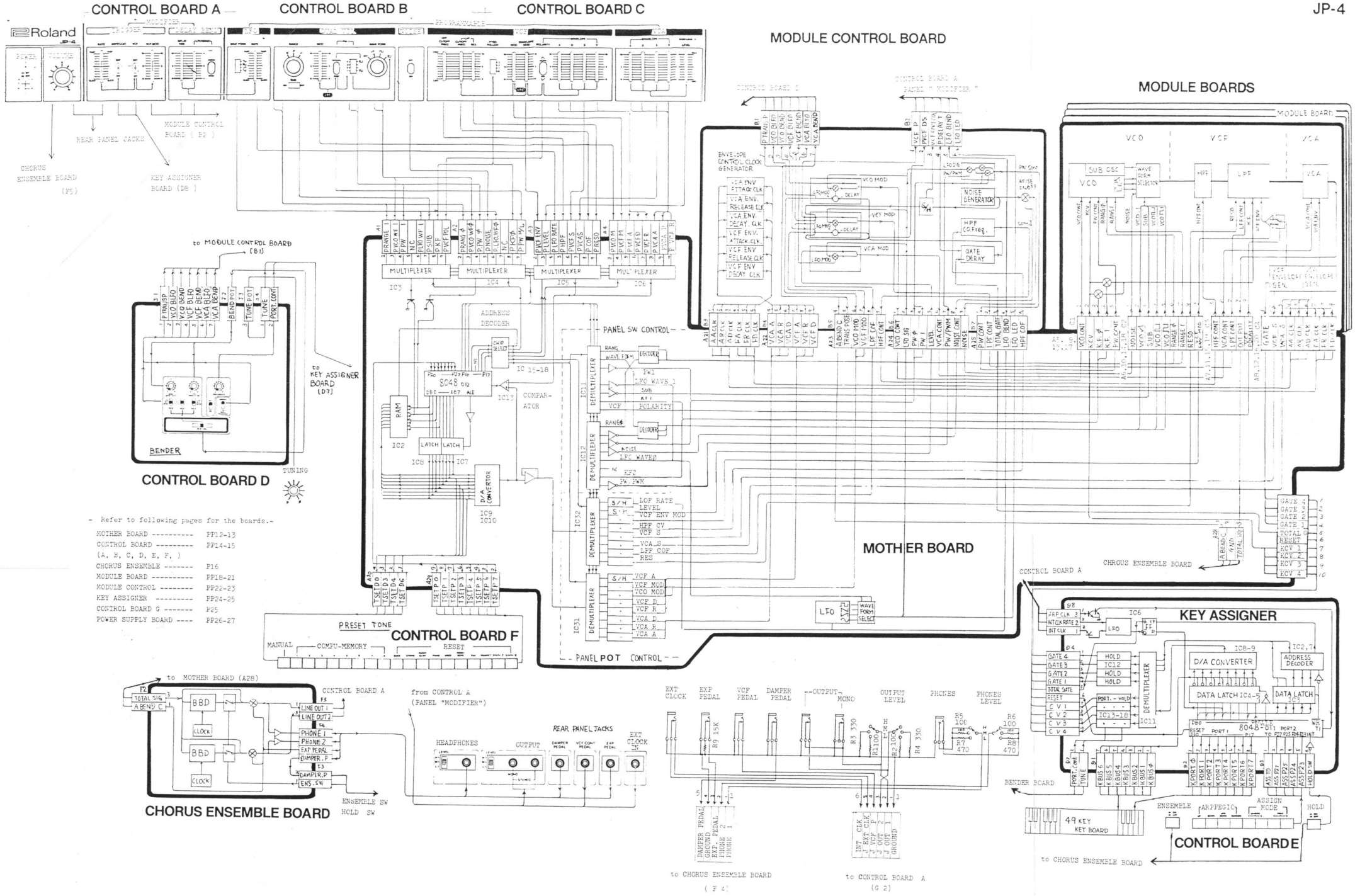
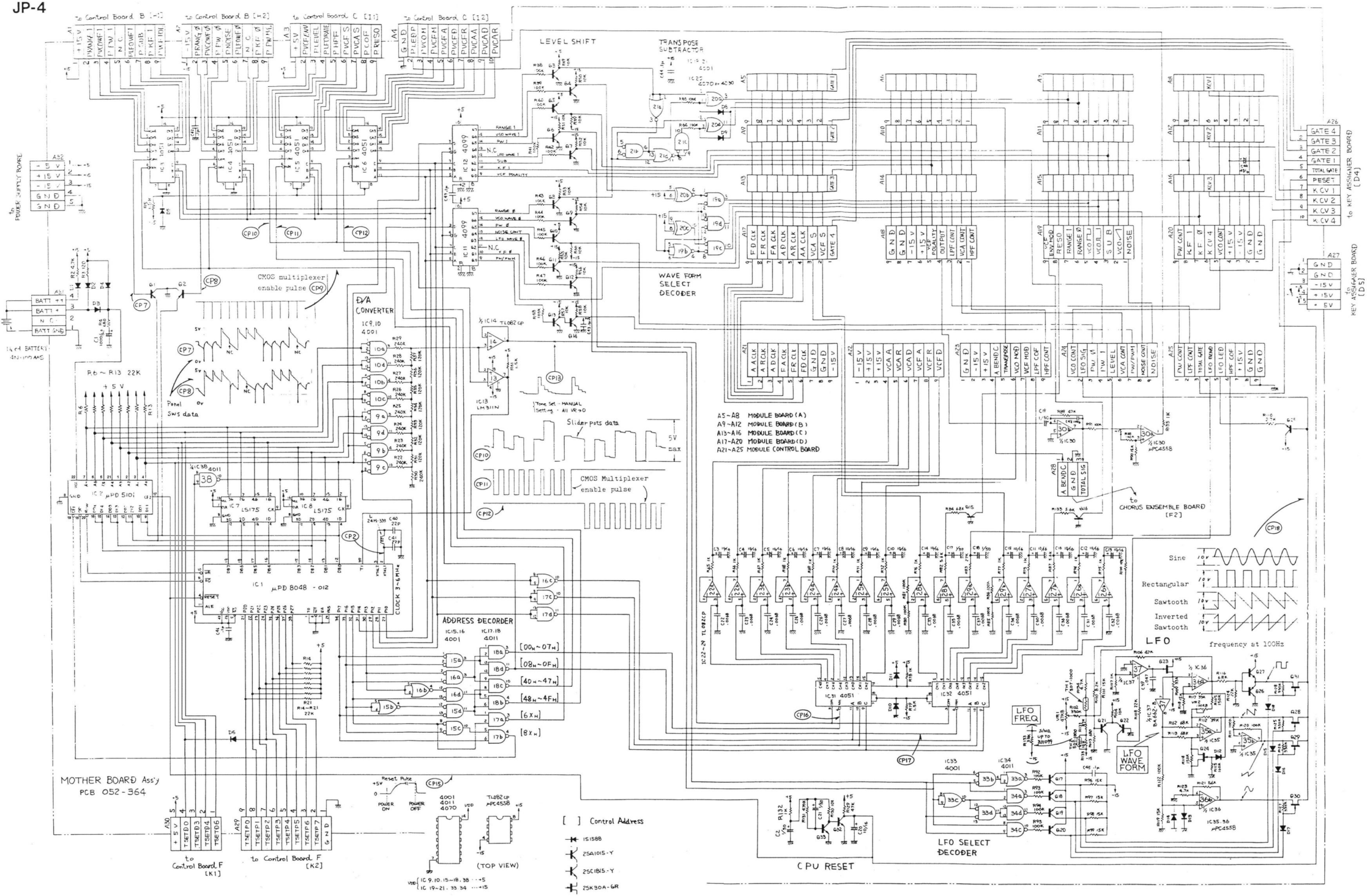
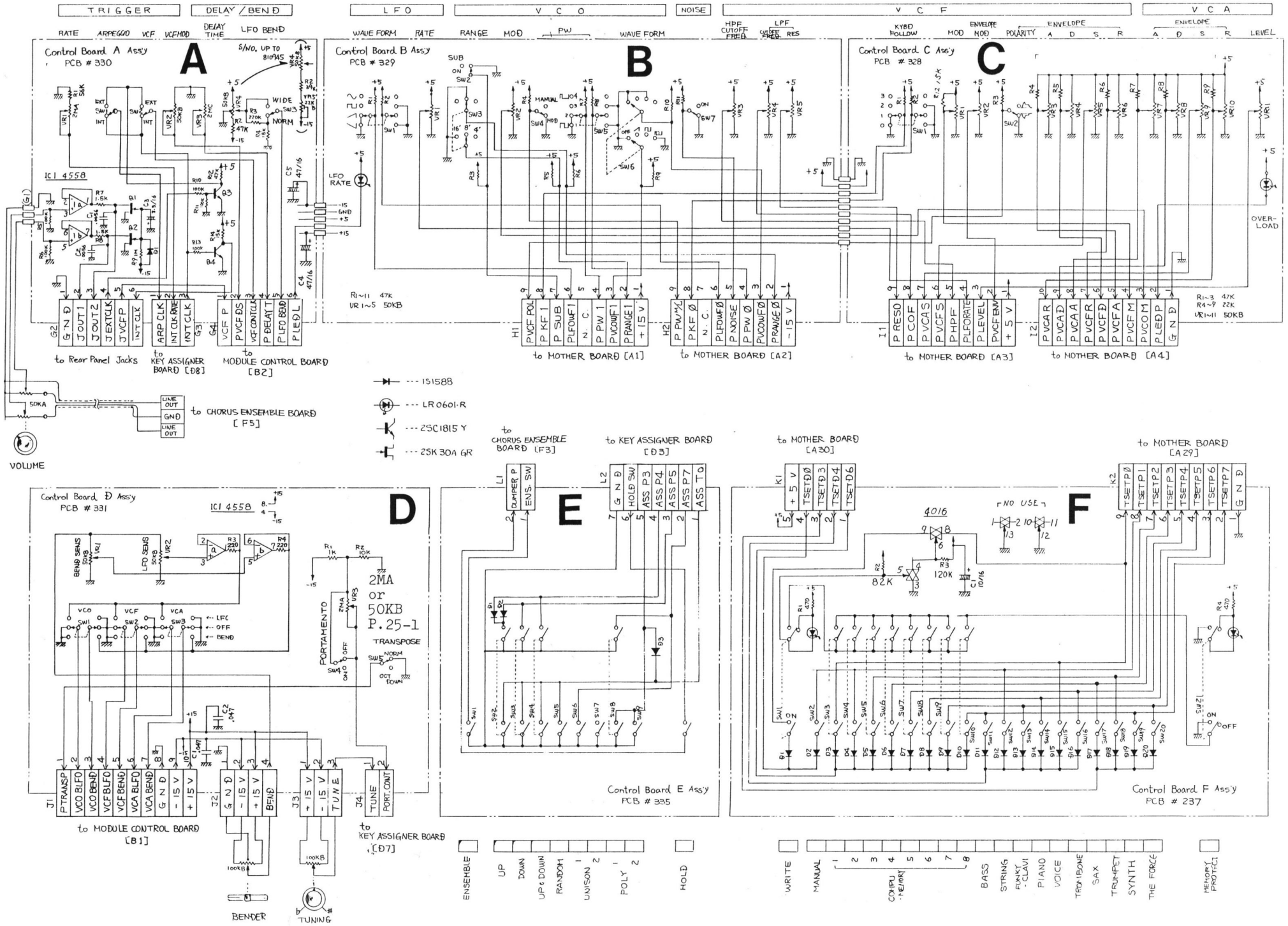
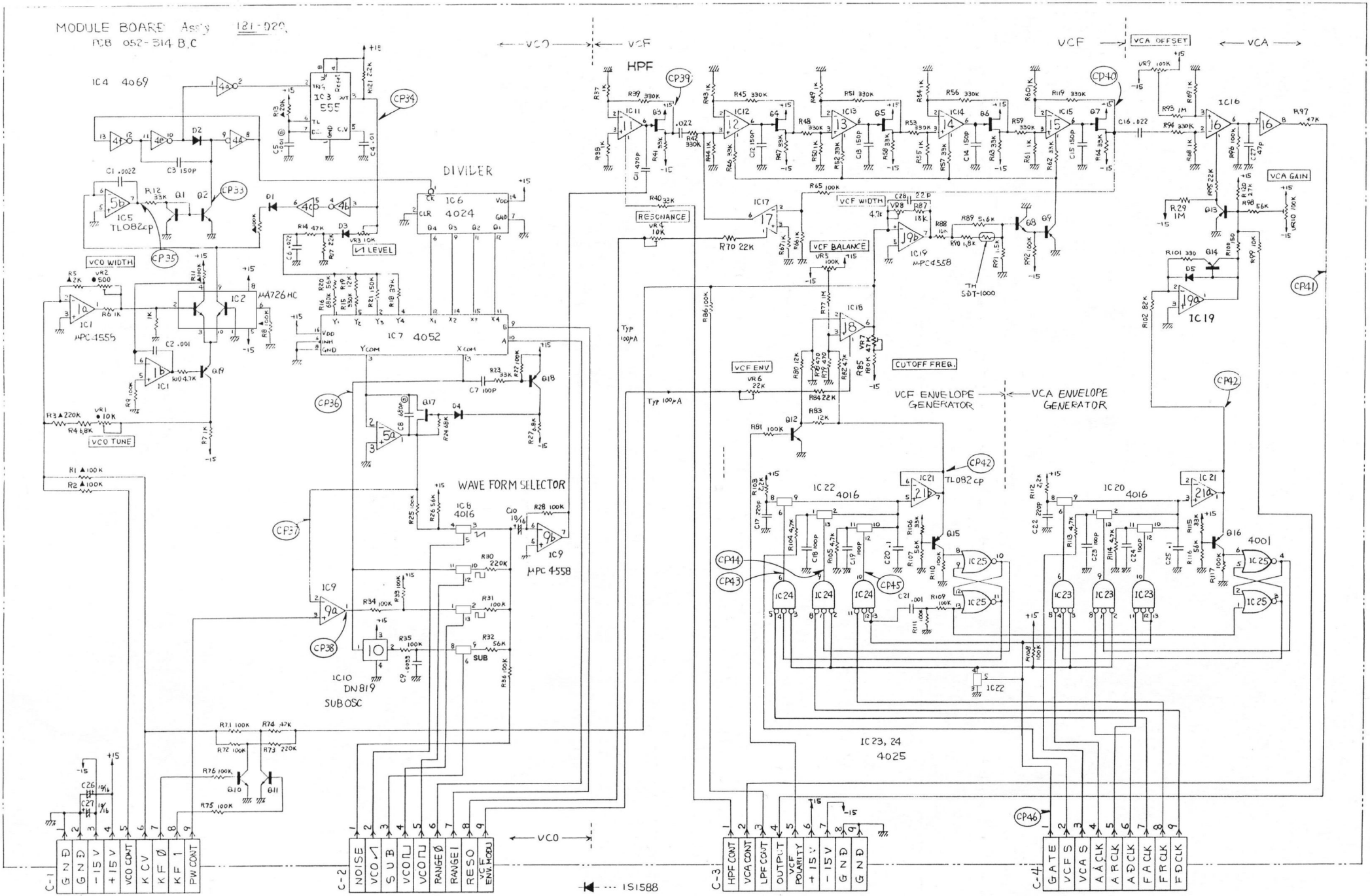


- Refer to following pages for the boards.-

MOTHER BOARD ----------	PP12-13
CONTROL BOARD ---------	PP14-15
(A, B, C, D, E, F,)	
CHORUS ENSEMBLE -------	P16
MODULE BOARD ----------	PP18-21
MODULE CONTROL --------	PP22-23
KEY ASSIGNER ----------	PP24-25
CONTROL BOARD G -------	P25
POWER SUPPLY BOARD ----	PP26-27


to Control Board B [H2]
to Control Board C [I1]
to Control Board C [I2]
LEVEL SHIFT
TRANSPOSE SUBTRACTOR
WAVE FORM SELECT DECODER
D/A CONVERTER
CMOS multiplexer enable pulse
Panel SWS data
Slider pots data
CMOS Multiplexer enable pulse
A5~A8 MODULE BOARD (A)
A9~A12 MODULE BOARD (B)
A13~A16 MODULE BOARD (C)
A17~A20 MODULE BOARD (D)
A21~A25 MODULE CONTROL BOARD
to CHORUS ENSEMBLE BOARD [F2]
to KEY ASSIGNER BOARD [D4]
to KEY ASSIGNER BOARD [D5]
to POWER SUPPLY BOARD
IC4 BATTERY
ADDRESS DECODER
MOTHER BOARD Ass'y
PCB 052-364
to Control Board F [K1]
to Control Board F [K2]
LFO
frequency at 100Hz
Sine
Rectangular
Sawtooth
Inverted Sawtooth
LFO FREQ
LFO WAVE FORM
LFO SELECT DECODER
CPU RESET
[ ] Control Address
1S158B
2SA1015-Y
2SC1815-Y
2SK30A-GR
(TOP VIEW)

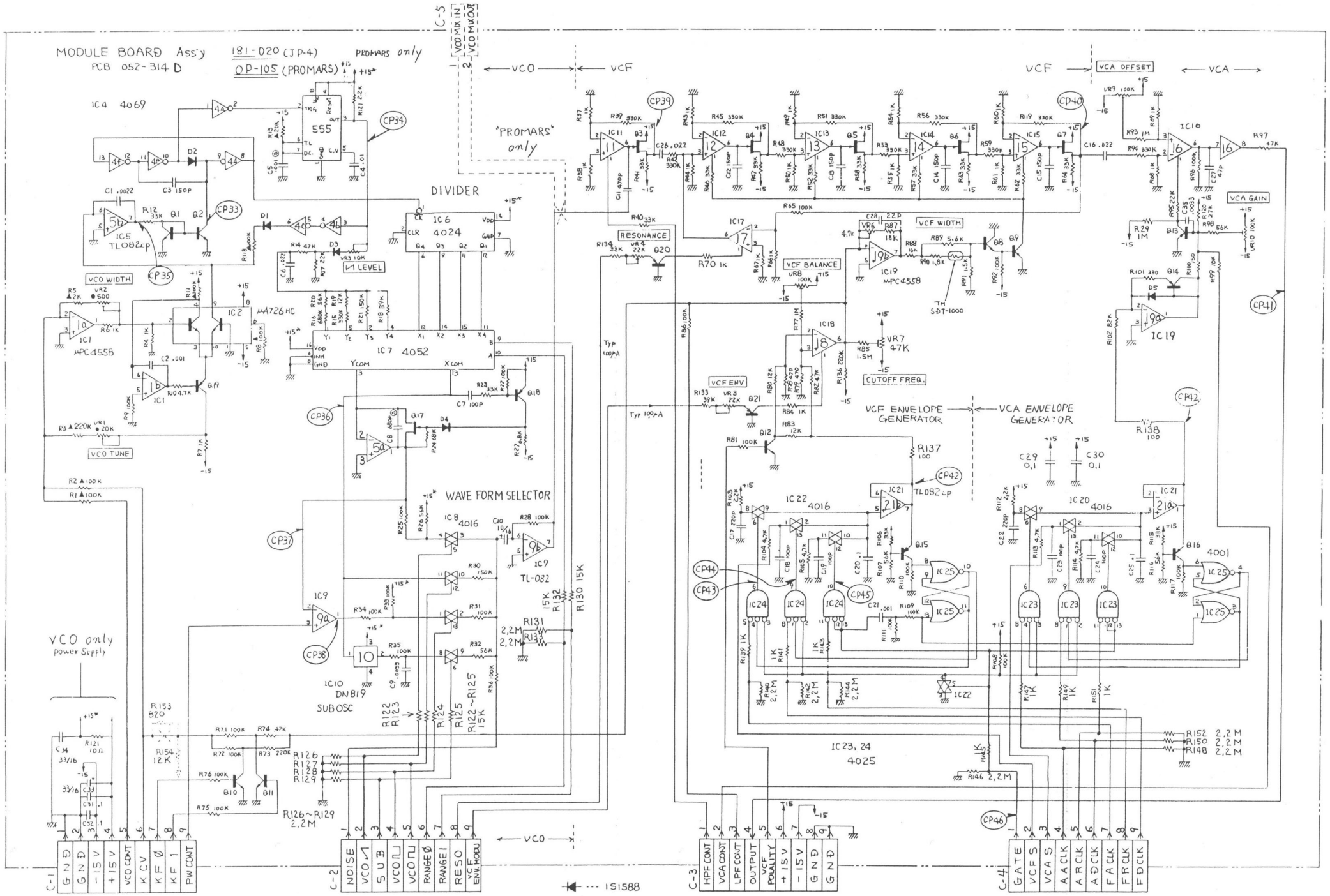

TRIGGER
DELAY / BEND
LFO
VCO
NOISE
VCF
VCA
A
B
C
D
E
F
Control Board A Ass'y PCB # 330
Control Board B Ass'y PCB # 329
Control Board C Ass'y PCB # 328
Control Board D Ass'y PCB # 331
Control Board E Ass'y PCB # 335
Control Board F Ass'y PCB # 237
to Rear Panel Jacks
to KEY ASSIGNER BOARD [D8]
to MODULE CONTROL BOARD [B2]
to MOTHER BOARD [A1]
to MOTHER BOARD [A2]
to MOTHER BOARD [A3]
to MOTHER BOARD [A4]
to CHORUS ENSEMBLE BOARD [F5]
VOLUME
to CHORUS ENSEMBLE BOARD [F3]
to KEY ASSIGNER BOARD [D3]
to MOTHER BOARD [A30]
to MOTHER BOARD [A29]
to MODULE CONTROL BOARD [B1]
to KEY ASSIGNER BOARD [D7]
BENDER
TUNING
ENSEMBLE
UP
DOWN
UP & DOWN
RANDOM
UNISON
POLY
HOLD
WRITE
MANUAL
COMPU MEMORY
BASS
STRING
FUNKY CLAVI
PIANO
VOICE
TROMBONE
SAX
TRUMPET
SYNTH
THE FORCE
MEMORY PROTECT



Ⓢ --- Polystyrene Film Capacitor (C5, C8)
▲ --- CRB ¼FX MFR
● --- MF VR

MODULE BOARD

SERIAL No. up to 790799


MODULE BOARD Ass'y
PCB 052-314 D
181-020 (JP-4)
OP-105 (PROMARS)
PROMARS only
IC4 4069
555
DIVIDER
IC6 4024
IC5 TL082cp
IC1 μPC4558
IC2 μA726HC
IC7 4052
VCO WIDTH
VCO TUNE
WAVE FORM SELECTOR
IC8 4016
IC9 TL-082
IC10 DN819
SUBOSC
VCO only power Supply
"PROMARS" only
VCO
VCF
VCA
VCF OFFSET
VCA GAIN
RESONANCE
VCF BALANCE
VCF WIDTH
CUTOFF FREQ.
VCF ENV
VCF ENVELOPE GENERATOR
VCA ENVELOPE GENERATOR
IC16
IC17
IC18
IC19 μPC4558
IC20 4016
IC21 TL082cp
IC22 4016
IC23, 24 4025
IC25 4001
C-1 GND GND -15V +15V VCO CONT KCV KF0 KF1 PW CONT
C-2 NOISE VCO SUB VCO VCO RANGE0 RANGE1 RESO EXT VCO
C-3 HPF CONT VCA CONT LPF CONT OUTPUT VCF POLARITY +15V -15V GND GND
C-4 GATE VCFS VCAS AACLK ARCLK ADCLK FACLK FRCLK FDCLK
to MOTHER BOARD A8,12,16,20
to MOTHER BOARD A7,11,15,19
to MOTHER BOARD A6, 10, 14. 18
to MOTHER BOARD A5,9, 13, 17
1S1588
2SA1015 Y
2SC1815 Y
2SK30A GR
Ⓢ --- Polystyrene Film Capacitor (C5, C8)
▲ --- CRB 1/4FX MFR
● --- MF VR
NOTE: R153 & R154 are "PROMARS" only
MODULE BOARD
SERIAL NO. 800800 - - -

CHANGINGS of VCF IC to 1R3109(IC12) involves some modifications on peripheral circuits whose designations are shown in type-written.

SUPPLEMENT on 181-020D Diagram

C36 and C37

S/N 861500-

Filter out pulses induced on KCV IN

uA726HC (IC2)

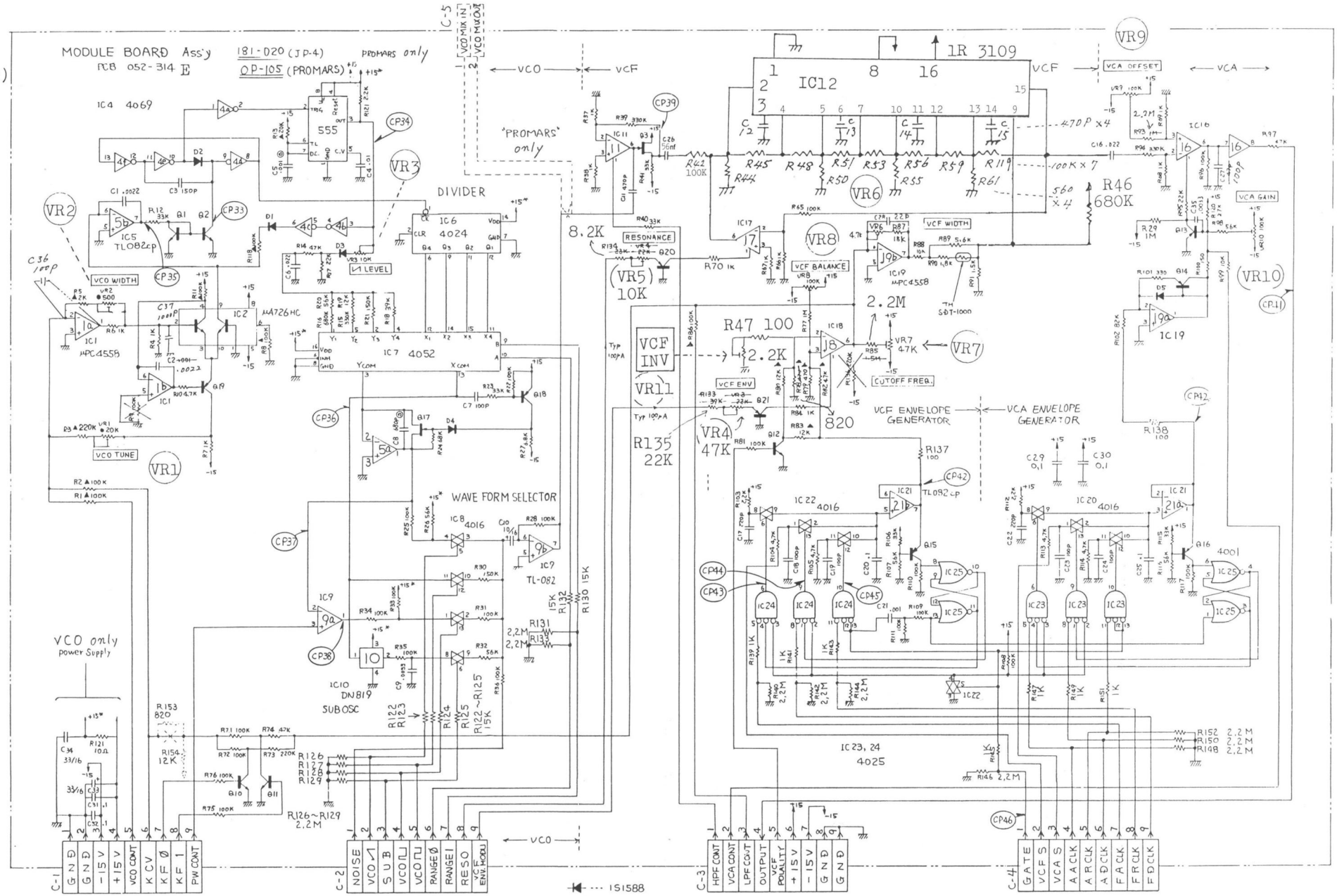
Factory selected with color dot

Resistance of R8 is to be determined according to the color on IC2.

Red -- 82K

Green-100K

Non --120K



Ⓢ --- Polystyrene Film Capacitor (C5, C8)

▲ --- CRB ¼FX MFR 1%

● --- MF VR

NOTE: R153 & R154 are "PROMARS" only

IC 11, 17, 18 : BA662 selected (same color)

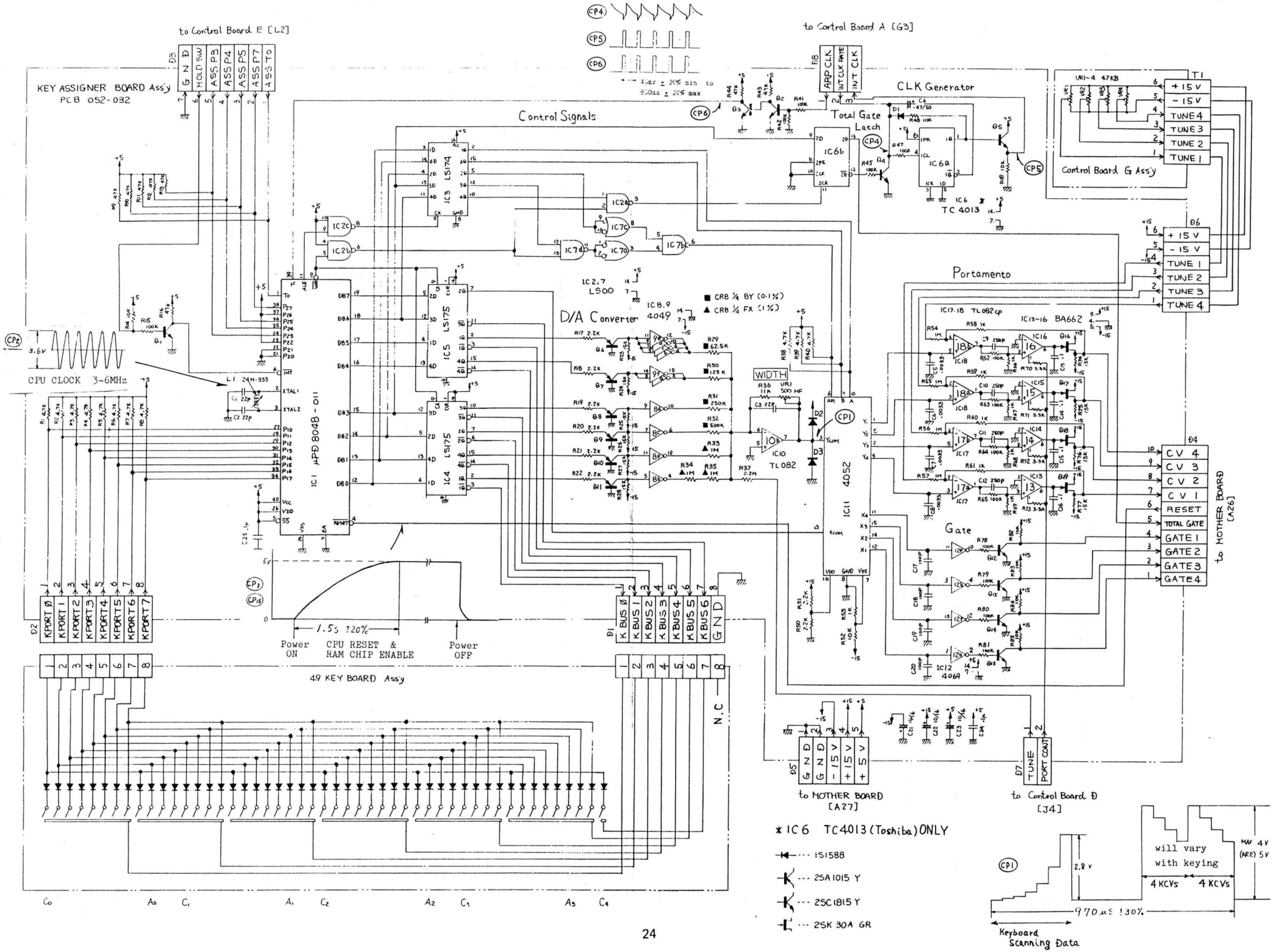
IC 16 : BA662 B

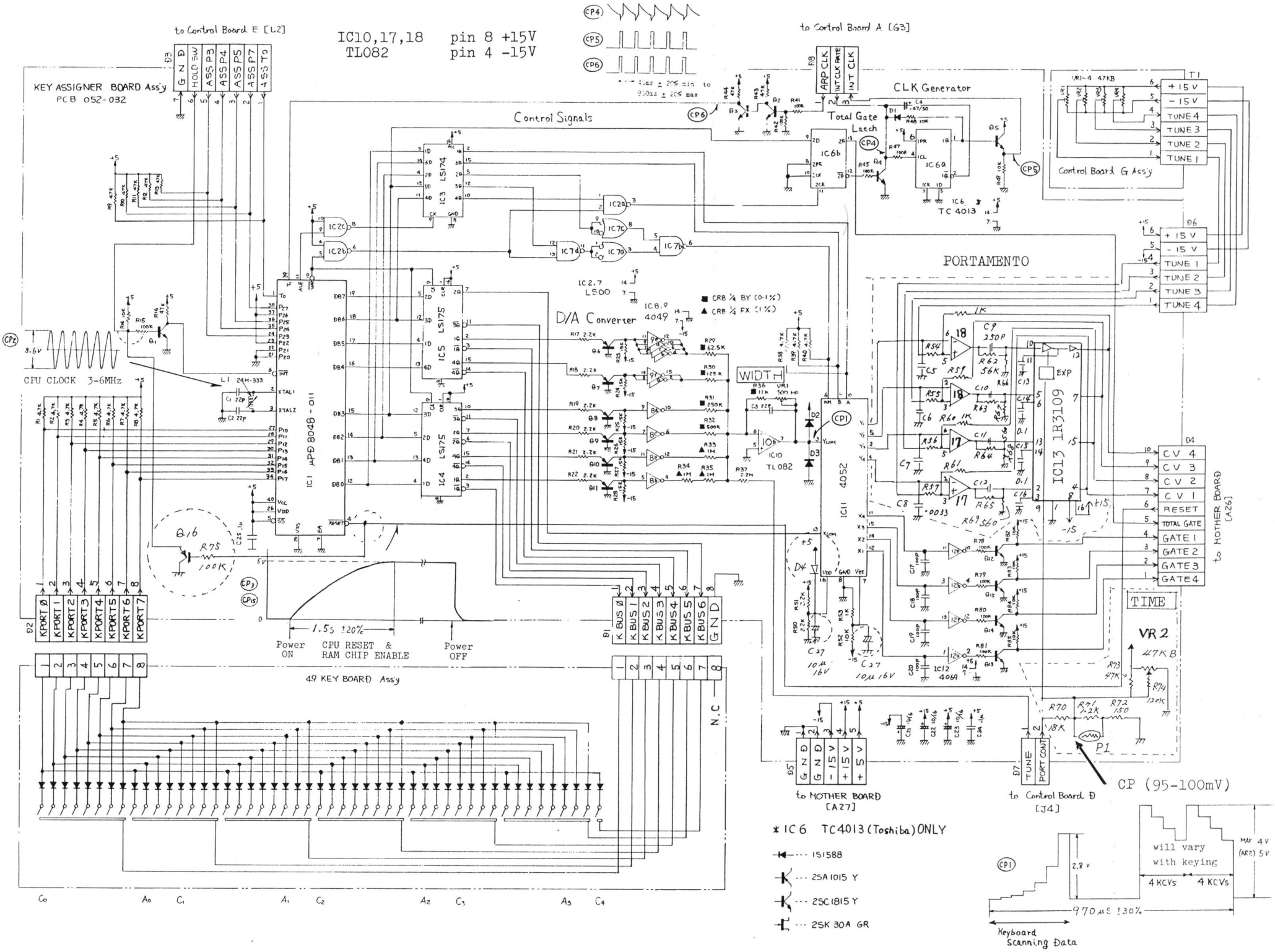
IC 4 : TC4069UBP or CD4069UBE

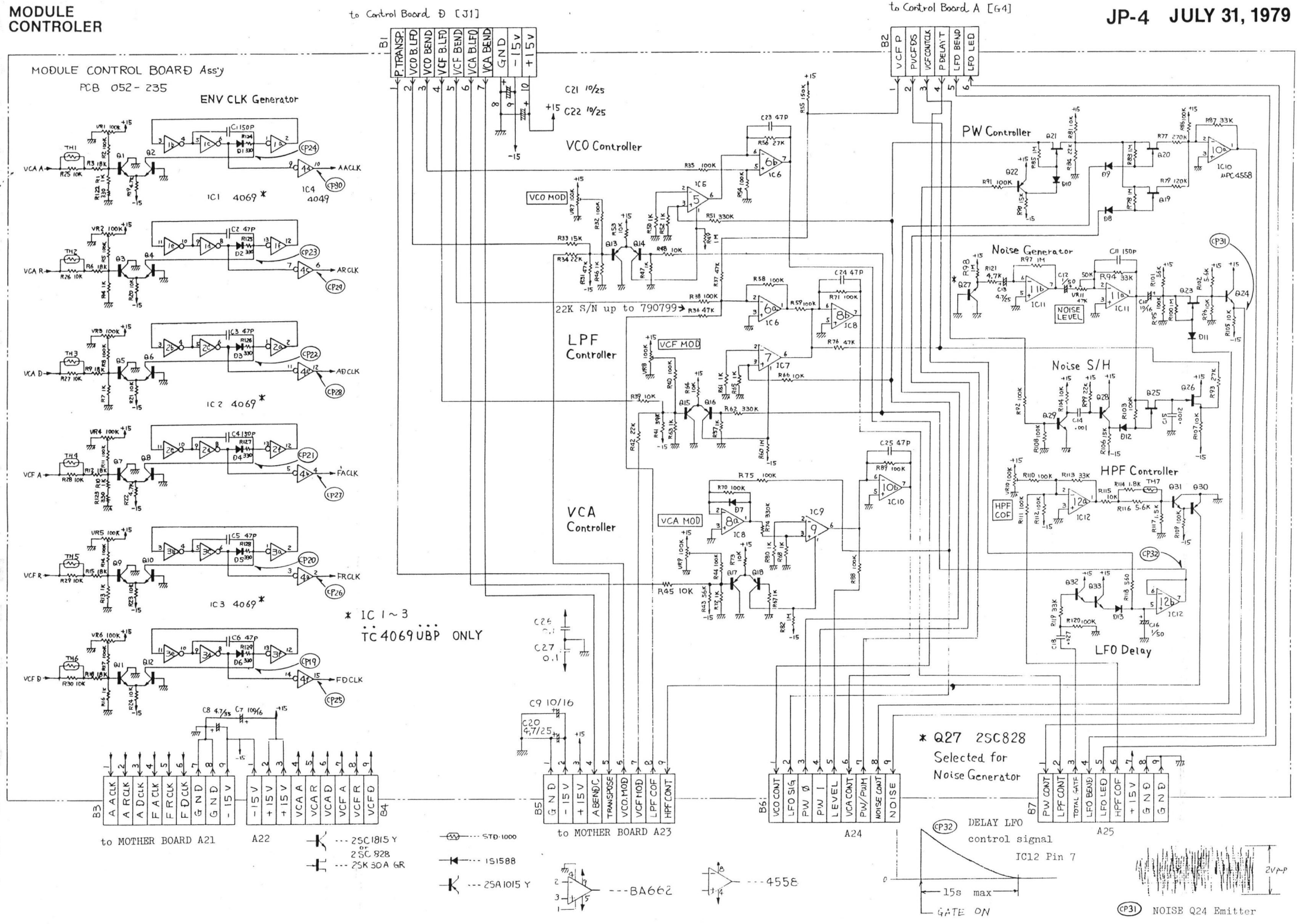
IC20, IC22 : 4016

IC23, IC24 : 4025

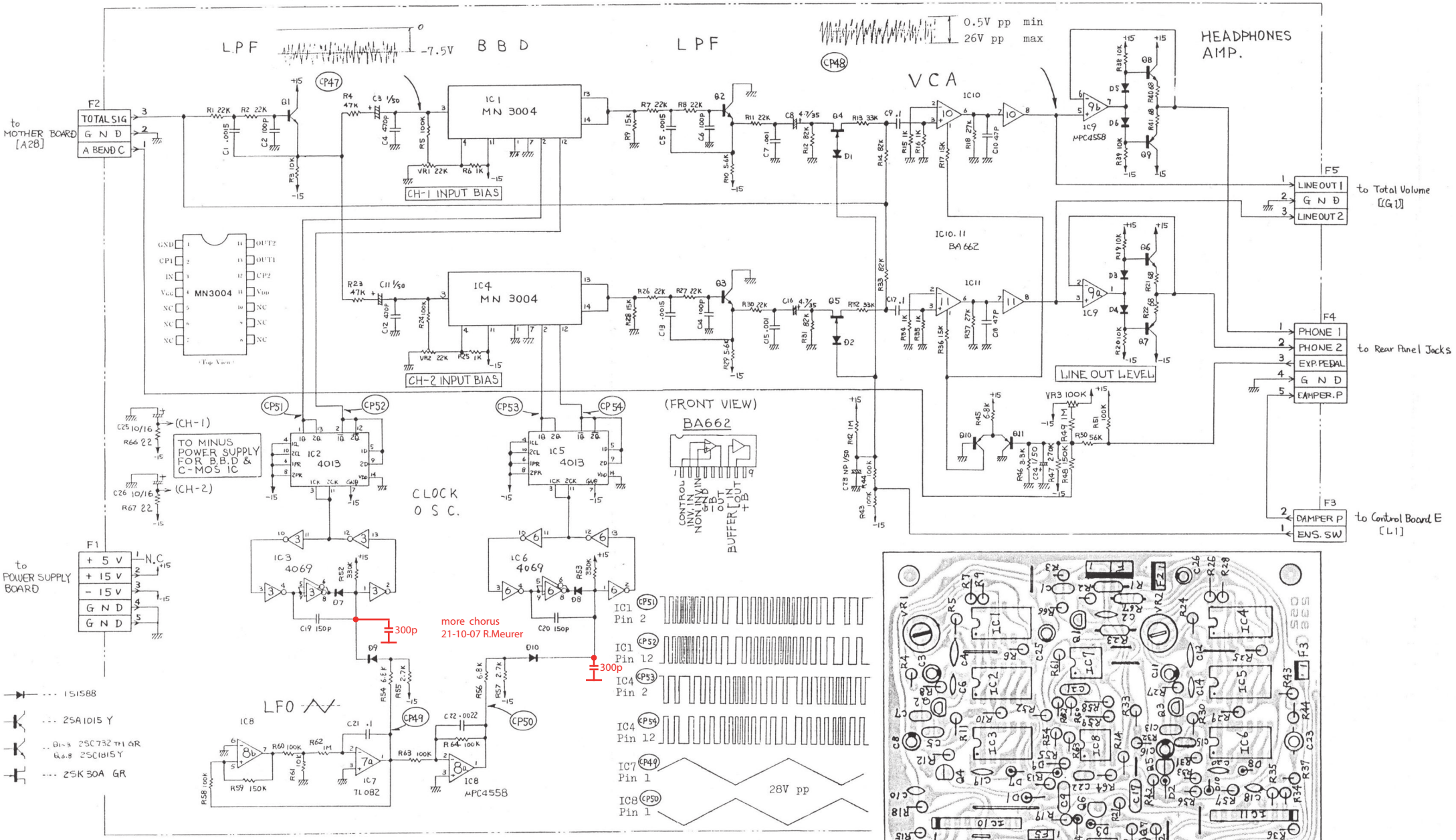
The same brand IC should be mounted on four module boards for simultaneous ATTACK TIME passages.


KEY ASSIGNER BOARD Ass'y
PCB 052-032
to Control Board E [L2]
to Control Board A [G3]
Control Signals
CLK Generator
Total Gate Latch
Control Board G Ass'y
Portamento
D/A Converter
WIDTH
Gate
CPU CLOCK 3-6MHz
IC1 μPD 8048-011
IC11 4052
IC10 TL082
IC6 TC4013
IC12 4069
IC2,7 LS00
IC8,9 4049
IC3 LS174
IC4 LS175
IC5 LS175
IC17,18 TL082cp
IC13-16 BA662
to MOTHER BOARD [A26]
to MOTHER BOARD [A27]
to Control Board D [J4]
49 KEY BOARD Ass'y
Power ON
CPU RESET & RAM CHIP ENABLE
Power OFF
1.5s ±20%
* IC6 TC4013 (Toshiba) ONLY
151588
2SA1015 Y
2SC1815 Y
2SK 30A GR
will vary with keying
4 KCVs
4 KCVs
970μs ±30%
Keyboard Scanning Data


KEY ASSIGNER BOARD Ass'y
PCB 052-032
to Control Board E [L2]
IC10,17,18 pin 8 +15V
TL082 pin 4 -15V
to Control Board A [G3]
CLK Generator
Total Gate Latch
Control Signals
Control Board G Ass'y
PORTAMENTO
D/A Converter
CPU CLOCK 3-6MHz
IC1 μPD 8048-011
IC13 1R3109
WIDTH
TIME
VR 2
Power ON
CPU RESET & RAM CHIP ENABLE
Power OFF
49 KEY BOARD Ass'y
to MOTHER BOARD [A27]
to Control Board D [J4]
to MOTHER BOARD [A26]
CP (95-100mV)
* IC6 TC4013 (Toshiba) ONLY
Keyboard Scanning Data
will vary with keying
4 KCVs
4 KCVs
970 μs ±30%


MODULE CONTROL BOARD Ass'y
PCB 052-235
ENV CLK Generator
to Control Board D [J1]
to Control Board A [G4]
B1
P.TRANSP.
VCO B.LFO
VCO BEND
VCF B.LFO
VCF BEND
VCA B.LFO
VCA BEND
GND
-15V
+15V
B2
VCF P
PVCFEGS
VCF CONTCLK
P.DELAY T
LFO BEND
LFO LED
VCO Controller
VCO MOD
PW Controller
Noise Generator
NOISE LEVEL
22K S/N up to 790799
LPF Controller
VCF MOD
Noise S/H
HPF Controller
HPF COF
VCA Controller
VCA MOD
LFO Delay
IC1 4069 *
IC4 4049
IC2 4069 *
IC3 4069 *
* IC 1~3
TC4069UBP ONLY
* Q27 2SC828
Selected for
Noise Generator
B3
A ACLK
A RCLK
A DCLK
F ACLK
F RCLK
F DCLK
GND
GND
-15V
to MOTHER BOARD A21
A22
-15V
+15V
+15V
VCA A
VCA R
VCA D
VCF A
VCF R
VCF D
B4
B5
GND
-15V
+15V
A BEND/C
TRANSPOSE
VCO MOD
VCF MOD
LPF COF
HPF CONT
to MOTHER BOARD A23
B6
VCO CONT
LFO SIG
PW Ø
PW I
LEVEL
VCA CONT
PW/PWM
NOISE CONT
NOISE
A24
B7
PW CONT
LPF CONT
TOTAL GATE
LFO BENS
LFO LED
HPF COF
+15V
GND
GND
A25
2SC1815 Y
or
2SC828
2SK30A GR
STD-1000
1S1588
2SA1015 Y
BA662
4558
DELAY LFO
control signal
IC12 Pin 7
15s max
GATE ON
2VP-P
NOISE Q24 Emitter

CHORUS ENSEMBLE BOARD



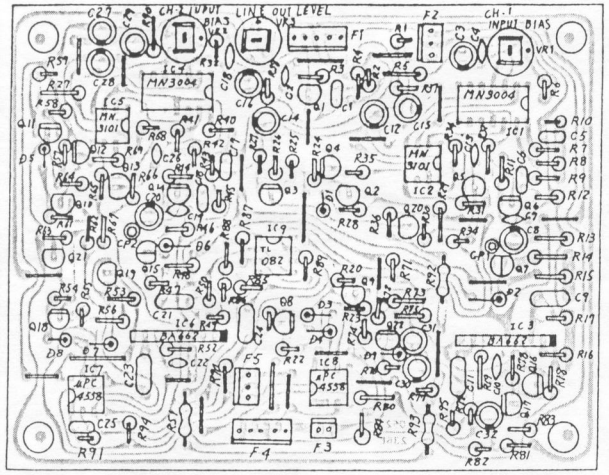
CHORUS ENSEMBLE BOARD 181-023C

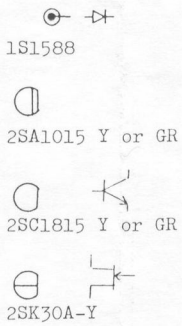
(Etch mask 052-236C)

SUPPLEMENT PAGE 16

IC3 IC6 Designation

MSM4069RS is dominant because of its greater S/N ratio, but its threshold varies from IC to IC within slightly larger range when compared with other brands.
These variations in threshold are compensated for by changing the value of R52 and R53 from 330k to 390k ohms.

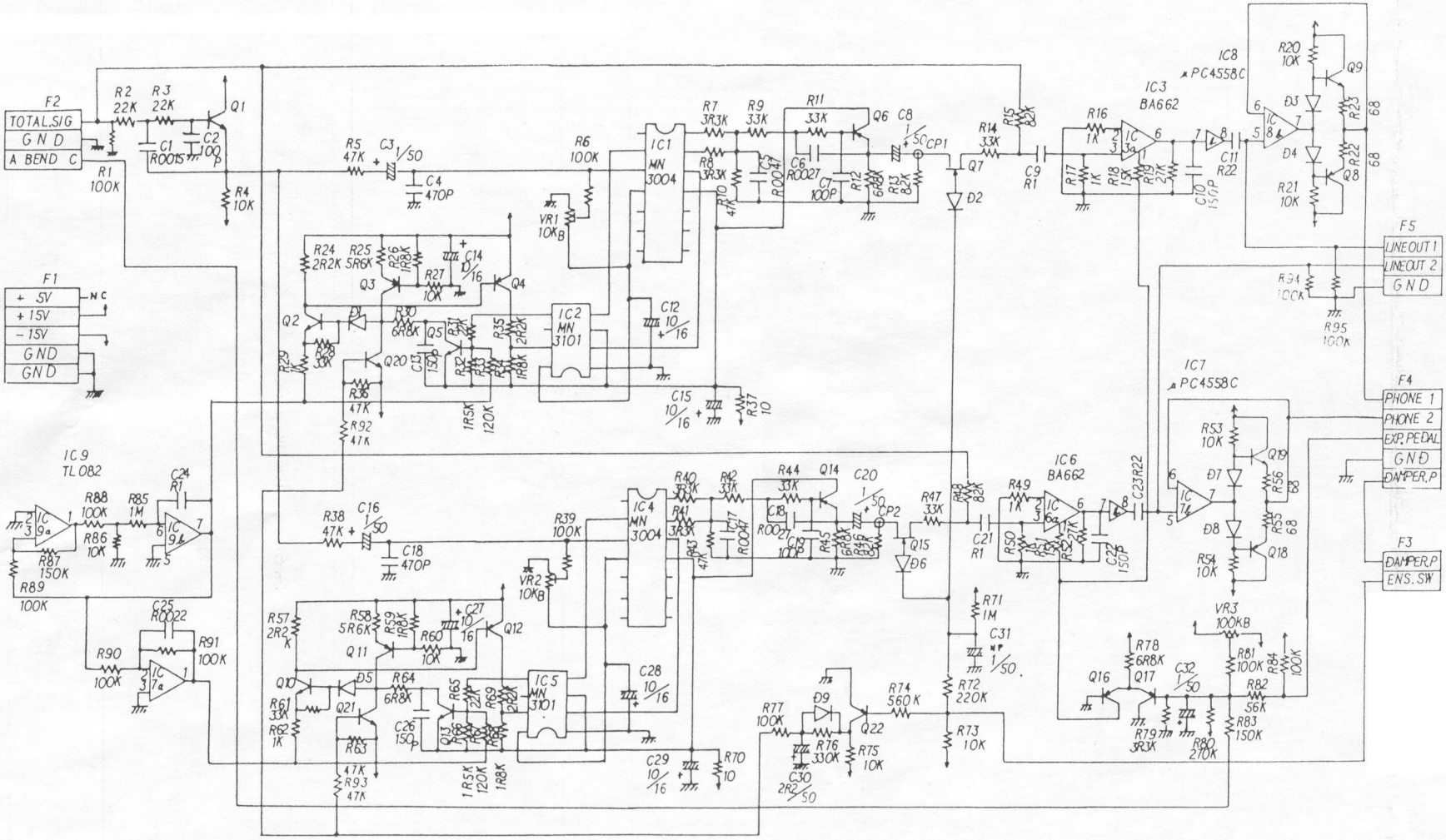




CHORUS ENSEMBLE BOARD 181-023E
(Etch mask 052-236E)

Compatible with 181-023C

(Effective S/N is not set forth at the date of issue.)
Clock Oscillators and BBD drivers are different from those on 181-023C and are disabled during ENSEMBLE "off" mode. No Clock leakages in off-mode.



INFORMATION ON DESIGN CHANGES

Some of circuit-design-changes involve modification on more than one pcb, causing matched pcbs to be used. Replacement-pcbs supplied from the factory may be the latest version and can fulfill the purpose with or without minor modifications.

PART 1 PCB IMPROVEMENTS & COMBINATIONS

See page 16-2 (PART 2) for:

Details for the pcb listed below
Design changes on sole board
Other major improvements

INTERCHANGEABLE

BASIC CONBINATION

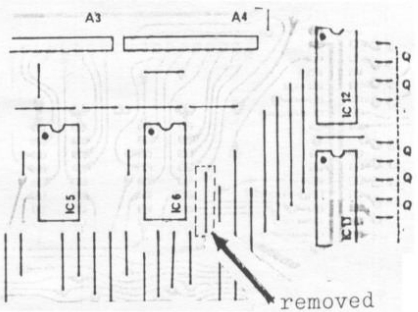
BASIC COMBINATION

MOTHER BOARD	MODULE BOARD	MODULE CONTROLLER	SERIAL NO.	KEY ASSIGNER	CONTROL BOARD D
181-019B (052-364B) with Q15 and Q16	181-020B or C (052-314B or C) without Q20, Q21	181-021 A, B or C (052-235 A, B or C) R36 = 22K	750100	181-022 A or B (052-032 A or B) IC (PORTA.) BA662	181-009 C or D (052-331 C or D) VR3 = 2MA
VCF: current control by Q15,Q16 (constant current sources)			790799		
needs some modifications(see P.19)		just change R36	800800		
181-019 B (052-364 B) without Q15,Q16	181-020 D (052-314 D) with Q20 and Q21	R36 = 47K		181-022 C (052-032 C) IC (PORTA.) 1R3109 needs additional adjustment (VR2) ADJ. SECTION 3	181-009 D (052-331 D) VR3 = 50KB
VCF: voltage control by IC27,IC28 via Q20,Q21 (V-I converters)			912200		
	VCF IC: BA662		942749	181-022 B (052-032 B) IC (PORTA.) BA662	181-009 D (052-331 D) VR3 = 2MA
	181-020 E (052-314 E) VCF IC: 1R3109	181-021 D or E (052-235 D or E) R36 = 47K	952750 952799 952800 952849 952850		
181-019 C or D (052-364 C or D) with transistor mounting holes to accommodate Q15 and Q16 for modification	VCF ADJUSTMENT: partially different from B/C/D versions Additional ADJ. SECTION 25 VCF INV (VR11) effective with S/N ..4100		993400 00.... 01.... 02.... first 2 digits cycles	181-022 C IC: 1R3109	181-009 D VR3 = 50KB

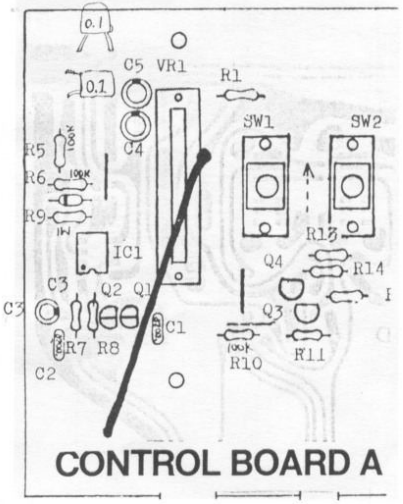
REDUCING NOISES ON GROUND PATH CONTROL BOARD-A, B, C

Noises are induced on GND of these PCBs while the ground path is passing through Mother board to DC source, causing ripples to be superimposed on Control board output voltages.
To by-pass M board, the jumper leading to A4 pin no.1 is removed. A wire is placed between the GND and ground lug on top panel as shown below.

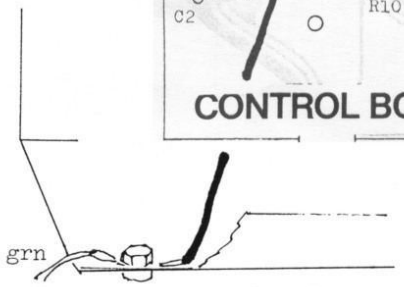
This modification would be effective if frequency fluctuates during VCF osccillation with RES knob raised.



MOTHER BOARD



CONTROL BOARD A



to power supply board

INFORMATION ON DESIGN CHANGES

PART II LIST OF MAJOR MODIFICATIONS

SERIAL NO.	WHAT IS IMPROVED	A F F E C T E D	P C B	PAGE
800800	easy adj. by addopting V-I converter for VCF, multi-turn trim for VCO	MODULE BOARD MOTHER BOARD MODULE CONTRLR	181-020D 181-019B 181-021C	19 13 22
820950	noises on panel control outputs is reduced by by-passing Mother board GND path	MOTHER BOARD CONTROL BRD A	181-019B 181-006	12-2 14
861500	IC11 is protected from charged voltage fed at its pins by providing C26, C27 and D4.	KEY ASSIGNER	181-022B	25-1 25-2
871600	VCO fluctuation due to connectors' loose contacts (-15V and CV path) is reduced by direct wirings	MOTHER BOARD KEY ASSIGNER POWER SUPPLY CONTROL BRD D	181-020 181-022B/C 181-024 181-009	12-1 25-1 26-1 14
952750	VCFs configurations are simplified and leveled by using 1R3109	MODULE BOARD	181-020E	16-2 21-1 21-2
	1R3109 ensures synchronous PORTAMENTO time of 4-VCO without adjustments	KEY ASSIGNER CONTROL BRD D	181-022C 181-009	25-1 25-2 14
..3800	cause of faulty analog voltages i.e. misreading of D/A bits is prevented by re-connecting IC13-14 (MANUAL mode)	MOTHER BOARD	181-019C/D	12-1
..4100	VOICE (preset) envelope can be tailored by adjusting VCF INV pot.	MODULE BOARD	181-020E/F	21-1 21-2
.....	S/N ratio is increased	CHORUS ENSEMBLE	181-023E	16-1

NOTE: Unfulfilled serial numbers indicate that no effective numbers are predictable at the issue date of 2nd edittion. First 2-digit in serial number increases by 1/month and is reset to 00 after 99.

IC SPECIFICATION

Although most of ICs of various makers are interchangeable, because of JP-4's sever design factors, some of them must be selectively used in accordance with designations on the circuit diagrams for sufficient performances.

1. Brand Classifications

PCB	DEGIGNATION		MANUFACTURE
MODULE CONTROLLER 181-021	IC1-IC3	CD4069UBE	RCA
MODULE BOARD 181-020	IC4	TC4069UBP or CD4069UBE	Toshiba RCA
CHORUS ENSEMBLE 181-023 A, B, C	IC3 IC6	MSM4069RS	Oki
KEY ASSIGNER 181-022	IC12	TC4069UBP or CD4069UBE	Toshiba RCA
	IC6	TC4013	Toshiba
	IC11	4052	exclude RCA

READ THROUGH ADDITIONAL PAGES (WITH A SUFFIX)

even if they seem to have no relation to the work being done based on original pages. Some of the contents on additional pages will supplement or correct those on the original pages; may include improvement on early products, since originals are kept unchanged as possible.

Often on several pages, will appear the same explanation that makes it well understood. These pages have interrelations in terms of alteration, pcb combination and so forth.

1R3109

The IR3109 contains four variable transconductance amplifiers designed for VCF applications in electronic musical instruments.
The device is equipped with four high input impedance buffers, and anti-log circuitry (V-in to I-out) which controls conductances of four amps.

. wide transconductance variable range (1μU -10mU)
. low input offset voltage (less than ±3mV) (transconductance amplifier)
. high input impedance. MOS P-channel (buffer)

2. Quadruple-use of The Same IC

The quadruplicate stages in the 4-voice JP-4 circuits require the same IC to be mounted for the same tonal characteristic.

MODULE BOARD 181-020 — IC20, IC22 4016 / IC23, IC24 4025 — for concurrent ATTACK TIME
the same brand for four modules

BA662 factory selected with a paint dot

Ideally, each of the following groups must be in complete set of the same color, but one or two ICs on a PCB would be of a color in a range ±2 of the group grade. See color code shown in the table below.

MODULE BOARD
181-020 A/B/C/D IC11-IC15 181-020 E IC17,IC18
of the same color for four modules for simultaneous tonal change

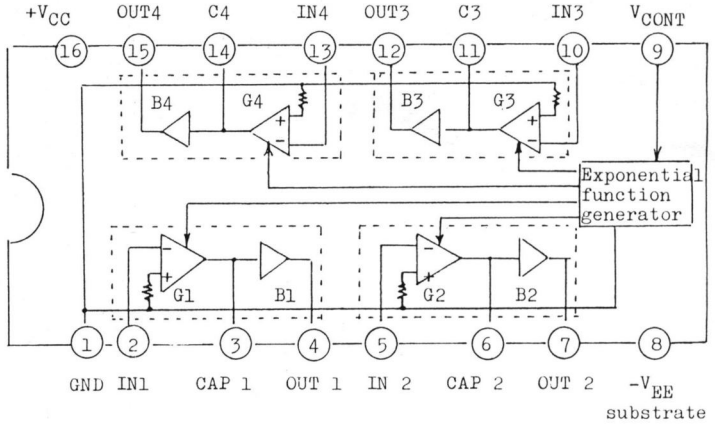
KEY ASSIGNER IC13-IC16
181-022C for synchronous Portamento time

BA662 color code

grade	1	2	3	4	5	6	7	8	9
color	BRN	RED	ORN	YEL	GRN	BLU	D.GRN or VIO	GRY or BLK	WHT
	low	←----	gm	------	high	---			----→

Mixed use of BA662A and BA662B is allowed for above applications.

1R3109
(top view)



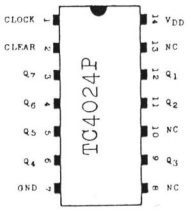
TC4024P

7-STAGE BINARY COUNTER

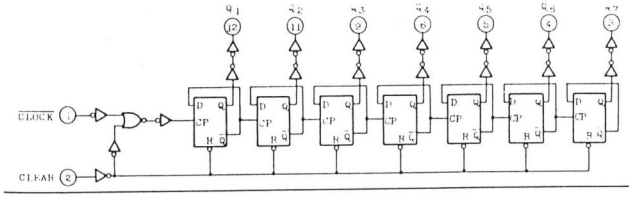
TRUTH TABLE

CLOCK ⚠	CLEAR	OUTPUT STATE
✳	H	All Outputs = 'L'
⚠	L	No Change
⚠	L	Advance to Next State

⚠ ; Level Change, ✳ ; Don't care

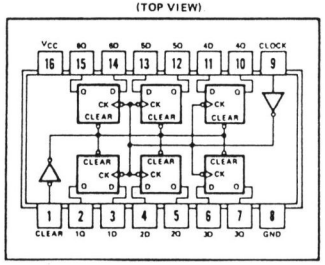


LOGIC DIAGRAM



SN74LS174 HEX D-TYPE FLIP-FLOP

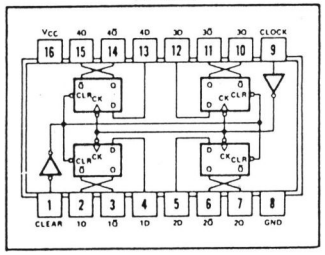
(TOP VIEW)



H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated steady-state input conditions were established.
† = '175, 'LS175, and 'S175 only

SN74LS175 QUADRUPLE D-TYPE FLIP-FLOP

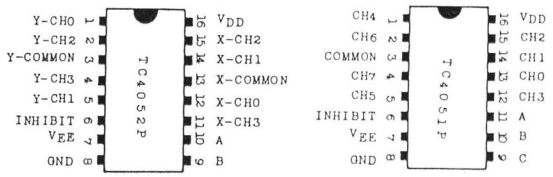
(TOP VIEW)



FUNCTION TABLE
(EACH FLIP-FLOP)

INPUTS			OUTPUTS	
CLEAR	CLOCK	D	Q	Q̄†
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q_0	$\bar{Q}_0$

TC4051BP SINGLE 8-CHANNEL MULTIPLEXER/DEMULTIPLEXER
TC4052BP DIFFERENTIAL 4-CHANNEL MULTIPLEXER/DEMULTIPLEXER



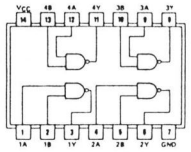
TRUTH TABLE

CONTROL INPUTS				'ON' CHANNEL		
INHIBIT	C ⚠	B	A	TC4051BP	TC4052BP	TC4053BP
L	L	L	L	0	0X, 0Y	0X, 0Y, 0Z
L	L	L	H	1	1X, 1Y	1X, 0Y, 0Z
L	L	H	L	2	2X, 2Y	0X, 1Y, 0Z
L	L	H	H	3	3X, 3Y	1X, 1Y, 0Z
L	H	L	L	4	—	0X, 0Y, 1Z
L	H	L	H	5	—	1X, 0Y, 1Z
L	H	H	L	6	—	0X, 1Y, 1Z
L	H	H	H	7	—	1X, 1Y, 1Z
H	✳	✳	✳	NONE	NONE	NONE

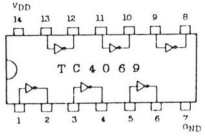
✳ Don't Care, ⚠ Except TC4052BP

74LS00

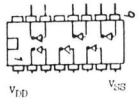
QUADRUPLE 2-INPUT POSITIVE-NAND GATES



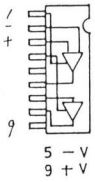
TC4069



TC4049P

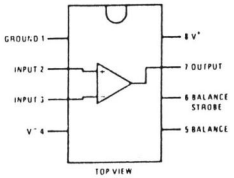


BA662

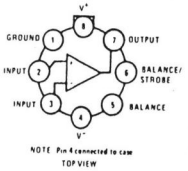


LM311

Dual-In-Line Package

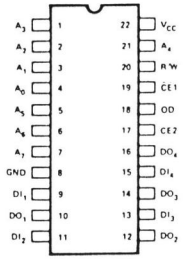


Metal Can Package

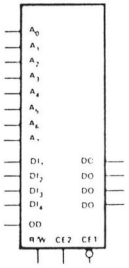


μPD5101C-E

PIN CONFIGURATION



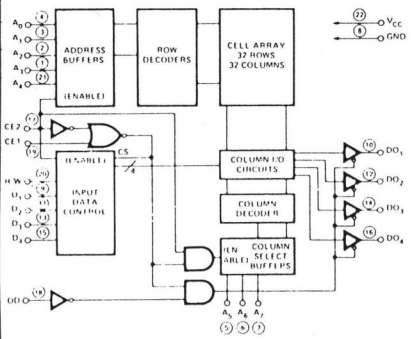
LOGIC SYMBOL



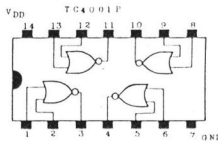
TRUTH TABLE

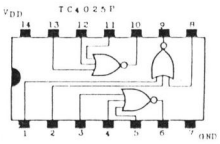
$\overline{CE_1}$	CE_2	OD	R/W	D_{IN}	Output	Mode
H	X	X	X	X	High Z	Not Selected
X	L	X	X	X	High Z	Not Selected
X	X	H	H	X	High Z	Output Disabled
L	H	H	L	X	High Z	Write
L	H	L	L	X	D_{IN}	Write
L	H	L	H	X	D_{OUT}	Read

BLOCK DIAGRAM



TC4001P QUAD 2-INPUT POSITIVE NOR GATE
TC4025P TRIPLE 3-INPUT POSITIVE NOR GATE

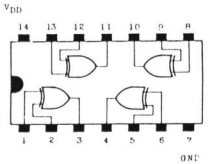




QUAD EXCLUSIVE-OR GATE

MC14070B

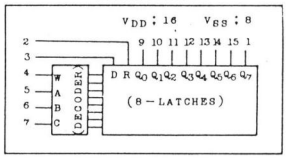
TC4030BP



TRUTH TABLE

INPUTS		OUTPUT
A	B	X
L	L	L
L	H	H
H	L	H
H	H	L

BLOCK DIAGRAM



TC4099BP

TC4099BP 8-BIT ADDRESSABLE LATCH

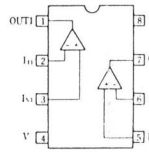
TRUTH TABLE

CONTROL INPUTS		ADDRESS INPUTS			OUTPUTS							
RESET	W.DIS.	C	B	A	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7
H	H	✳	✳	✳	L	L	L	L	L	L	L	L
L	H	✳	✳	✳	—	—	—	—	—	—	—	—
H	L	L	L	L	D	L	L	L	L	L	L	L
H	L	L	L	H	L	D	L	L	L	L	L	L
H	L	L	H	L	L	L	D	L	L	L	L	L
H	L	L	H	H	L	L	L	D	L	L	L	L
H	L	L	H	L	L	L	L	L	D	L	L	L
H	L	H	L	H	L	L	L	L	L	D	L	L
H	L	H	H	L	L	L	L	L	L	L	D	L
H	L	H	H	H	L	L	L	L	L	L	L	D
L	L	L	L	L	D	—	—	—	—	—	—	—
L	L	L	L	H	—	D	—	—	—	—	—	—
L	L	L	H	L	—	—	D	—	—	—	—	—
L	L	L	H	H	—	—	—	D	—	—	—	—
L	L	H	L	L	—	—	—	—	D	—	—	—
L	L	H	L	H	—	—	—	—	—	D	—	—
L	L	H	H	L	—	—	—	—	—	—	D	—
L	L	H	H	H	—	—	—	—	—	—	—	D

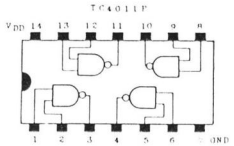
✳ ; DON'T CARE D ; DATA INPUT
— ; HOLDS PREVIOUS DATA

TL082, TL072
LM353
μPC 4558C

Connection Diagram (Top View)

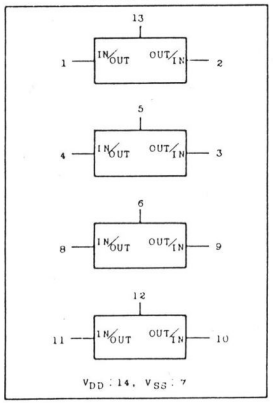


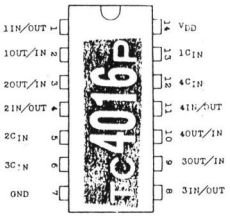
TC4011P QUAD 2-INPUT POSITIVE NAND GATE



TC4016 QUAD BILATERAL SWITCH

BLOCK DIAGRAM





TRUTH TABLE

C_{IN}	Impedance Between IN/OUT − OUT/IN ✳
H	$2 \sim 20 \times 10^2 \Omega$
L	$> 10^9\ \Omega$

✳ See Electrical Characteristics

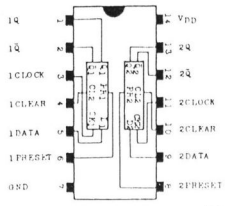
TC4013P

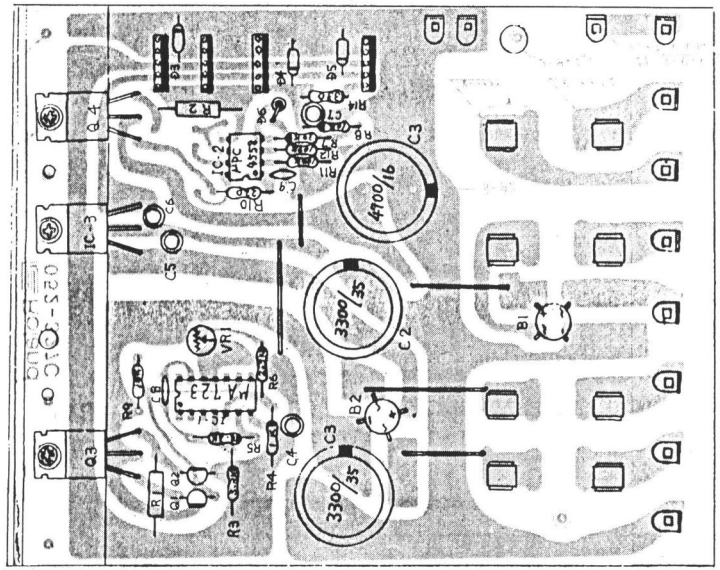
TRUTH TABLE

INPUTS				OUTPUTS	
CL	PR	D	CP ⚠	Q_{n+1}	$\bar{Q}_{n+1}$
L	H	✳	✳	H	L
H	L	✳	✳	L	H
H	H	✳	✳	L	H
L	L	L	⚠	L	H
L	L	H	⚠	H	L
L	L	✳	⚠	Q_n*	$\bar{Q}_n$*

✳ ; Don't Care
⚠ ; Level Change
* ; No Change

DUAL D-TYPE FLIP-FLOP



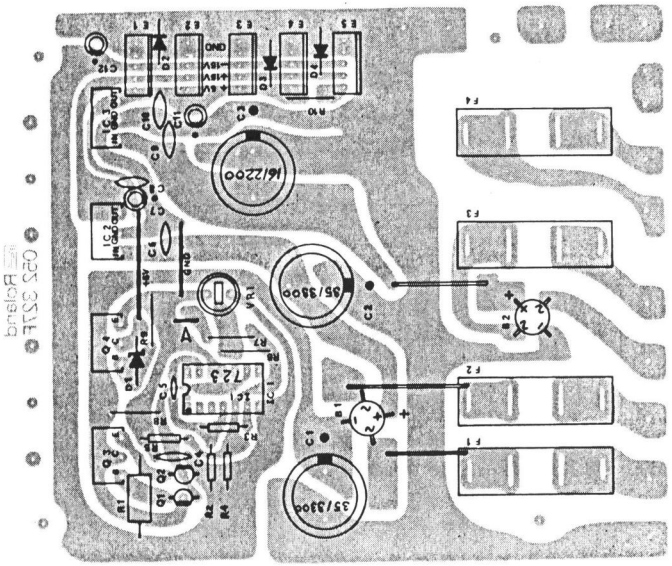


181-024C
Right

Serial No. up to
790799

Use 181-024F for
replacement

DIFFERENCE BETWEEN
181-024 E and F:
only conductor
spacing



POWER SUPPLY BOARD 181-024F
(Etch mask 052-327F)
Serial No. 800800 and higher

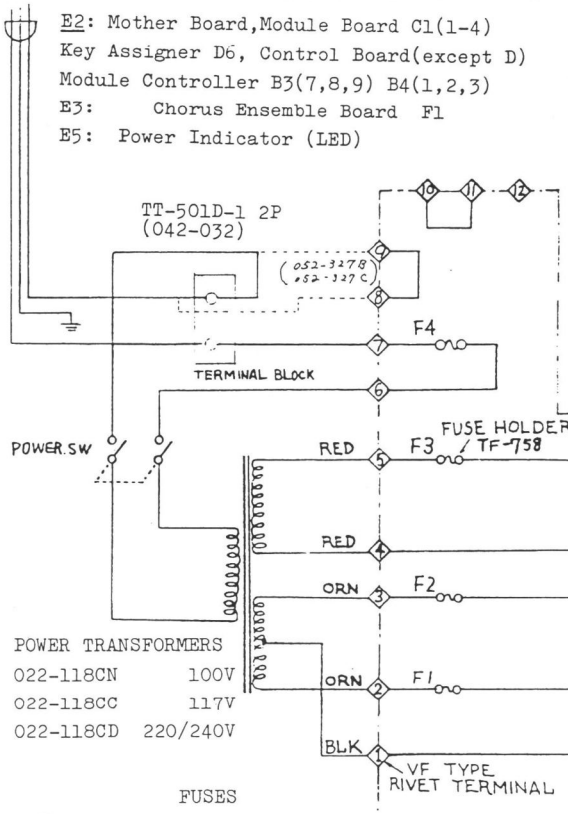
DESTINATIONS of CONNECTORS

E1: Mother Board IC30 (Output Mixer)
Control Board D(via Module Controller B5(1,2,3))
Module Board C3(2,6,8,9) VCF,VCA, ENV GEN

E2: Mother Board,Module Board C1(1-4)
Key Assigner D6, Control Board(except D)
Module Controller B3(7,8,9) B4(1,2,3)

E3: Chorus Ensemble Board F1

E5: Power Indicator (LED)

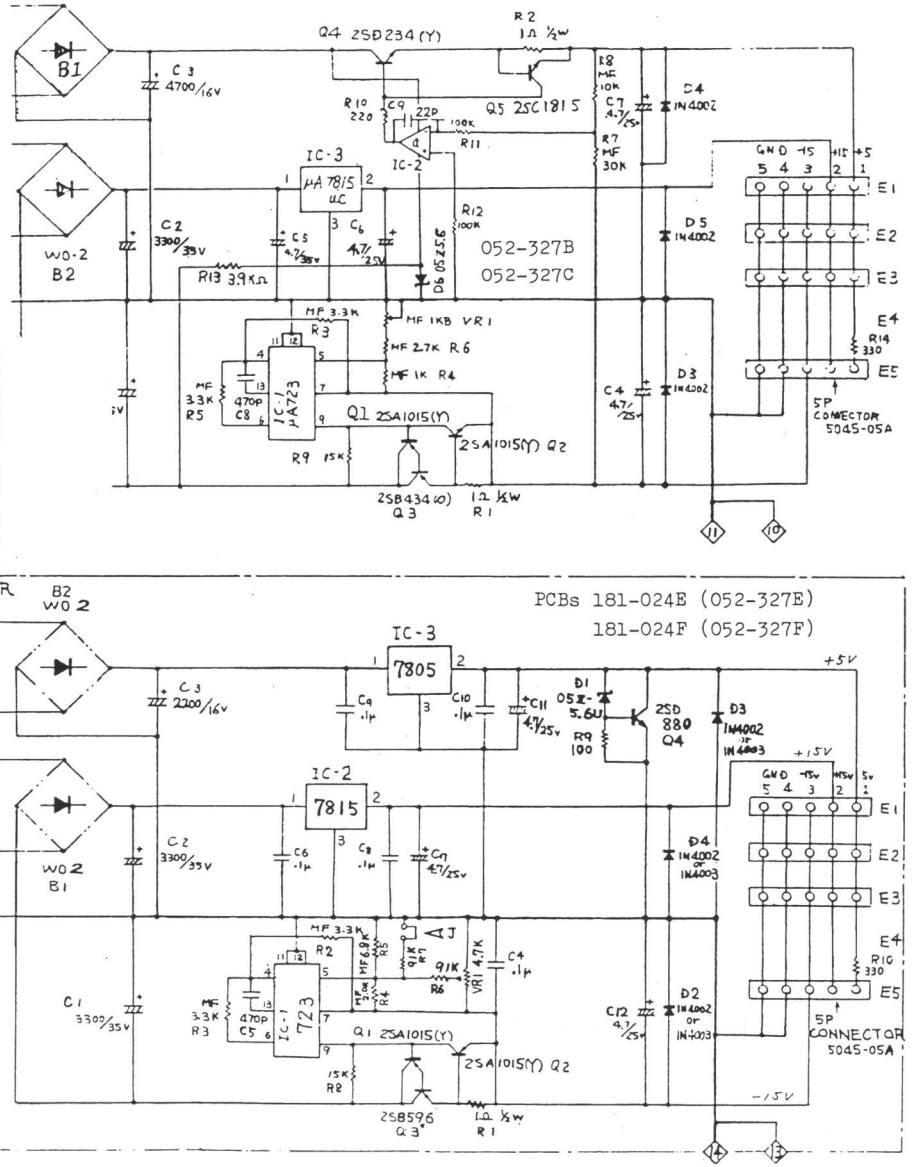


POWER TRANSFORMERS

022-118CN	100V
022-118CC	117V
022-118CD	220/240V

FUSES

AC	F1-F3	F4
100/117V	SGA0002(2A) (008-028)	SGA0001(1A) (008-026)
220/240V	CEE T2A (008-070)	CEE T500mA (008-063)

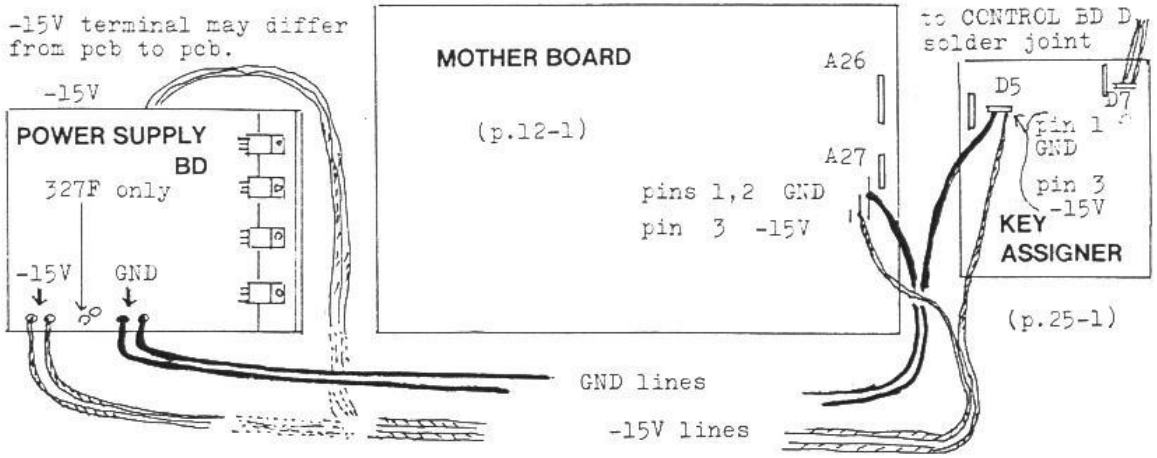


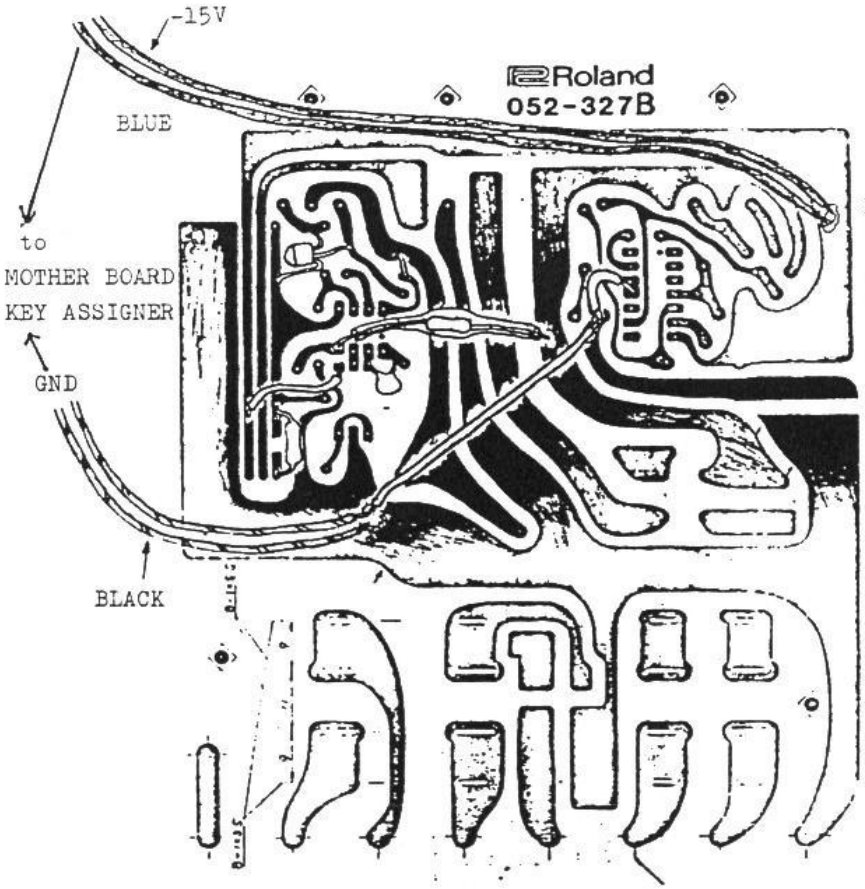
DIRECT WIRINGS **–15V & GROUND, TUNE & PORTAMENTO**

POWER SUPPLY to MOTHER AND KEY ASSIGNER BOARDS
KEY ASSIGNER to CONTROL BOARD D

One of the important modifications for stable VCO pitch. Prevents voltage fluctuations on -15V and KCV circuits resulting from connectors' loose contacts.
This has been done at the factory with serial number 871600 and subsequent, and will prove effective when done on the products left undone.

For the details about the wirings other than power supply, see respective pages.

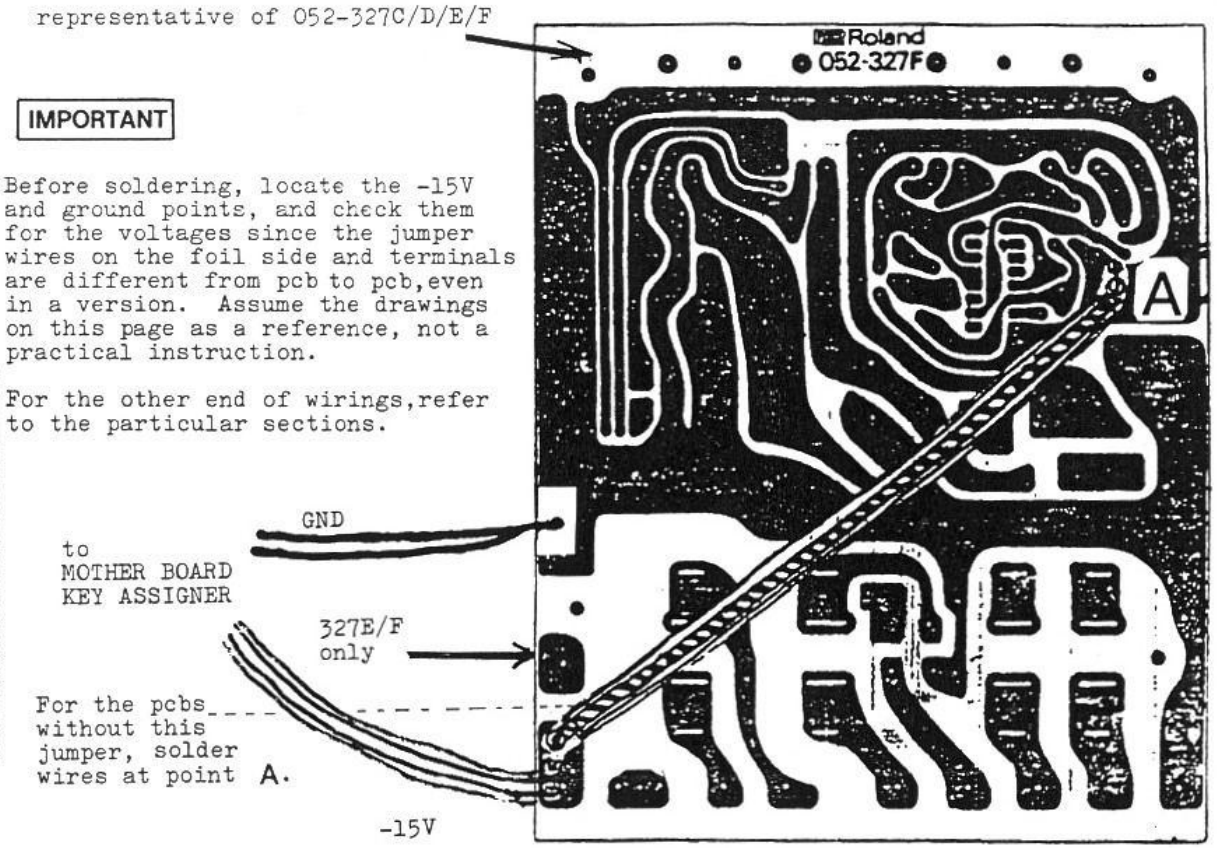




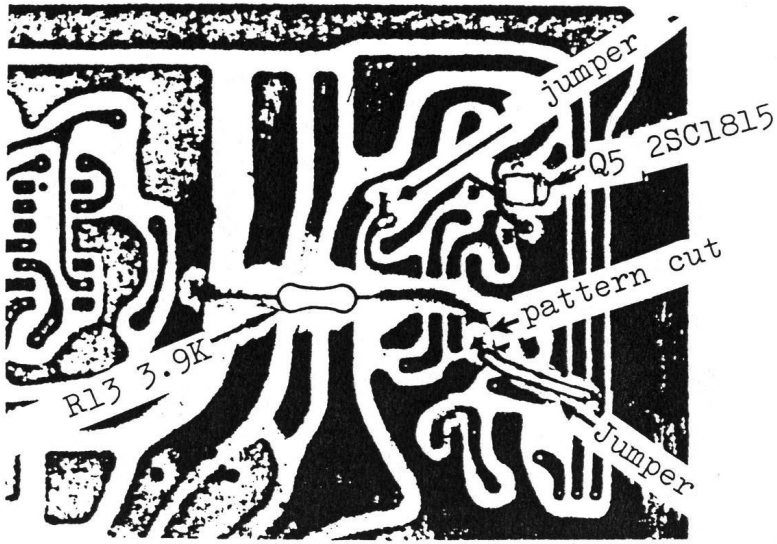
IMPORTANT

Before soldering, locate the -15V and ground points, and check them for the voltages since the jumper wires on the foil side and terminals are different from pcb to pcb, even in a version. Assume the drawings on this page as a reference, not a practical instruction.

For the other end of wirings, refer to the particular sections.

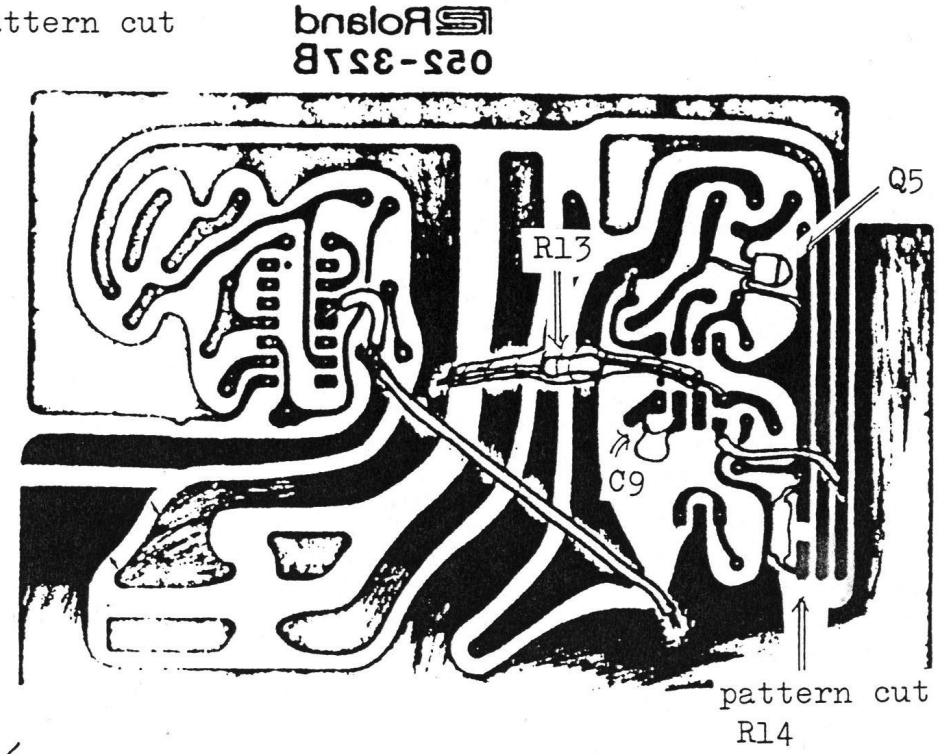


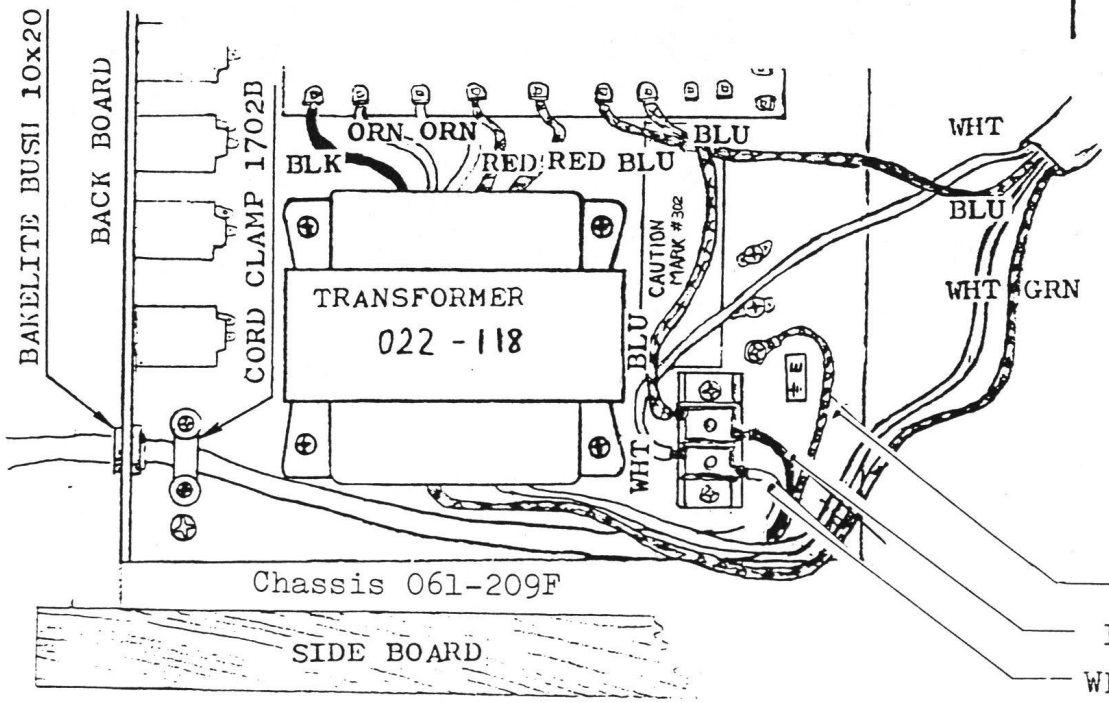
Components, jumpers and pattern cut on foil side



TOP VIEW

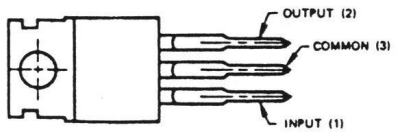
view from component side





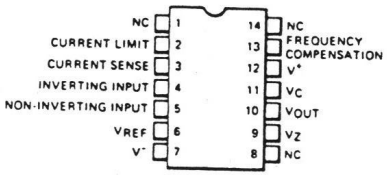
7805
7815

(TOP VIEW)
PACKAGE OUTLINE GH



μA723

(TOP VIEW)



Green (3-phase)

Black (100/117V) Brown (220/240V)

White (100/117V) Blue (220/240V)

MOTHER BOARD

A26

1	GATE 4
2	GATE 3
3	GATE 2
4	GATE 1
5	TOTAL GATE
6	PESET
7	K CV 1
8	K CV 2
9	K. CV 3
10	K. CV 4

KEY ASSIGNER

D4

CV 4	10
CV 3	9
CV 2	8
CV 1	7
RESET	6
TOTAL GATE	5
GATE 1	4
GATE 2	3
GATE 3	2
GATE 4	1

REPLACING PCB INVOLVES ADJUSTMENTS

After replacing PCBs, the following adjustments must be performed.

POWER SUPPLY BOARD
(including IC change on this board)
Basically, all sections are to be examined since variations in DC supply can affect most circuits.

MOTHER BOARD
Sections 4-24
except CHORUS

KEY ASSIGNER BOARD
Sections 2-3

MODULE BOARD
Sections 7-20 except CHORUS

MODULE CONTROLLER BOARD
Sections 7-26 except CHORUS

CHORUS ENSEMBLE BOARD
Sections 27-28

DIFFERENT ADJUSTMENT BETWEEN SERIAL NUMBERS & VERSIONS

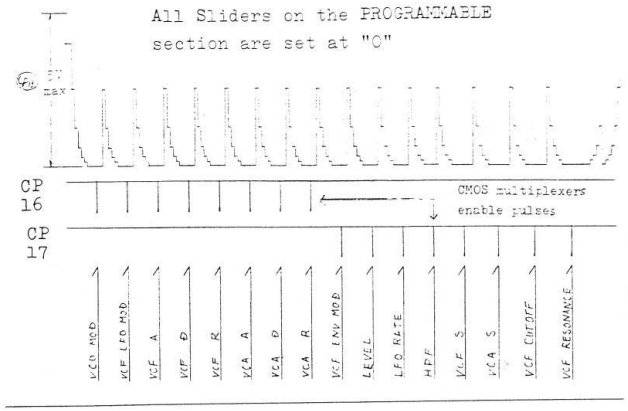
Before replacing PCB, refer to pp.12-2, 16-2 for compatibility, modifications involved or PCB combination.
Some adjusting sections and steps are selectively applicable to particular PCB as shown below.

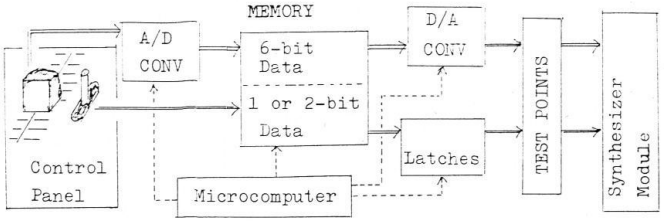
① Steps are different from for other versions.

② Sole adjustment to this version.

SERIAL NO.	KEY ASSIGNER 181-022	MODULE BOARD 181-020	CONTROL BOARD A 181-006
750100 790799	052-032 A or B	052-314 B or C Sections 11-12 ①	052-330 Section 6 ②
800800 942749		052-314 D ① Sections 11-12	Changing of VR4 LFO BEND (DELAY/BEND) to a pot with center click can omit above adjustment
952750 952799	052-032 C ② Section 3	052-314 E ① Sections 11-12	
952800 952849	052-032 B		
952850	052-032 C		
..4100	Section 3 ②	052-314 E Section 25 ② Sections 11-12 ①	

(Revised Feb. 1981)





TP	SLIDER
20	VCO MOD
21	VCF MOD
22	VCF ENV A
19	VCF ENV D
18	VCF ENV R
15	VCA ENV A
17	VCA ENV D
16	VCA ENV R
28	VCF ENV MOD
29	VCA LEVEL
30	LFO RATE
27	HPF C O F
26	VCF ENV S
23	VCA ENV S
25	LPF C O F
24	LPF RES

NOISE

TP	11
OFF	0
ON	1

SUB

TP	5
OFF	0
ON	1

VCF POLARITY

TP	7
NORMAL	1
INVERT	0

VCF KEY FOLLOW

TP	6	13
3	0	0
2	0	1
1	1	0
0	1	1

VCO WAVEFORM

TP	2	9
OFF	0	0
	1	1
	1	0
	0	1

PW/PWM

TP	14
MANUAL	1
LFO MOD	0

LFO WAVEFORM

TP	4	12
∿	1	1
⊓	1	0
◸	0	1
⊿	0	0

PULSE WIDTH

TP	3	10
4/ ⊓	1	1
3/ ↑	1	0
2/	0	1
1/ ⊓	0	0

VCO RANGE

TP	1	8
16'	0	1
8'	1	0
4'	1	1

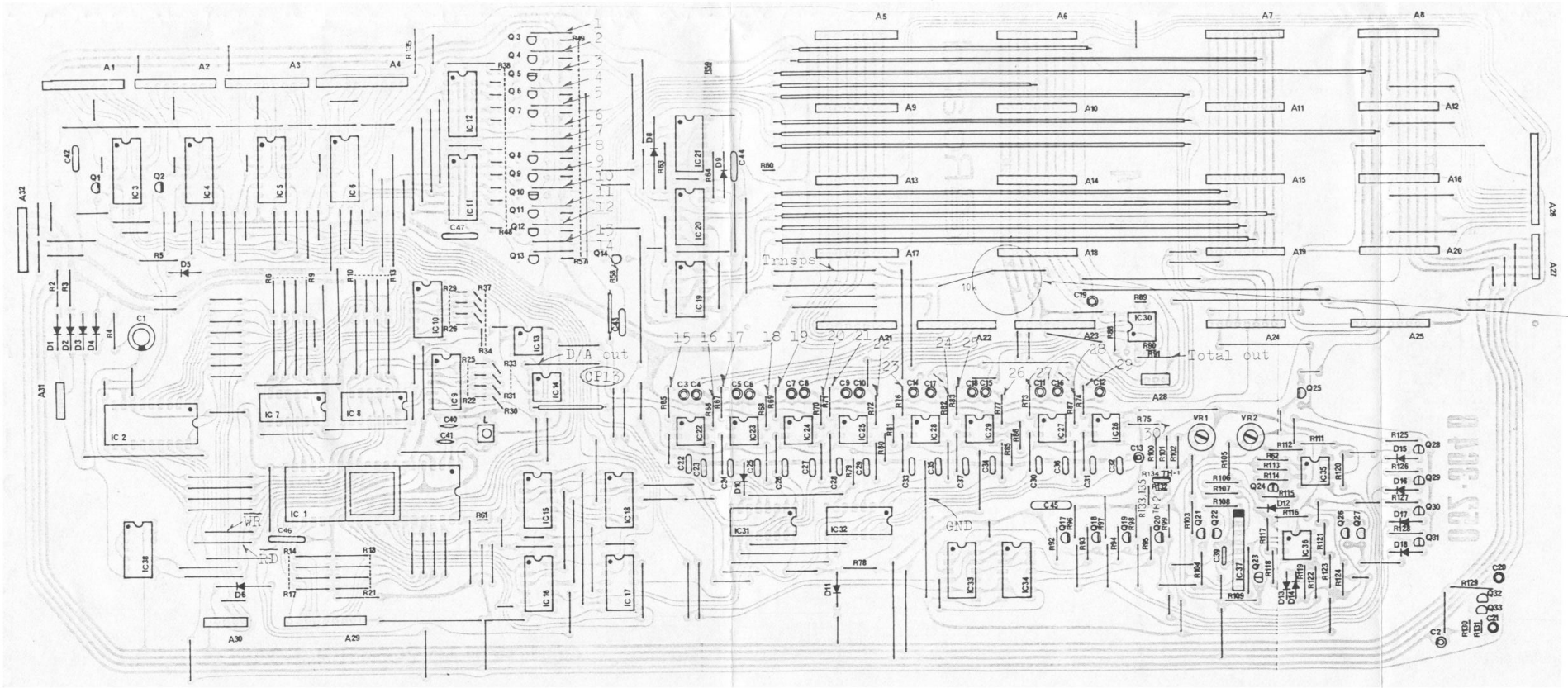
MOTHER BOARD 181-019B
(Etch mask 052-364B)

IMPORTANT

In replacing the Mother board, check both the existing board and the new replacement board for existance or absence of Q15 and Q16. If different, see page 19 for modification.

Figures in TP colum in the table to immediate right and figures at top of the other tables refer to test points shown in the PCB layout below. The following applies.

1. For sliders; voltage will vary within the range of 0V to +5V as the designated slider is being moved.
2. For switches; the output will be a logical 0 (low) or 1 (high): (0V,+15V),(-15V,+5V),(0V,+5V), depending on the lever position.



Components on foil side:

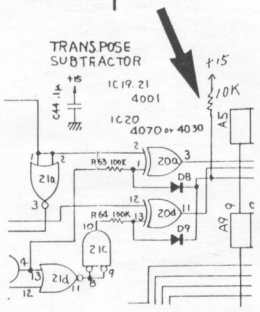
C48, C49

Connector A6, A10, A14, A18, A23 (connections to Power Supply Board E1)

To comensate for loose connection in A27,
pins 1 and 2---- GND
pin 3 -------- -15V
are directly connected to Power Supply Board via exclusive wires - both at the foil side. SEE pp. 12-1(5), 26-1.

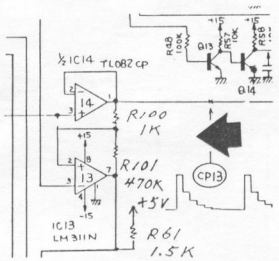
Protecting IC20 against break-down
With S/N 891900
(181-019B)

1



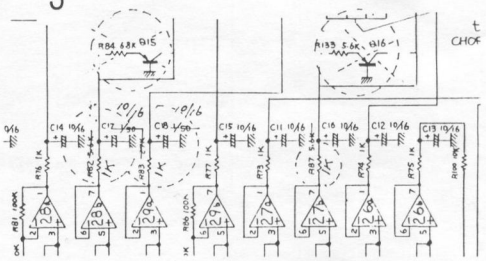
Preventing IC13 and IC14 from misreading D/A outputs
With S/N xx3800
(181-019 C/D)

2



Primary Circuit Change
Circuits in dash circles concern VCF control system.
The modifications show constant voltage application for use together with Module board 181-020 -D, -E or -F, while original ones for 181-020 -A, -B or -C.
(Refer to pp. 12 and 19.)

3



MODIFICATIONS ON MOTHER BOARD
other than those described on the left

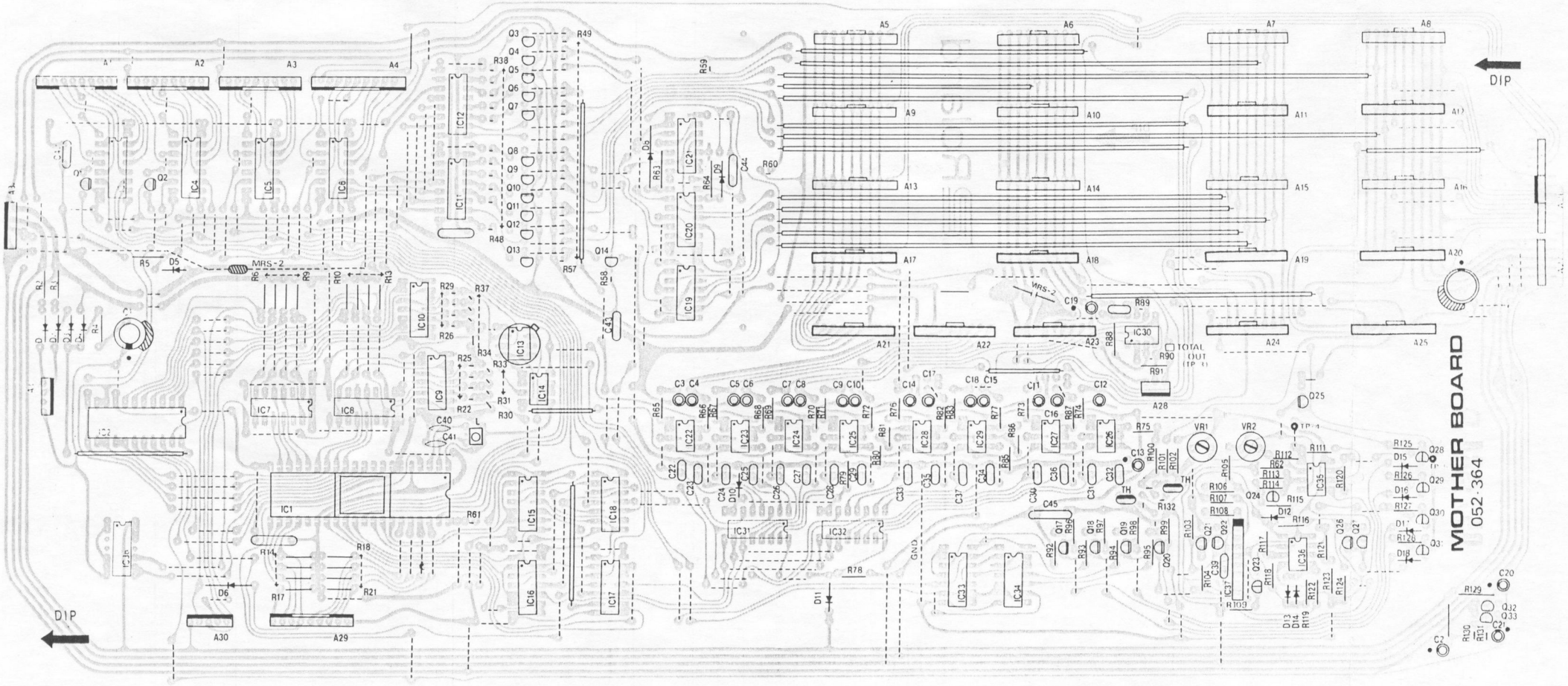
4. Disconnecting ground path from Control Boards A, B and C

The jumper wire leading to pin 1 of terminal A4 is removed to prevent noises from being induced on control boards.
With Serial Number 820950. Refer to illustration on back page.

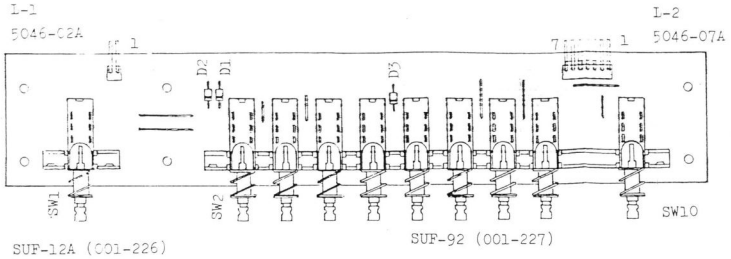
5. Direct wiring to avoid loose connections

For stable VCO performance, lead wires (-15V and ground) from power supply board 181-024 are directly soldered at terminal A27.
With Serial Number 871600. See pp. 16-2, 26-1.

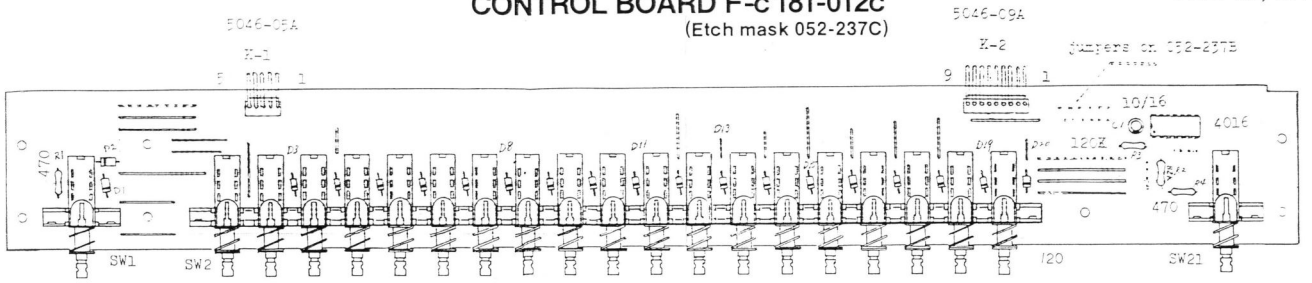
MOTHER BOARD 181-019C/D (pcb 052-364C/D)
With Serial Number 993400
(C and D: the same circuit, but minute pattern differences)
Interchangeable with B version with small modifications.
Refer to no. 3 above, and pp. 12-2, 13 and 19.



CONTROL BOARD E-a 181-011a (Etch mask 052-335A)

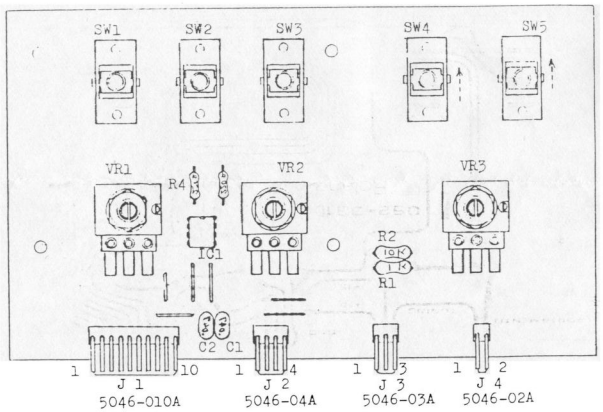


CONTROL BOARD F-c 181-012c
(Etch mask 052-237C)



CONTROL BOARD D-d 181-009d

View from foil side

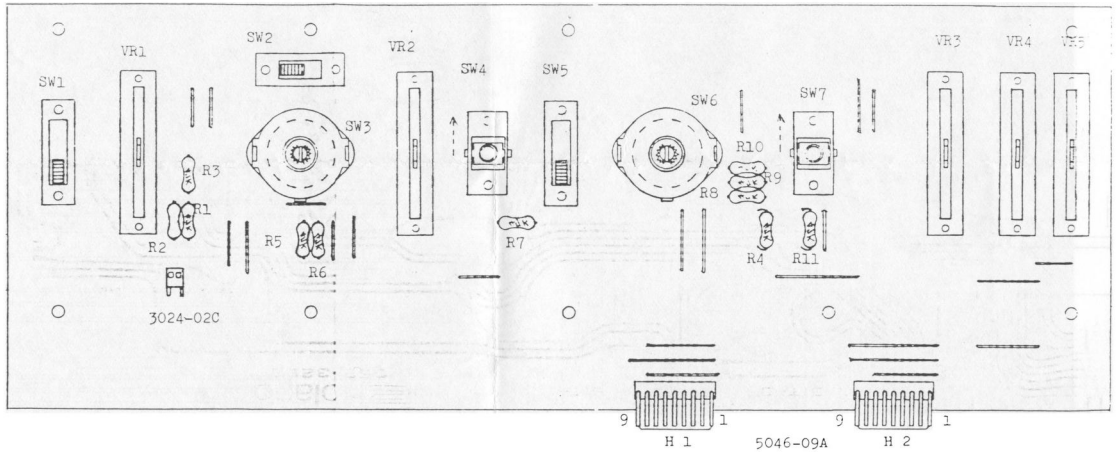


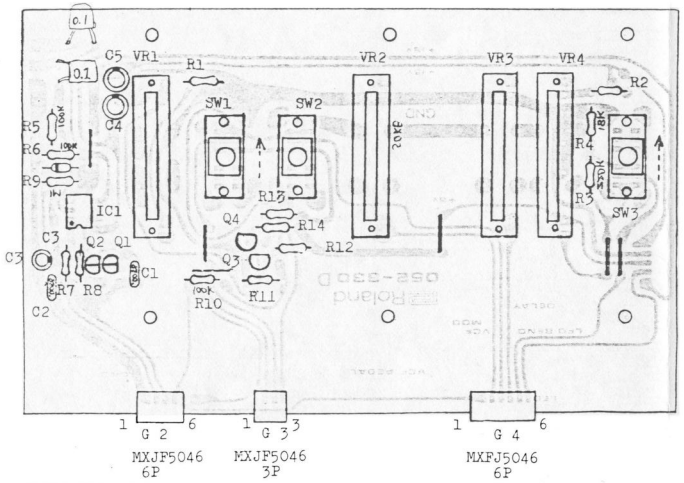
CONTROL D
SW1,2,3
LBC-23M-18K (001-238)
SW4,5
LBC-42M-18K (001-237)
VR3 VM10RB10C2MAK20 (028-756)
VR1,2
VM10RB10C50KBK20 (028-762)

CONTROL B
SW1,5
SQPR-2412P (001-228)
SW2 SSB-022 (001-182)
SW3 SRM-1034-K15 (001-234)
SW4,7
LBC-42M-18K (001-237)
SW6 SRM-1043-K15 (001-224)
All Pots
EVA-V17C16B54 (029-355)

CONTROL BOARD B-d 181-007d

View from foil side





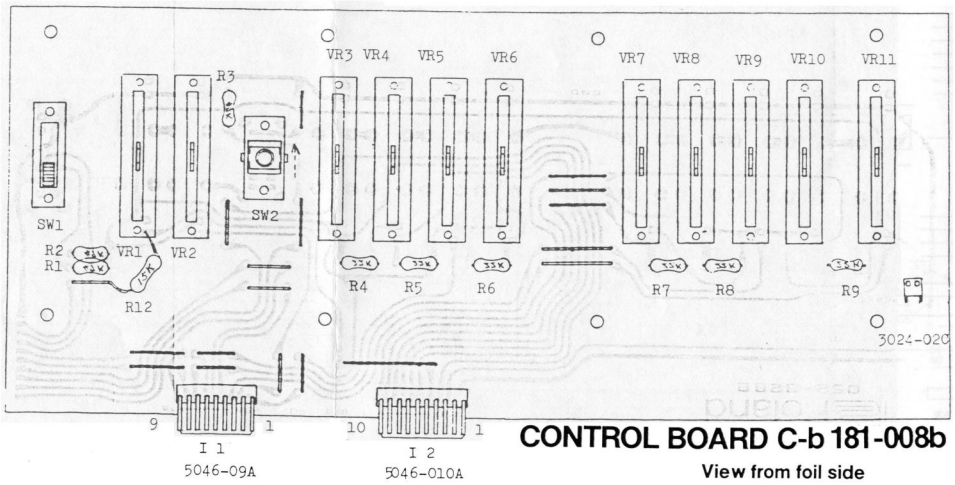
CONTROL BOARD A-d 181-006d

View from foil side

CONTROL A
VR1 EVA-V17C16A26 (029-350)
VR2 EVA-V17C16B54 (029-355)
VR3 EVA-V17C16C26 (029-370)
VR4 EVA-V23C16B54 (029-426)
When used for VR4 on 052-330B/C, center tap pin should be cut off.

SW1,2,3
LBC-42M-18K (001-237)

CONTROL C
SW1 SQPR-2412P (001-228)
SW2 LBC-42M-18K (001-237)
All Pots
EVA-V17C16B54 (029-355)



CONTROL BOARD C-b 181-008b

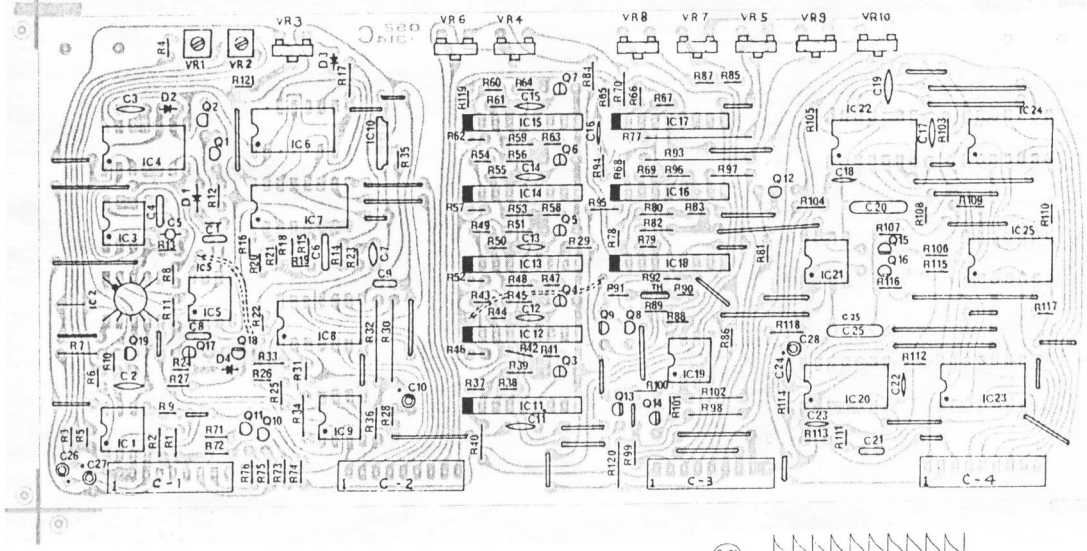
View from foil side

IMPORTANT
BOARD A -- GND of this board should be connected to top case's ground lug. See p. 12-2 for detail.
BOARD B -- VR3's value is determined according to version of KEY ASSIGNER accompanying; 052-032A/B-2MA: 052-032C-50KB.
Pins of connector J-4 are solder joint to avoid loose connection. See pp. 16-2 (list) and 25-1.

IMPROVEMENTS on MODULE BOARD and ITS PERIPHERIES

MODULE BOARD 181-020C (Etch mask 052-314C)

Read description on this page when replace this PCB.



The VCF circuit on the Module Board has been changed for easier RESONANCE adjustment and this change affects the Mother and Module Controller boards. Simplified circuits shown below illustrate the differences between the new and the old configurations.

Basic differences between the designs

Old circuit (right) Current from Constant Current Sources Q15 and Q16 is shared with four ICs. Changing one trimmer changes the loads and upsets the balance of the other modules. Adjusting the trimmer so as to accurately divide the current sources is difficult.

New circuit (left) In the new circuit, the trimmers are independent of each other because they are supplied from constant voltage sources, IC27 and IC28. Q20 and Q21 serve as V-I converters.

Information about REPLACEMENT, MODIFICATION and ADJUSTMENT

1. Replacement
   Replacement will be a new one, it requires some modifications on itself when it replaces old one. Or it requires other PCBs to be modified when new "VCF" is needed.

Note that Modules A, B, C and D in the same JP-4 must be identical.

2. Modification

-Module Controller-

Just change R36 in value.

-Mother Board-

Being of the same pattern, can easily be modified.

-Module Board-

New to Old
Follow the dotted lines; solder resistors in parallel. When VR4=47K, R135=22K, 47K and 22K in the dotted parentheses are not required.

Old to new
Practically difficult, no component holes in the PCB to accommodate Q20 and Q21.

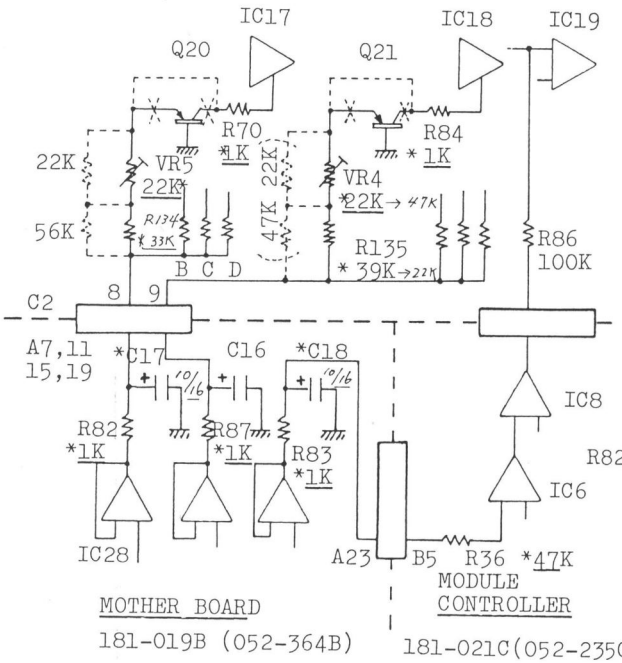
3. Adjustment

Some steps are different between versions:

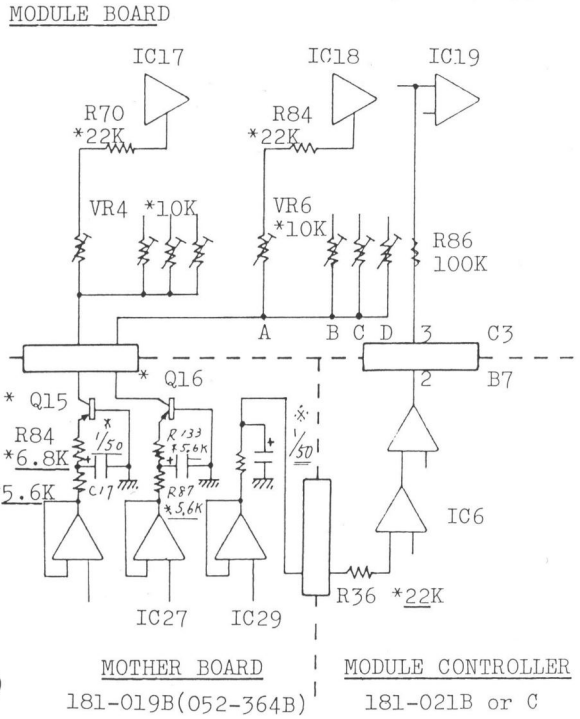
Section 11. VCF RESONANCE
052-314 A/B/C -- 11-A
052-314 D/E -- 11-B

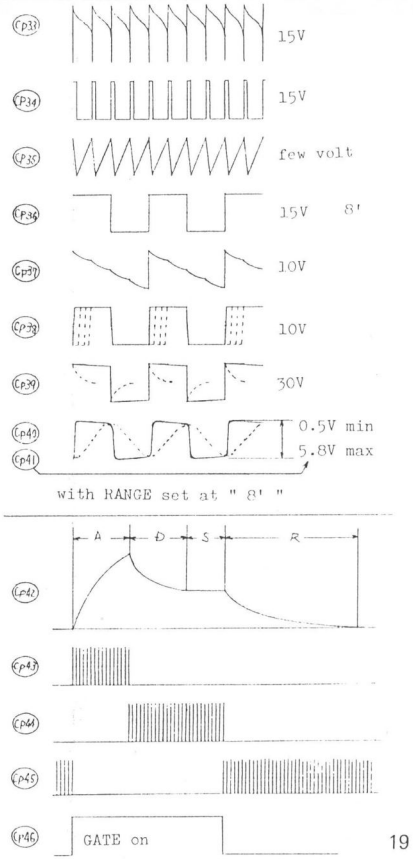
Section 25
052-314 E only

181-020 D or E
(052-314 D or E)
Serial number 800800 and higher



181-020C (052-314C)
Serial no. up to 790799





MODULE BOARD 181-020D (Etch mask 052-314D)

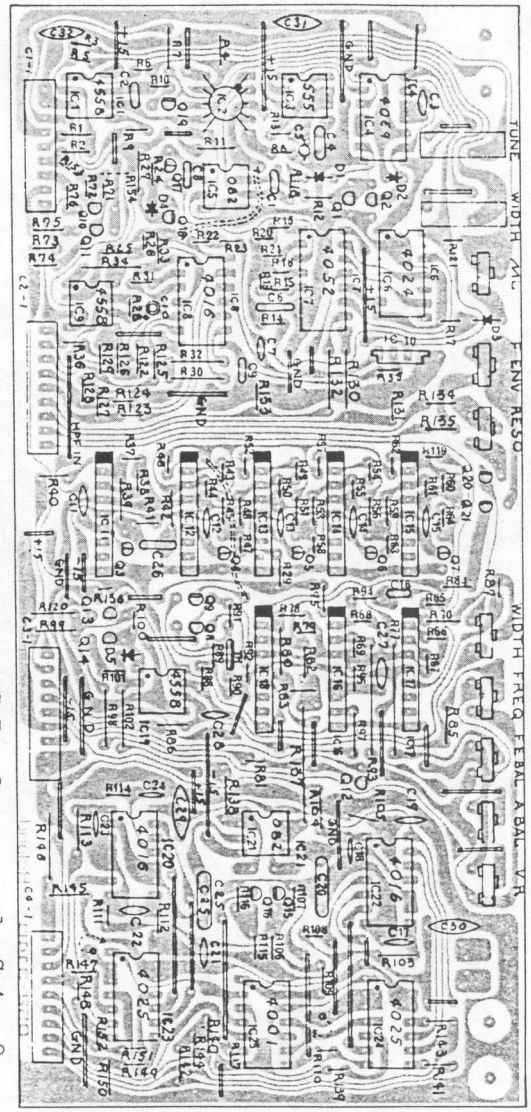
S/N 800800 to 942749

BA662

Besides BA662A and BA662B, there are factory-selected BA662's which are marked with paint in different colors accoding to their electrical characteristics.

When replacing:

1. BA662A's are good replacements for BA662B's.
2. BA662B's cannot be used for BA662A's.



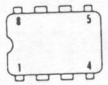
3. In any Module Board, factory-selected IC's must be a set of the same color. (except IC6 -- non selected)

Pins jumper wired:
IC3 pin 3 ---- IC4 pin 14

R153
R154 blank

MC1455P

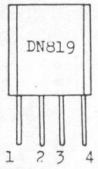
P1 SUFFIX
PLASTIC PACKAGE
CASE 626
(Top View)
(MC1455P1 only)

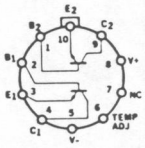


1. Ground
2. Trigger
3. Output
4. Reset
5. Control Voltage
6. Threshold
7. Discharge
8. Vcc

(TOP VIEW)

µA726H





MODULE BOARD 181-020E (Etch mask 052-314 E)

Serial No. 952750 and higher

DIFFERENCES FROM THE PREDECESSORS

Using IC12 IR3109 for VCF in place of BA662 selected.
Adding VCF INV ADJ. for easier preset "VOICE" sound tailoring.

Although interchangeable with former PCBs, the following are involved when replacing:

Different steps for VCF FREQ and WIDTH adjustments
Some alterations on this pcb - when existing one is 181-020 B or C - to meet circuit configuration indicated on p.19 (in this case read 181-020D as 181-020E).

SUPPLEMENT p.21

BA662 (also see p.16-2 "2")

The BA662 is a current controlled variable transconductance (vari-gm) amp custom made for Roland products. Device with A suffix features low offset coefficient than one with B suffix. "A" can replace "B" except when "gm" is a great factor.
Some devices miss suffix at IC-maker and need markings wherever stored for future use.

Factory Selected (colored) BA662

BA662's are further graded based on "gm", painted in a color. Both "A" and "B" in the same color are characterized by a gm in the same range.
Colored IC can replace uncolored one on which no specific gm is placed by the circuits. Factories might use selected ICs for non-selected in assembling pcbs, if colored ICs are surplus, in stock.

CORRECTION

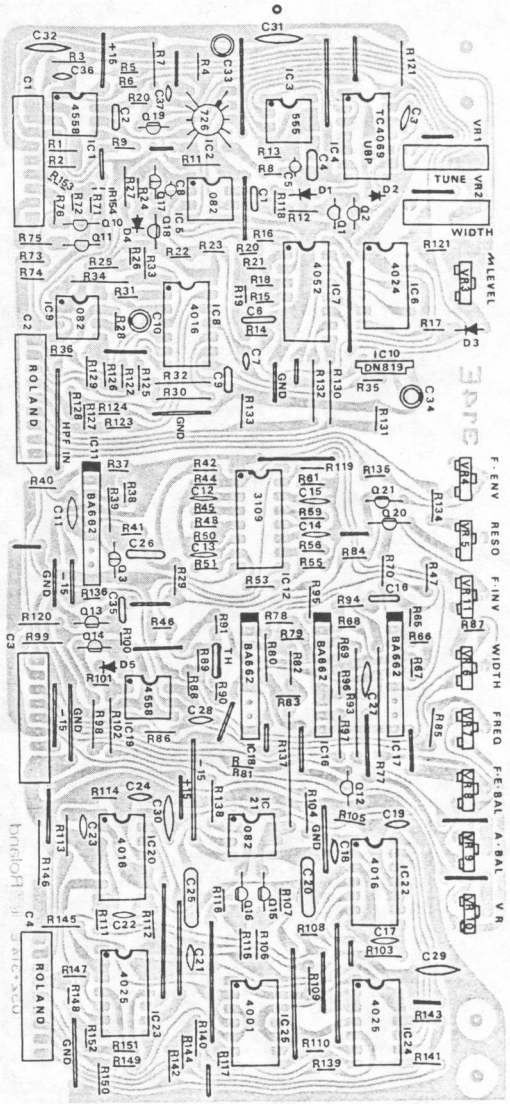
p.20 Trimpot, VR number

RESONANCE	VR-4 to VR-5
VCF ENV	VR-3 to VR-4

p.21 3. In any Module .... to

3. In any Module Board as well as in four modeles, factory selected ICs should be a complete set of the same colore except IC16.

See p.16-2 IC SPECIFICATION 2.

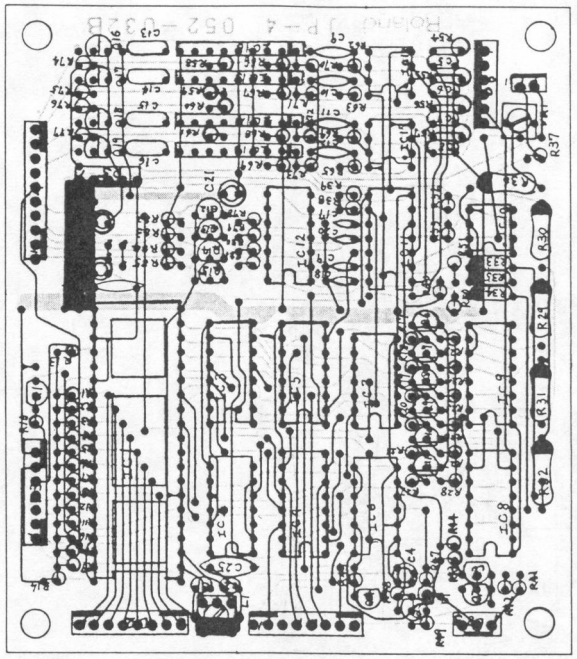


KEY ASSIGNER BOARD 181-022B

(Etch mask 052-032B)

5045-10A

5045-07A



Parts attached on foil side:

D2, D3 --- 1S1588

C3 ------- 22pfd

5045-08A 5045-03A

NOTE:

BA662A can replace BA662B.

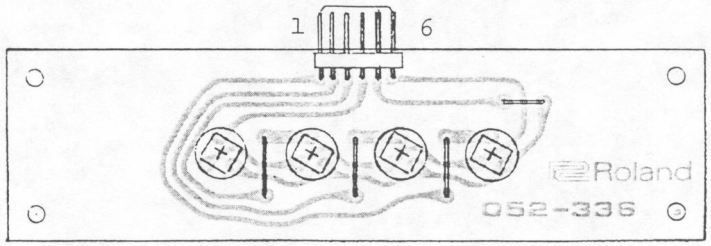
Factory selected BA662's (painted) must be a set of the same color.

When a PORTAMENTO TIME is not coincident with other Modules' due to IC replacement,(IC13-IC16), cut and try the capacitor. (C13-C16)

CONTROL BOARD G 181-013

(Etch mask 052-336)

5046-06A



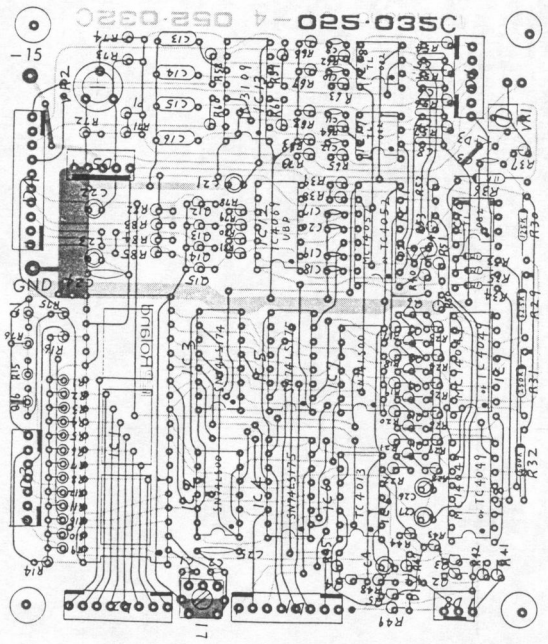
View from foil side

All trimmers
CR19R 47KB

KEY ASSIGNER 181-022C (pcb 052-032C)

Serial Numbers 952750-952799
952850-

NOTE: S/N 952800-952849
181-022B



to CONTROL BOARD D
J-4

181-022B and 181-022C
INTERCHANGEABLE
With PORTAMENTO (VR-3)
on CONTROL BOARD D
changed as PCBs change:

181-022B--VM10RB10C
K20 2MA

181-022C--VM10RB10C
K20 50KB

ADJUSTMENT

PORTAMENTO - VR2
C version only

IC13 1R3109

Four circuits on one chip provide synchronous Portamento Times.

IMPROVEMENTS ON 181-022B

Capacitors and Diode for IC11 protection
S/N 861500-
C26, C27 and D4 are connected to IC 4052 as shown in dashed cicles on circuit diagram, facing page, to protect it against breakdown due to charged voltages.

Connector By-Pass Wirings - for stable CV and VCO voltages -
Compensation for loose-connections
S/N 861500-
Plugs and receptacles on D7 (Key Assigner) and J-4 (Control Board D) are solder jointed, or leads are directly soldered on conductive foils at terminal areas. This treatment also eliminates impedient Portamento effects in PORTAMENTO OFF mode.

S/N 871600-
Besides original wirings through connectors, -15V and Ground for Key Assigner are fed through additional sole wires from Power Supply board to D5 pin 3 (-15V),and pin 1 or 2 (GND). Lead ends are soldered at the foil side.
(Refer to p. 26-1 Power Supply Board.)

JULY 31, 1979

MODULE CONTROLLER BOARD 181-021C

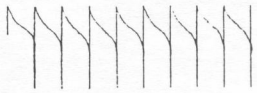
(Etch mask 052-235C)

NOTE:
R36 = 47K when associate Module Boards are 052-314D
R36 = 22K when the Module Boards are 052-314C
Refer to "Improvements on MODULE BOARD" on page 19.

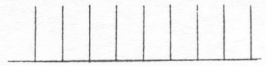
Holder No.185A

Nylon rivet NRP-345

D1-D6 Cathodes

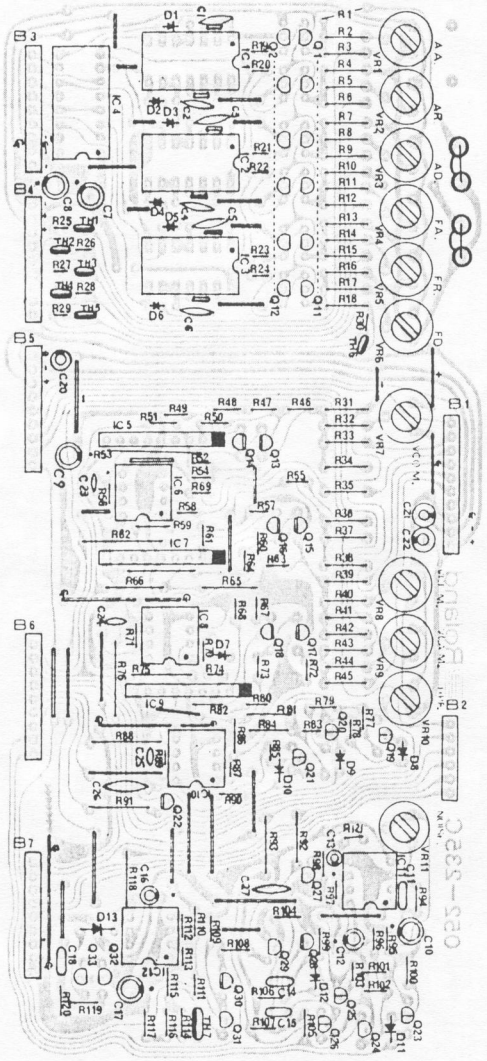


CLKs(TC4049) Outputs



Moving the A, D or R sliders from bottom to top will increase the frequency by approximately 1000.

Housings PICD-9S-TL1



Wafer terminal
5045-10A

Wafer terminal
5045-06A

Holder No.184A

MODULE CONTROLLER BOARD 181-021D/E

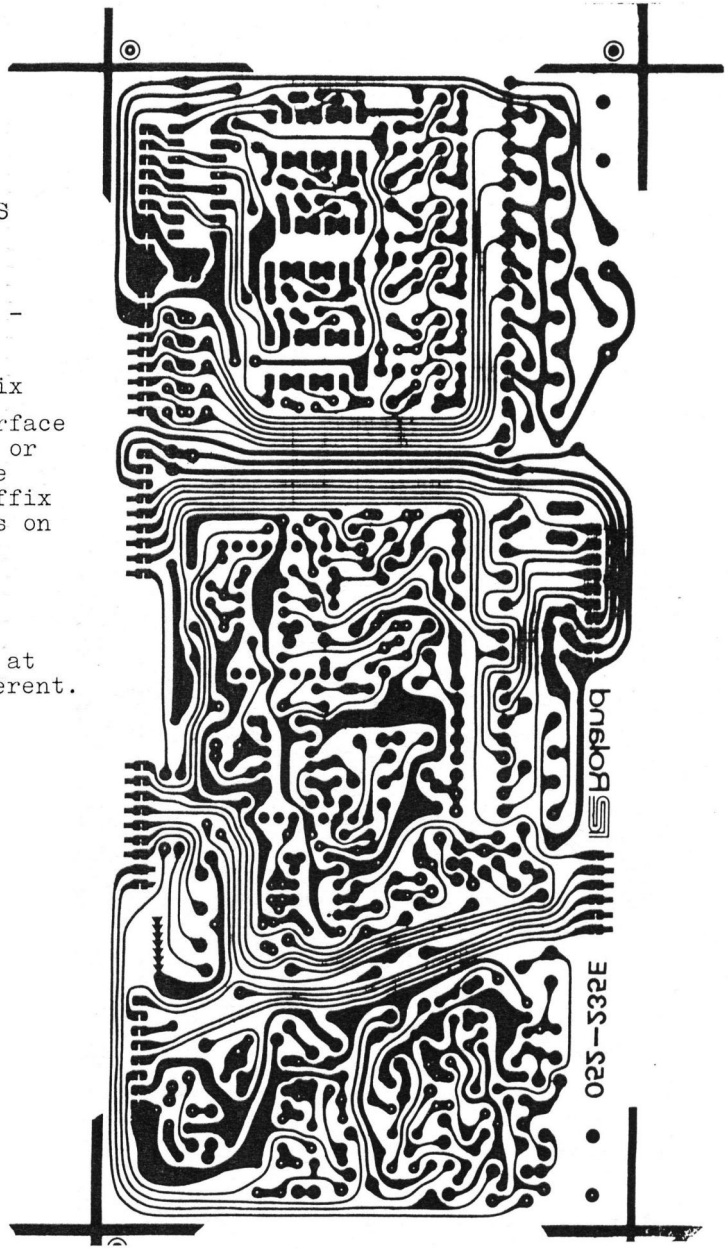
(Etch mask 052-235D/E)
S/N 912200 and above

DIFFERENCES BETWEEN PCBS
WITH DIFFERENT SUFFIX

- No differences in circuit configuration -

C suffix vs D or E suffix

components which are surface mounted (at foil side) or series-connected outside component holes on C suffix are accomodated in holes on D or E.

D suffix vs E suffix

Only conductor spacings at terminal areas are different.