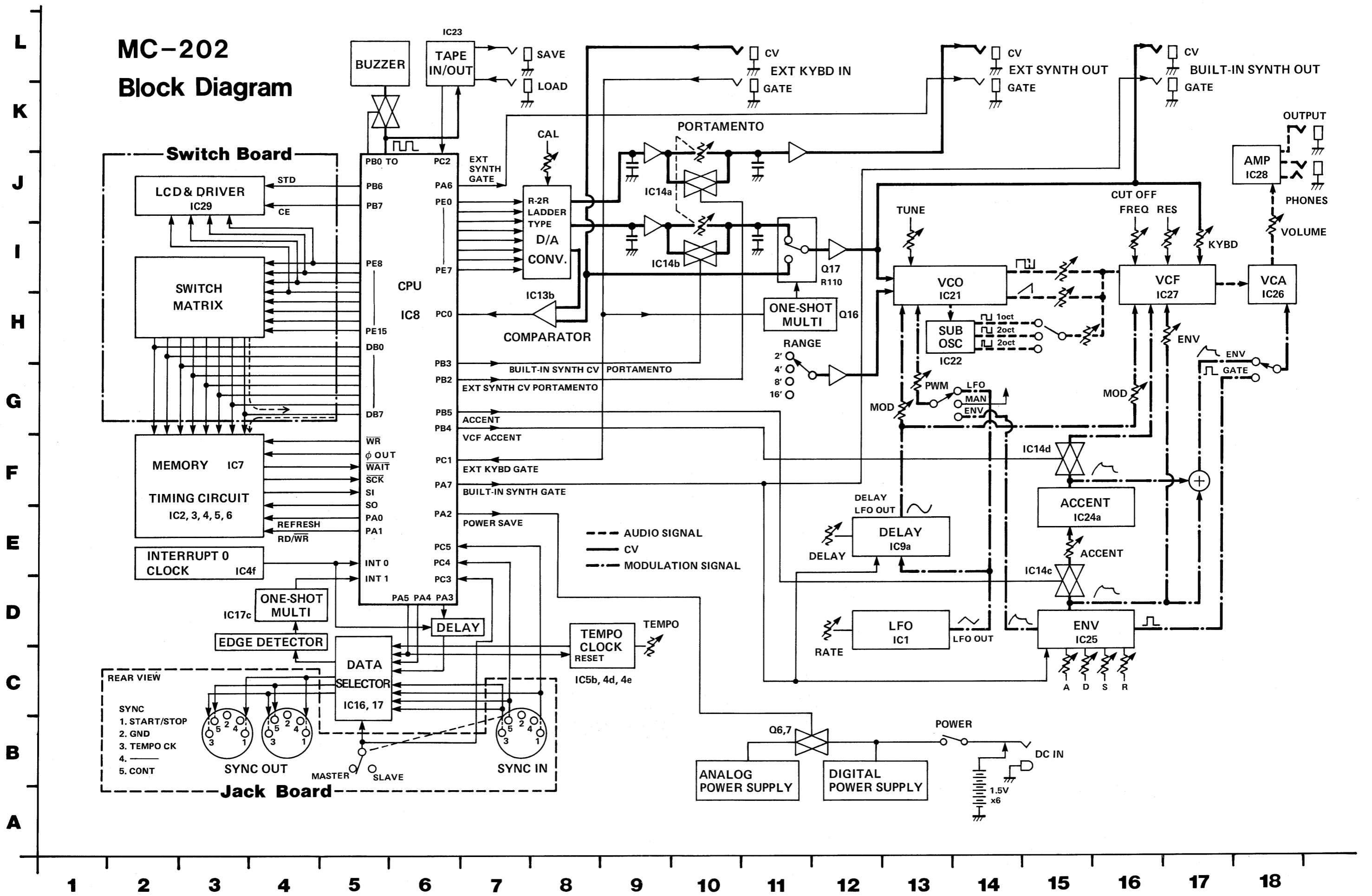
CAUTION:

Place the polarizer on the LCD with the front facing outside. Otherwise the readout is white characters on a dull black background.



BLOCK DIAGRAM

**MC-202
Block Diagram**



CIRCUIT DESCRIPTIONS

The MC-202 hardware is divided into five basic sections as shown in the figure below.

The following description will mainly concentrate on digital aspects of the MC-202 circuitry.

CPU

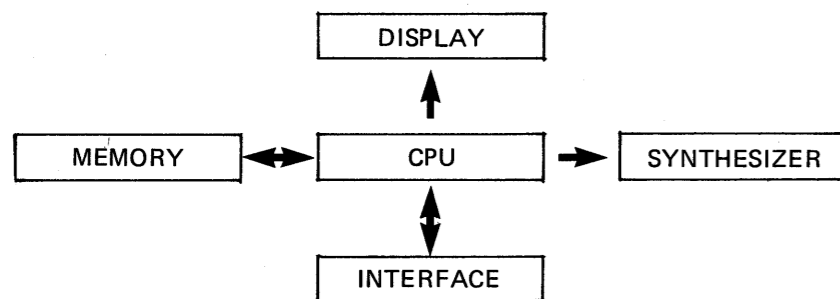
IC8 is an 8-bit microcomputer consisting of 8-bit ALU, ROM, RAM, Timer, Serial Interface and 46 I/O lines, all fabricated on a single chip. Some pin functions are directly denoted on the circuit diagram, respectively.

INT 0 (active high)

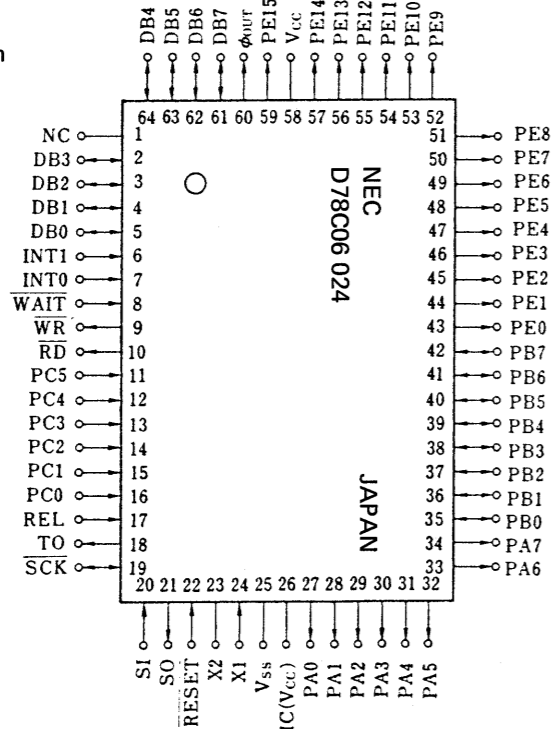
When the CPU senses a high at INT 0 pin, it begins fractions of Panel switch reading, CVs refresh and display data transfer in time sequence. The CPU repeats the cycle for the subsequent fractions at INT 0 rate. This interrupt signal has priority over INT 1.

INT 1 (active rising edge)

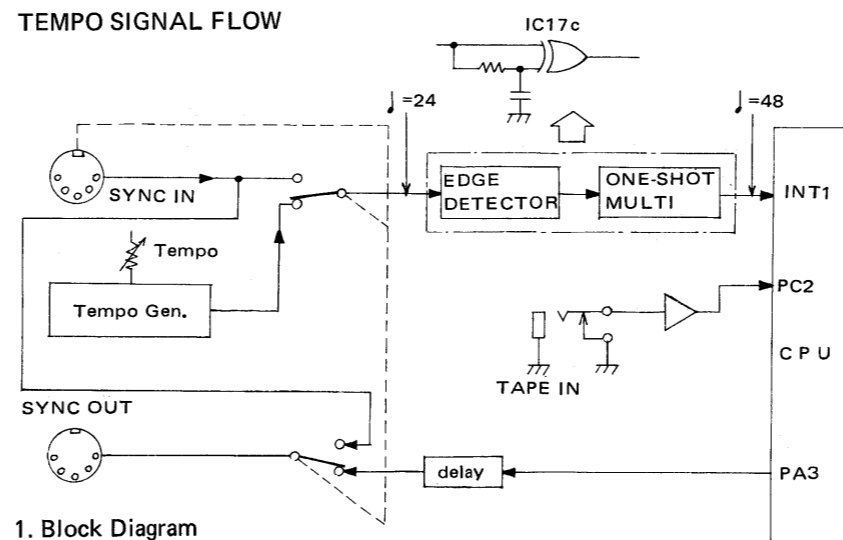
This signal is either Internal Tempo Clock or External one selected by IC16. The selected tempo clock triggers IC17c on every positive and negative edges to have doubled frequency at pin 10 of IC17c -- 48 clocks/quarter. The clocks are the time base for STEP TIME and GATE TIME in the PLAY mode.



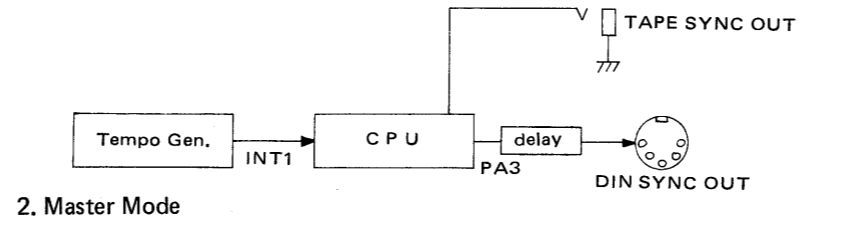
μPD78C06G
Pin configuration
(Top view)



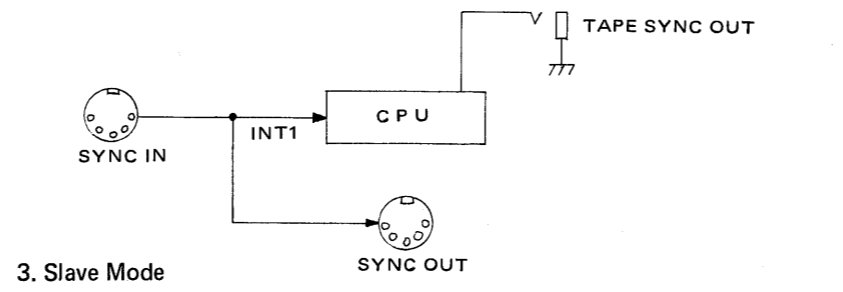
TEMPO SIGNAL FLOW



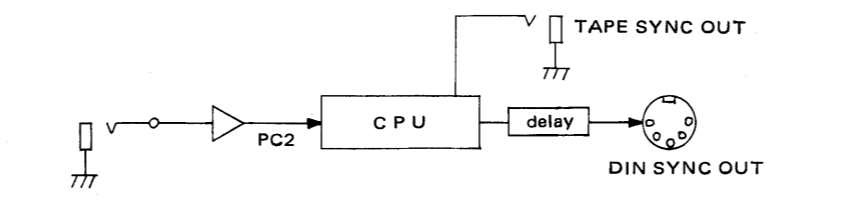
1. Block Diagram



2. Master Mode



3. Slave Mode



4. Tape Sync Mode

DELAYED SYNC OUTPUTS

For positive synchronization with an external equipment being engaged with the MC-202, the internally generated START/STOP, TEMPO and CONT signals are passed onto SYNC OUT DIN sockets through delay circuits. The delay circuits will prevent the following problems from occurring at the external equipment.

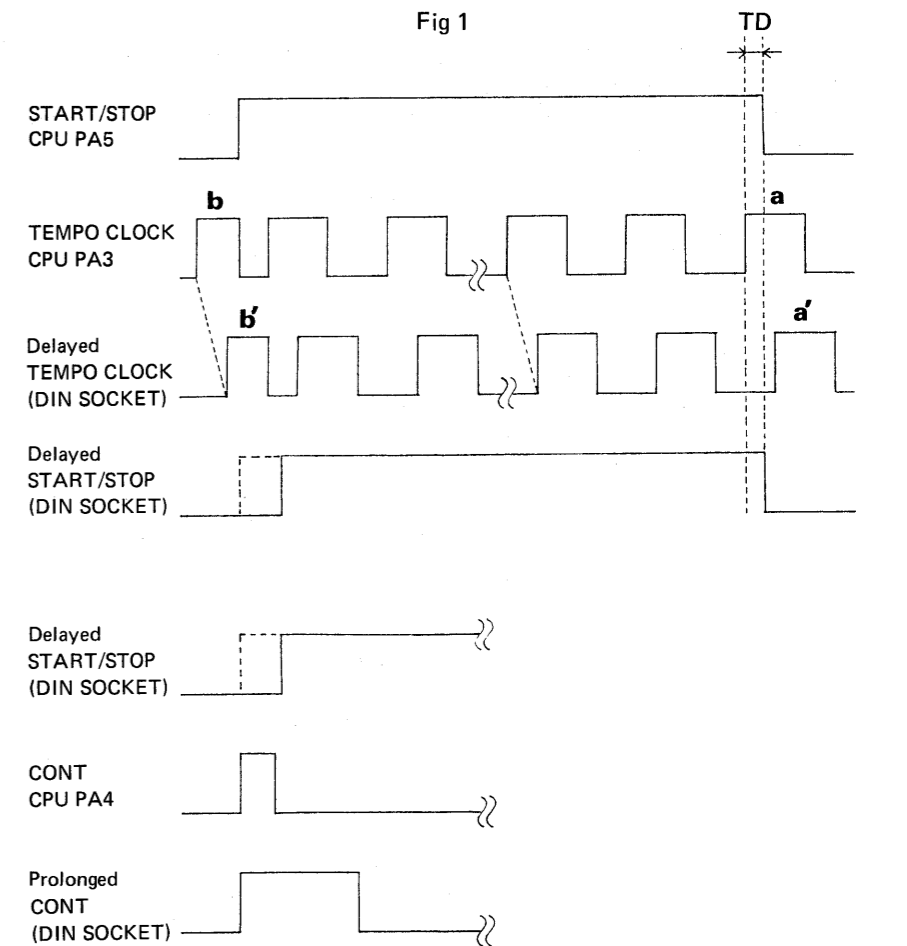
- * An odd sound after the end of the last measure.
- * CONT is ignored.

TEMPO CLOCK

When a measure has been completed, the CPU checks the D-RAM memory to know if there is a data to be taken for further process. It takes a time period of TD for the CPU to make the decision. This TD allows the tempo clock **a** to reach the external device and to trigger its sound source, sounding an odd note.

The delay circuit IC30 inserted in SYNC OUT path eventually delays the entire tempo clocks so that clock **a'** goes high after TD has passed.

NOTE: Due to the characteristics of the Shift Register IC30, the delayed Tempo Clocks slightly jitter, having no ill effect on actual applications.



START/STOP

The delayed tempo clocks will bring an adverse effect upon START ON. It is obvious from Fig. 1 that when the Tempo oscillator is reset by the rising edge of a START, unnecessary clock **b'** can trigger one of external sound sources because they have been enabled by the high START. This **b'** will in turn bring a redundant clock at the end of the last measure, causing the same ill effect as **a** mentioned under TEMPO CLOCK.

Start Delay Circuit consisting of R501, D501 and C59 effectively delays the rising edge of the START signal behind **b'**, but does not affect on the transition of START to STOP.

CONTINUE

In Roland products, pressing CONTINUE button on their own panel generates a CONT signal and a concurrent START signal. In accepting these signals as external control signals, any Roland product first senses START signal, then checks CONT for its presence. To keep pace with the delayed START, the falling edge of the CONT is sustained for a time enough for the external unit to detect it.

MEMORY

IC7 M5K4164 P-20 is a 65,536 words by 1 bit Dynamic N-MOS RAM(D-RAM). In the MC-202 circuitry the D-RAM is configured as an 8,192 words by 8 bits memory and is operated in a page mode.

At the beginning of a memory cycle REF is removed from IC7 to defeat the refreshing cycle. A row address at A0-A7 of IC7 is strobed into chip with RAS when IC3c, d flip-flop is set by delayed CPU WR, selecting one of the 256 rows.

On the next CPU WR, another flip-flop IC2a, b reverses pins 3 and 4.

Output at pin 4 is applied to two places.

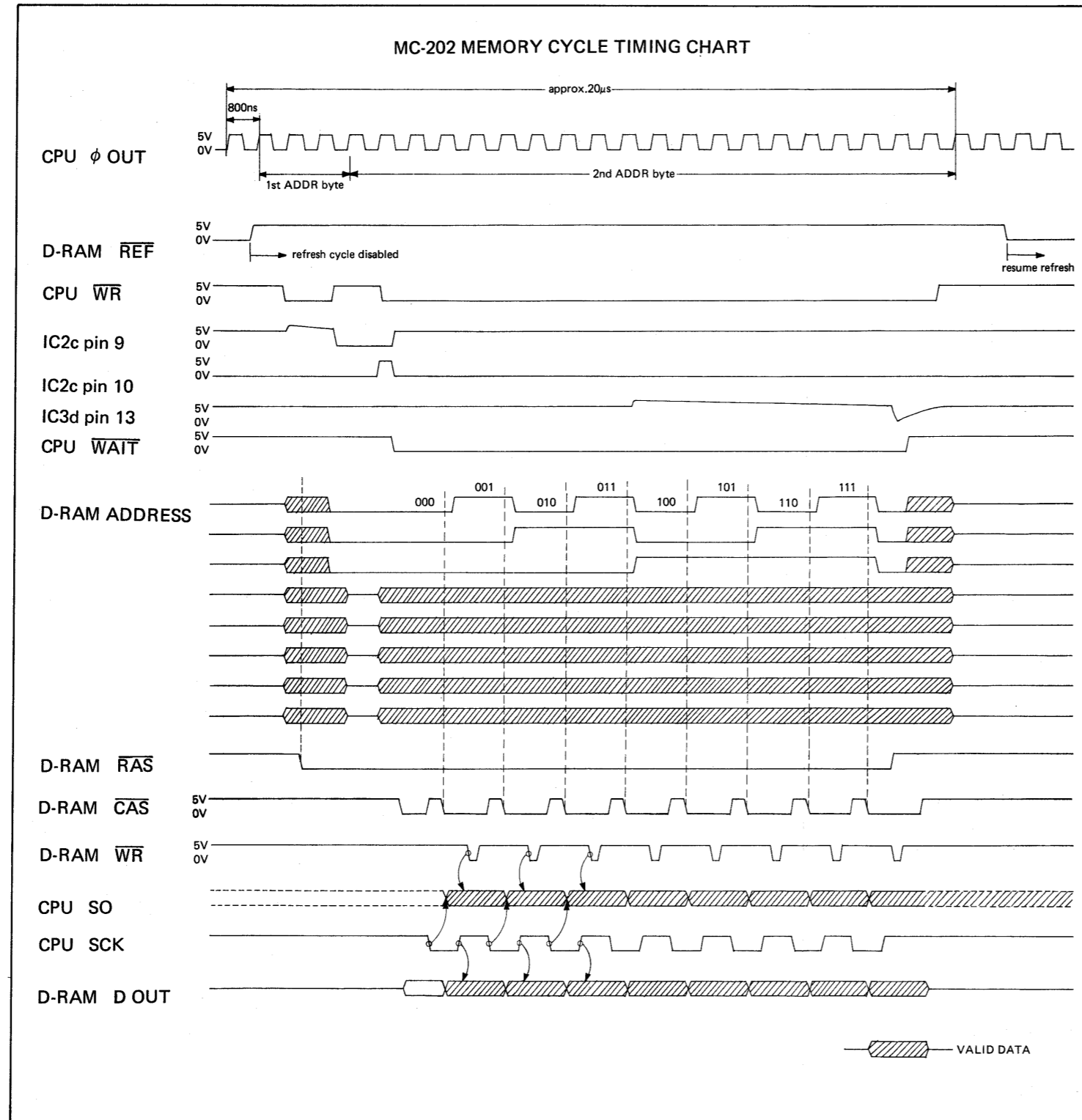
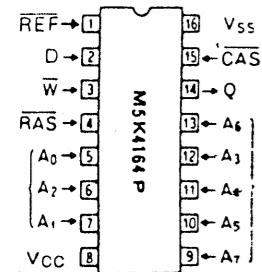
- 1) Pin 8 of the CPU as a WAIT, telling the CPU to hold the processed data waiting until the WAIT goes high.

- 2) Pin 1 of IC5a through R33 as a CK, causing it to count CPU φ OUT and have respective outputs at Q0-Q3. A specific combination of Q1-Q3 defines higher order bits of a column address which has been left undefined by software.

Outputs from pin 3 of IC2a and pin 3(Q0) of IC5a cause IC3b to have CAS which enables IC7 to strobe column address into the chip.

Q0 is also applied to two other places.

- 1) CPU as a SCK through IC4b, ticking serial data chain being transferred between the CPU and D-RAM IC7.
- 2) IC7 as RAM WR through IC2a and 4a when pin 13 of IC2d is low, allowing data to be stored into the chip.



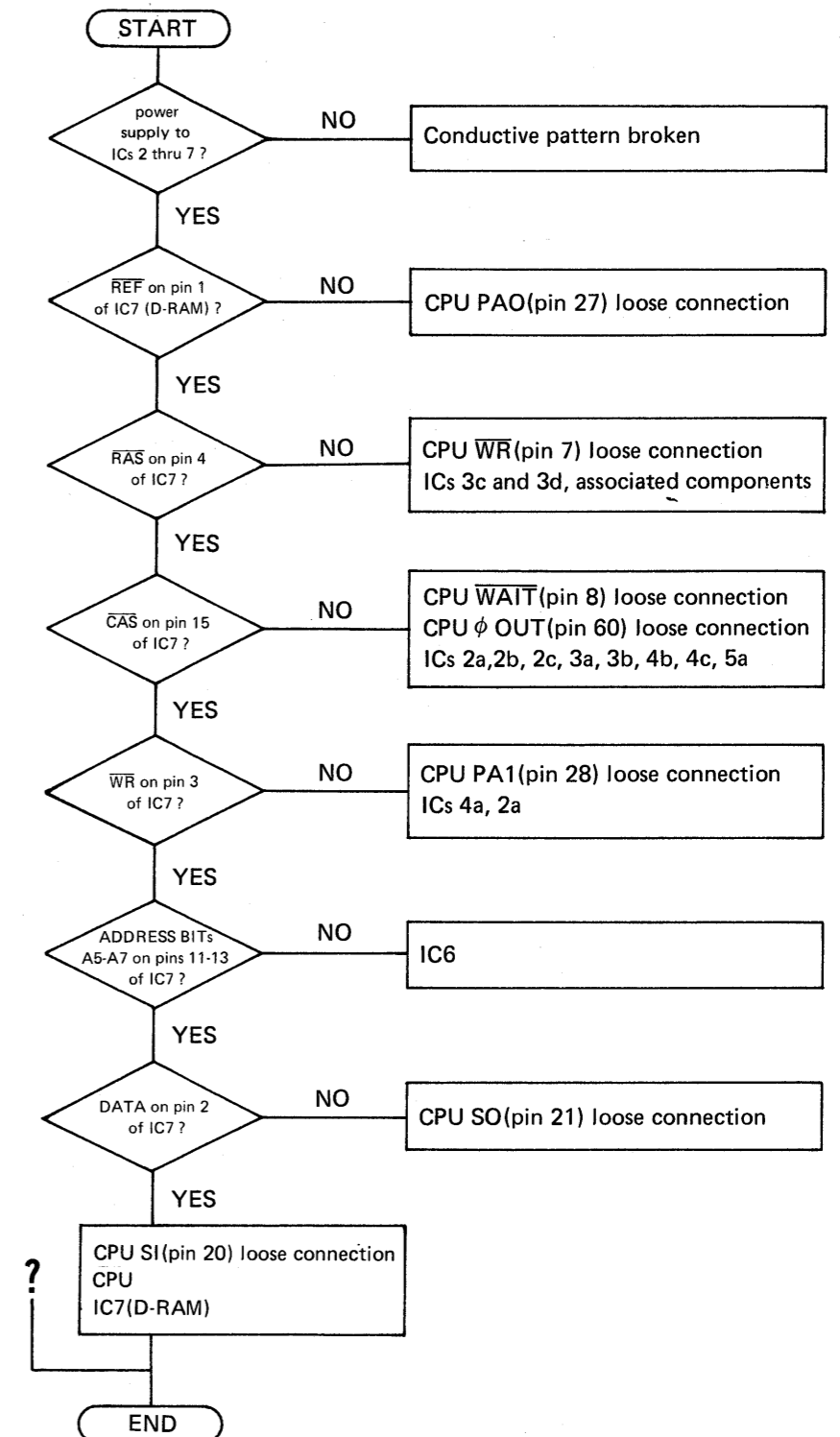
TROUBLESHOOTING MEMORY CIRCUITRY

The following chart will help in fault discovering of memory circuits. The MC-202 MEMORY CYCLE TIMING CHART should also be referred to for visual comprehension.

When the CPU is suspensive, first check CPU pins for loose connection including cold joint, disturbed solder connection and poor adhesion. In doing so, use a small knife as a tool; insert the blade between CPU pin and conductive pattern to disclose unsoldered pin.

FAULT ISOLATION CHART

(Particular setup is unnecessary for checking -- the MC-202 is set in the WRITE mode when the power is applied.)



ADJUSTMENT

1. INTERRUPT CLOCK

- 1-1. Connect oscilloscope to pin 12 of IC4f.
- 1-2. Adjust TM1 (INT) for 2ms/cycle.

2. TEMPO CLOCK

- 2-1. Connect the scope to pin 11 of IC5b.
- 2-2. Set TEMPO control (VR7) to FAST.
- 2-3. Adjust TM2 (TEMPO) for 8.33ms/cycle.

3. D/A REFERENCE VOLTAGE

- 3-1. Connect digital voltmeter to pin 1 of IC11 (or IC12).
- 3-2. Adjust TM3 for +5.333V.

4. VCO

CAUTION

CAL on the Rear Panel

This is an adjustment to minimize pitch difference between EXT KYBD IN and the Internal KCV. If EXT IN jack is engaged without CAL readjusted, pitch drift will be heard in the beginning of every note. When adjusting, keep in mind that the CAL might have been set to tune the MC-202 to the user's EXT system.

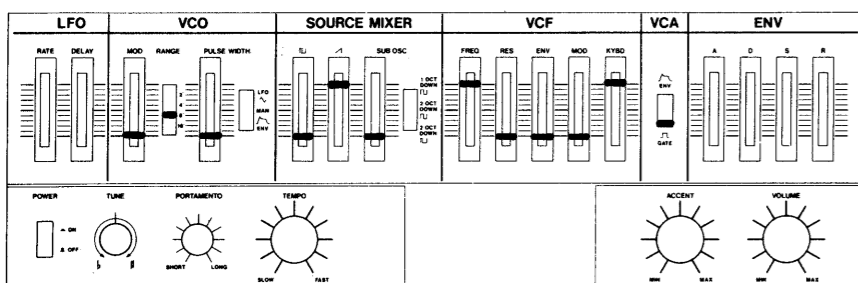
FACTORY-ADJUSTMENT

CAL is set where no pitch difference is detected when 2,000V is applied from C3 key on an external keyboard.

The following calibration procedure is described using Lissajous method.

Connect the V IN of the scope to the MC-202 OUTPUT and H IN (EXT) to a standard tone generator (or tuner) referenced to 442Hz at A4.

Set the MC-202 as indicated.



4-1. VCO Width

- 4-1-1. Set the generator for F note.
- 4-1-2. While holding 4F key, adjust VR3(TUNE) or TM5(TUNE) for still Lissajous.
- 4-1-3. Holding 2F key, adjust TM6 (VCO Width) for still Lissajous.
- 4-1-4. Repeat steps 4-1-2 and 3 until no further improvement can be made.

4-2. VCO Tune

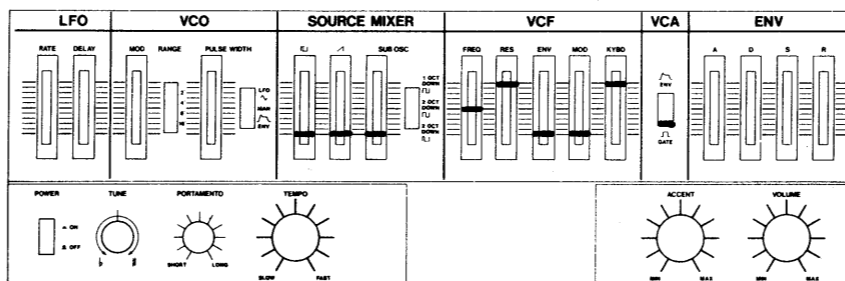
- 4-2-1. Center VR3(TUNE).
- 4-2-2. Set the generator for 442Hz(A4).
- 4-2-3. Holding 3A, adjust TM5(TUNE) for still Lissajous.

4-3. Pulse Width

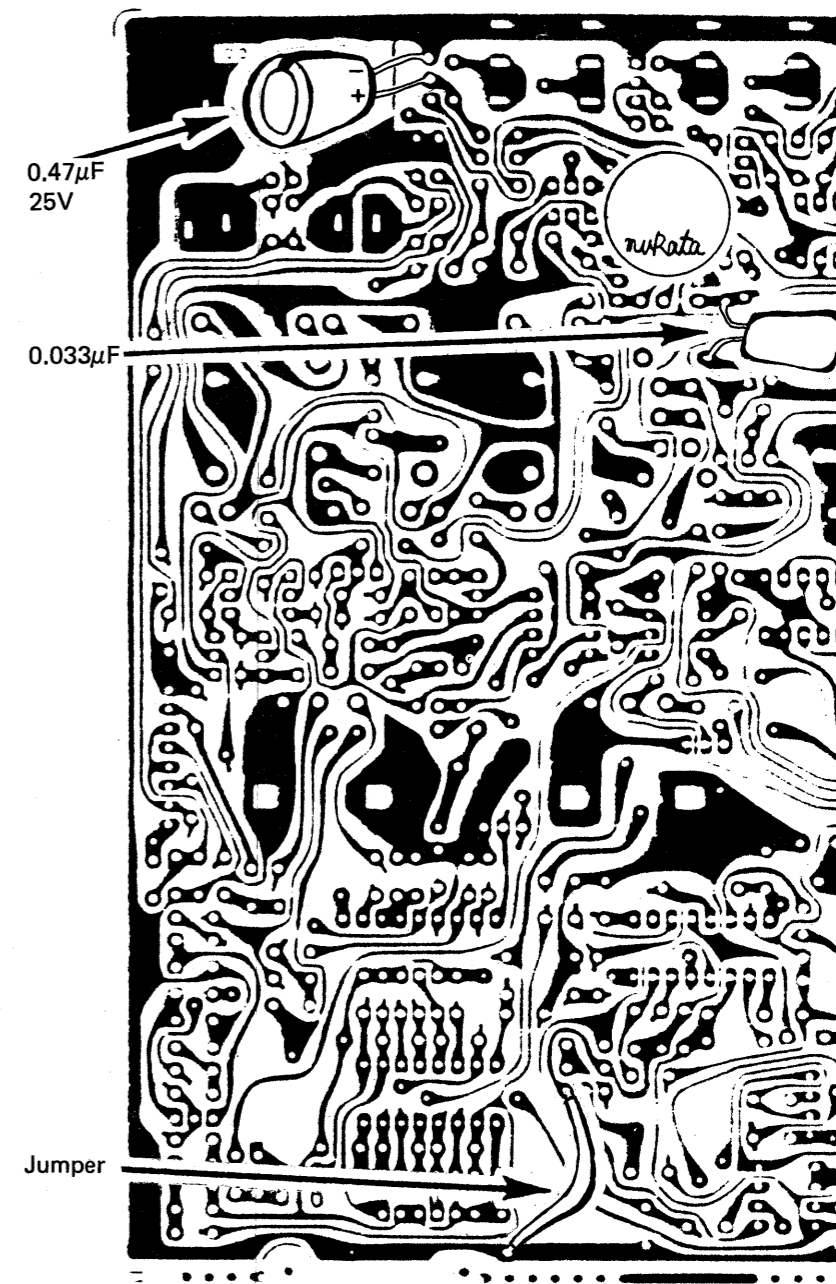
- 4-3-1. Raise VR8(□) to the top.
- 4-3-2. Lower VR9(∠) to the bottom.
- 4-3-3. Adjust TM4(PWM) for equal mark and space period.

5. VCF WIDTH

- 5-1. Set the scope H to INT.
- 5-2. Set the panel controls as indicated.



- 5-3. Holding 3A key, adjust VR11(FREQ) for approximately 1kHz.
- 5-4. Alternately playing 3F and 4F keys, adjust TM7(VCF WIDTH) until 4F waveform doubles 3F waveform in frequency.



CHANGE INFORMATION

The following modifications should be checked on a given unit for implementation and, if not found, be done to eliminate problems described below.

1) ADD

- 0.47µF across Q35(EXT CV OUT) collector and ground.
- 0.033µF across Q29(ENV) base and ground.

Sometimes pop or muddy sound is heard from both built-in and EXT voices when a note is followed by a new note having a great difference in frequency. This is because a new gate occurs slightly behind the CVs transition.

2) CHANGE

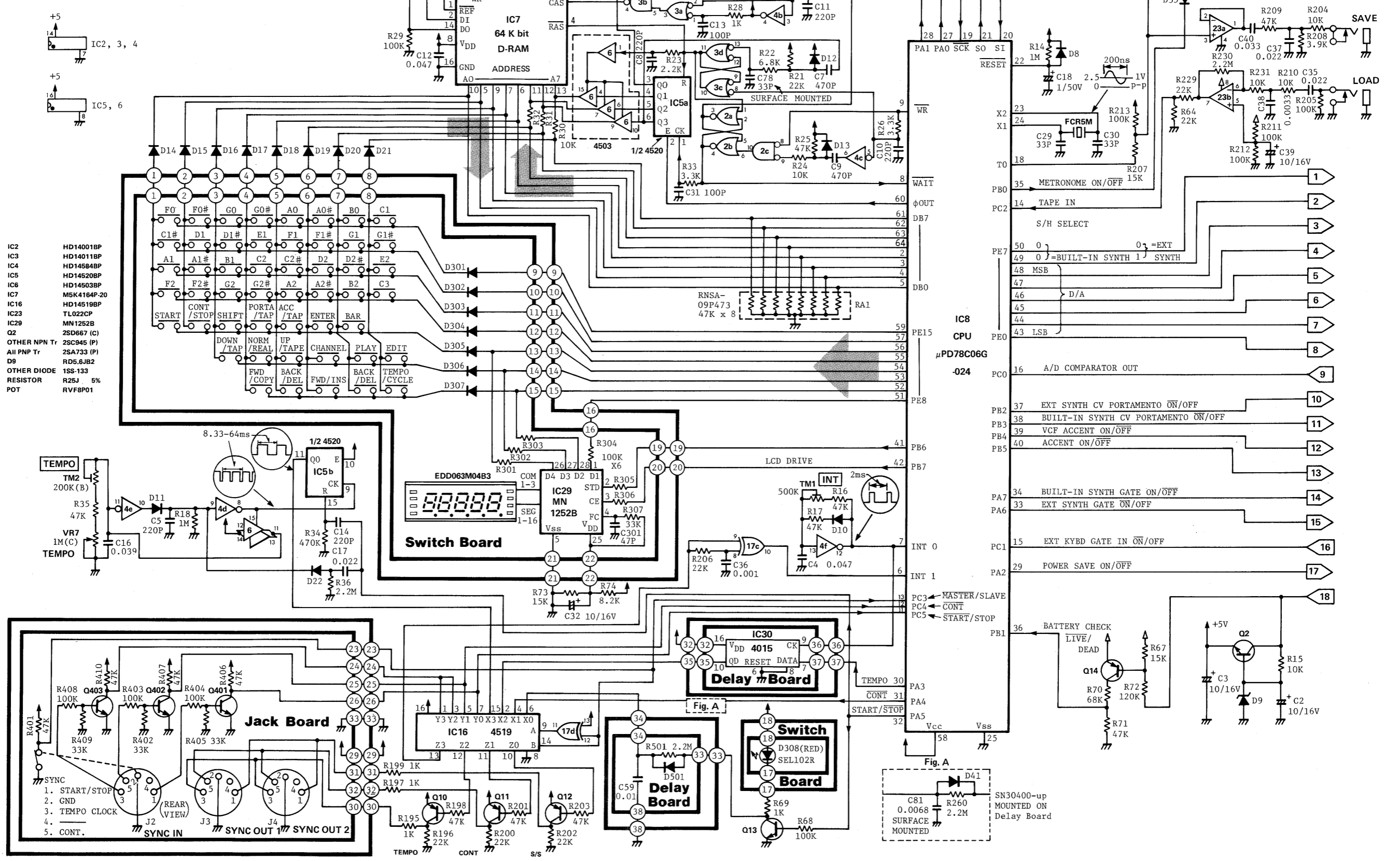
- R56 (IC9, POWER SUPPLY) from 220 Ohms to 100.
- Jumper wire between grounds of VCO and VCA.

A vibrato-like effect is heard when a note around 500Hz is played with headphones jack engaged.

This is because the current returning from headphones develops a ground potential difference between the ground paths.

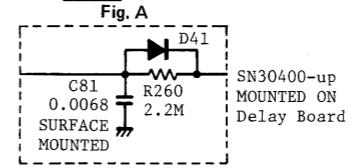
CIRCUIT DIAGRAM (Digital)

MC-202 (Digital)



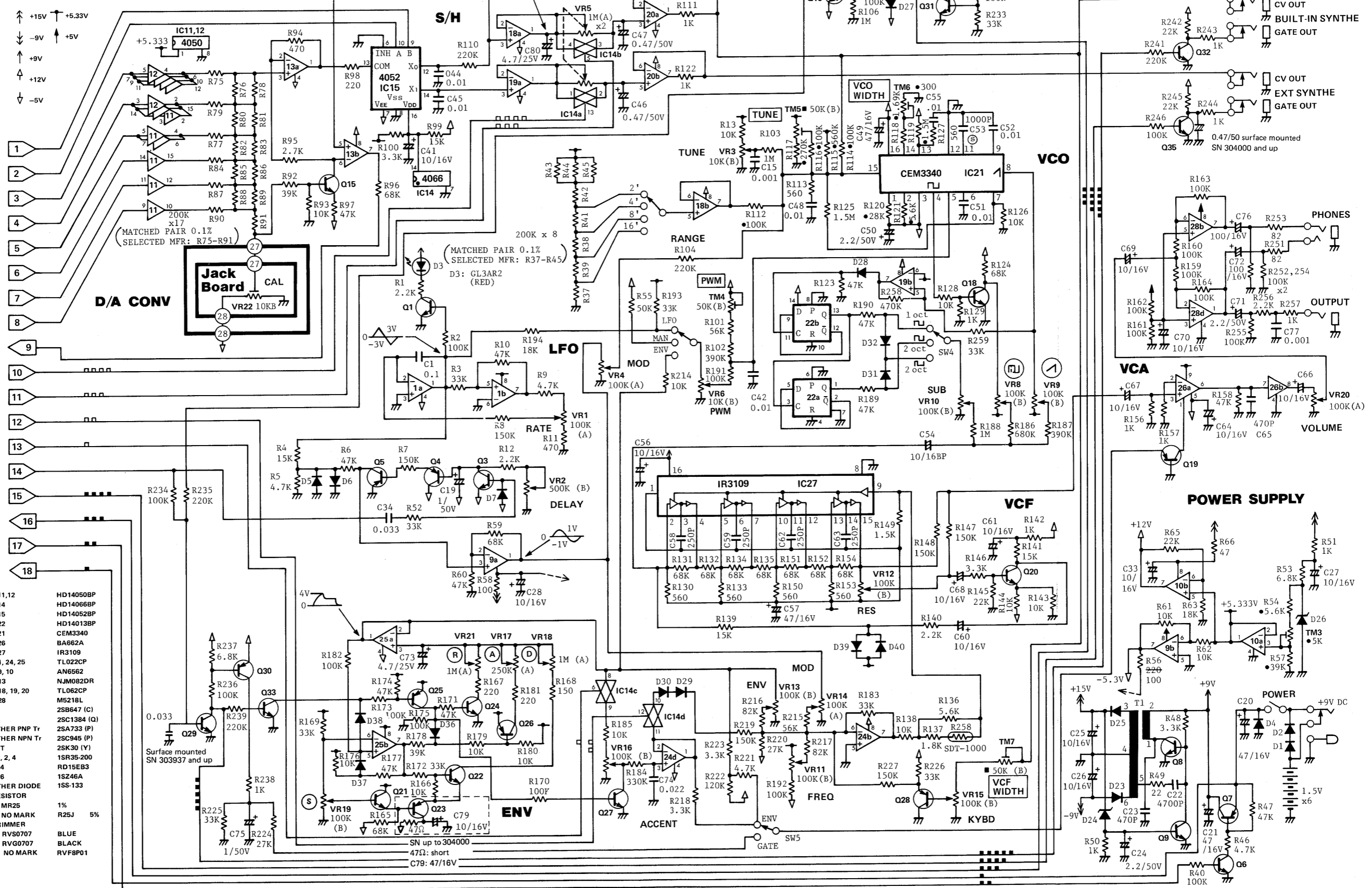
- IC2 HD14001BP
- IC3 HD14011BP
- IC4 HD14584BP
- IC5 HD14520BP
- IC6 HD14503BP
- IC7 MSK4164P-20
- IC16 HD14519BP
- IC23 TL022CP
- IC29 MN1252B
- Q2 2SD667 (C)
- OTHER NPN Tr 2SC945 (P)
- All PNP Tr 2SA733 (P)
- D8 RD5.6JB2
- OTHER DIODE 1SS-133
- RESISTOR R25J 5%
- POT RVF8P01

- 1. START/STOP
- 2. GND
- 3. TEMPO CLOCK
- 4. SYNC
- 5. CONT.



(Analog)

MC-202 (Analog)



- IC11,12 HD14050BP
- IC14 HD14066BP
- IC15 HD14052BP
- IC22 HD14013BP
- IC21 CEM3340
- IC26 BA662A
- IC27 IR3109
- IC1, 24, 25 TL022CP
- IC9, 10 AN562
- IC13 NJM082DR
- IC18, 19, 20 TL062CP
- IC28 M5218L
- Q7 2SB647 (C)
- Q8 2SC1384 (Q)
- OTHER PNP Tr 2SA733 (P)
- OTHER NPN Tr 2SC945 (P)
- FET 2SK30 (Y)
- D1, 2, 4 1R535-200
- D24 RD15EB3
- D26 1S246A
- OTHER DIODE 1SS-133
- RESISTOR
- MR25 1%
- NO MARK
- TRIMMER
- RVS0707 BLUE
- RVG0707 BLACK
- NO MARK RVF8P01

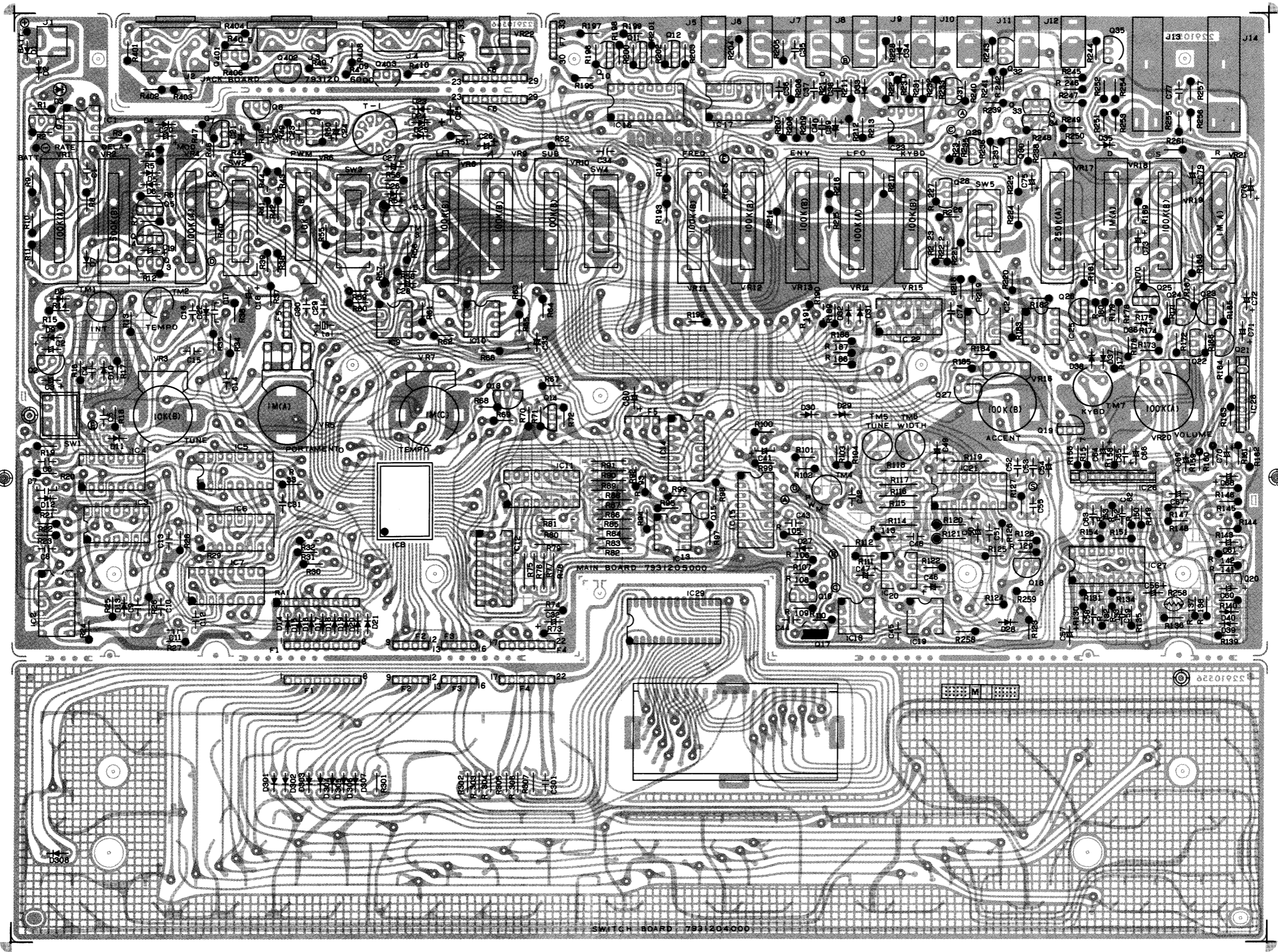
M
L
K
J
I
H
G
F
E
D
C
B
A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

JACK BOARD 7931206000 (pcb 2291056600)

MAIN BOARD 7931205000 (pcb 2291055500)

L
K
J
I
H
G
F
E
D
C
B
A



SWITCH BOARD 7931204000 (pcb 2291055600)

View from component side

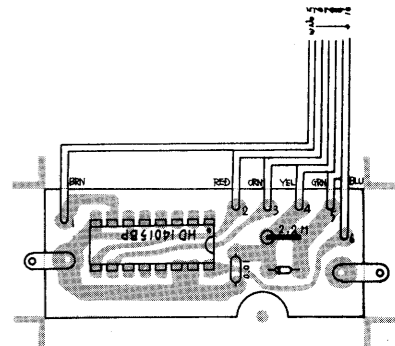
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

DELAY BOARD

SN up to 303900

7931207000

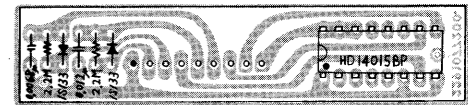
(pcb 2291058600)



SN 304000 and up

7931207001

(pcb 2291077200)



Electrically compatible but different in dimensions.

The means of PCB support should be prepared at the location of the old PCB before replacing it with new one.

View from foil side

