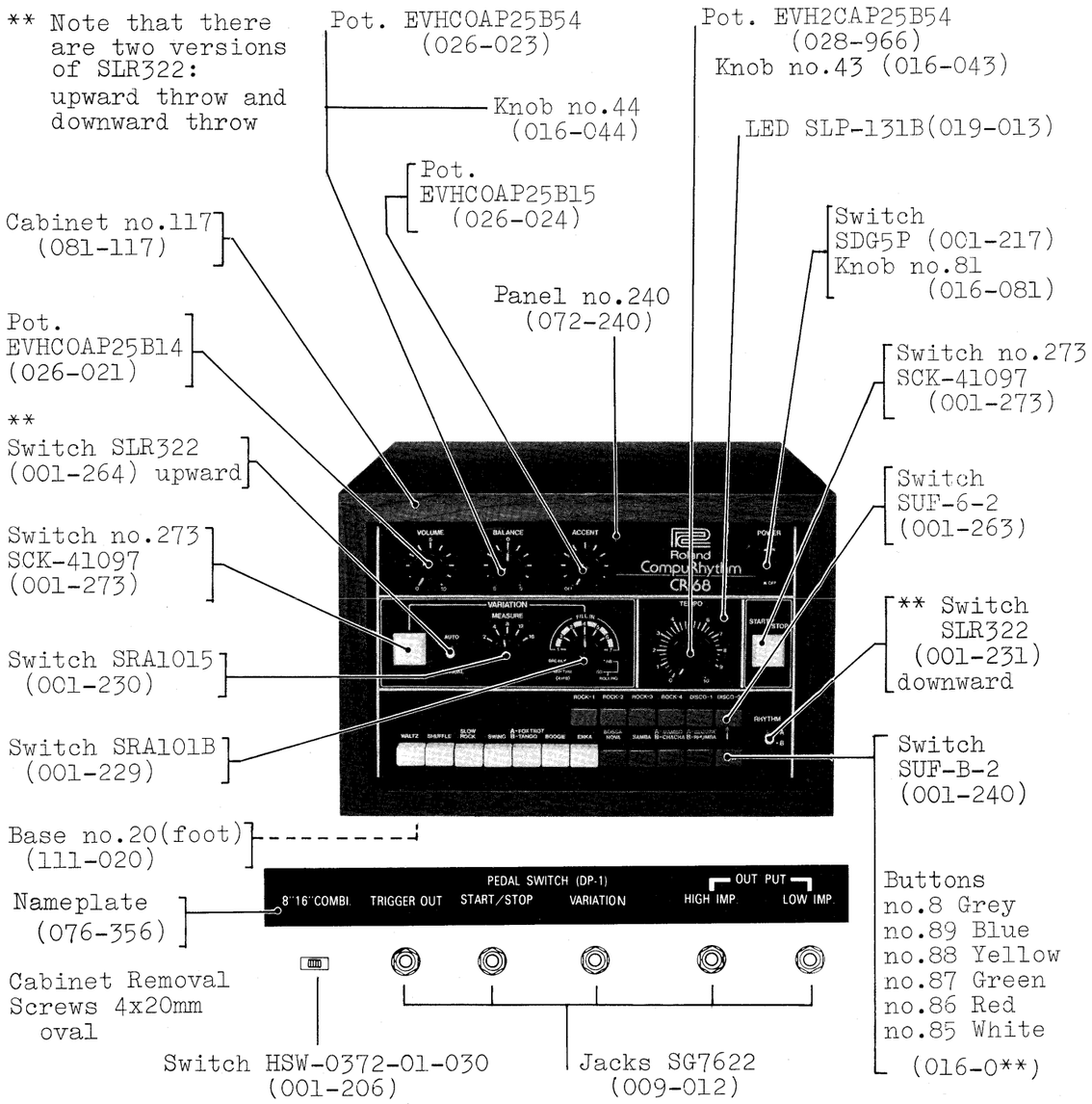
CR-68 SERVICE NOTES

SPECIFICATIONS

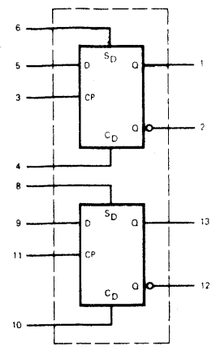
OUTPUT LEVEL	OdBm max @ Vol. max	Accent min
OUTPUT IMPEDANCE	Hi: 220k-ohm	Lo: 10k-ohm
TRIGGER PULSE OUTPUT	On: +15V	Off: 0V
POWER CONSUMPTION	8 watts	
DIMENSIONS	260(W) x 275(D) x 180(H)mm	
WEIGHT	4.5kg	

** Note that there are two versions of SLR322: upward throw and downward throw



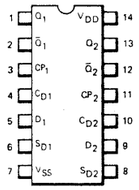
LOGIC SYMBOL

F4013



V_{DD} = Pin 14
V_{SS} = Pin 7

CONNECTION DIAGRAM DIP (TOP VIEW)



NOTE:
The Flatpak version has the same pinouts (Connection Diagram) as the Dual In-line Package.

F4013 TRUTH TABLES

SYNCHRONOUS INPUTS		OUTPUTS	
CP	D	Q_{n+1}	$\bar{Q}_{n+1}$
↑	L	L	H
↑	H	H	L

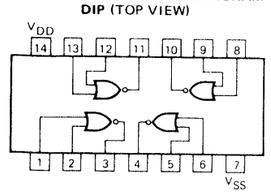
Conditions: S_D = C_D = LOW

ASYNCHRONOUS INPUTS		OUTPUTS	
S_D	C_D	Q	$\bar{Q}$
L	H	L	H
H	L	H	L
H	H	L	L

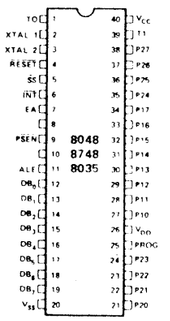
L = LOW Level
H = HIGH Level
↑ = Positive-Going Transition
X = Don't Care
Q_{n+1} = State After Clock Positive Transition

F4001 QUAD 2-INPUT NOR GATE

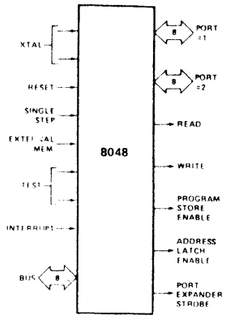
F4001
LOGIC AND CONNECTION DIAGRAM DIP (TOP VIEW)



PIN CONFIGURATION

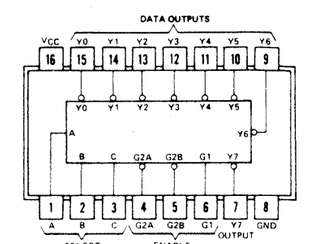


LOGIC SYMBOL

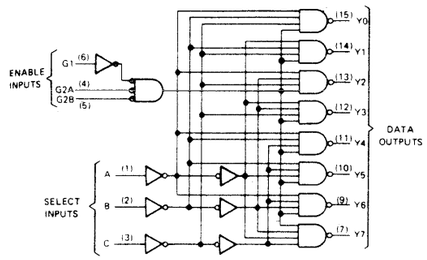


DECODERS/DEMULTIPLEXERS

SN54LS138, SN54S138 . . . J OR W PACKAGE
SN74LS138, SN74S138 . . . J OR N PACKAGE
(TOP VIEW)



'LS138 S138

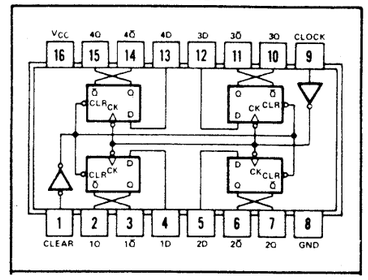


'LS138, 'S138
FUNCTION TABLE

INPUTS					OUTPUTS							
ENABLE		SELECT										
G1	G2*	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

*G2 = G2A + G2B
H = high level, L = low level, X = irrelevant

SN54175, SN54LS175, SN54S175 . . . J OR W PACKAGE
SN74175, SN74LS175, SN74S175 . . . J OR N PACKAGE
(TOP VIEW)



TYPES	TYPICAL MAXIMUM CLOCK FREQUENCY	TYPICAL POWER DISSIPATION PER FLIP-FLOP
'174, '175	35 MHz	38 mW
'LS174 LS175	40 MHz	14 mW
'S174 'S175	110 MHz	75 mW

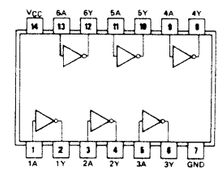
QUADRUPLE D-TYPE FLIP-FLOPS

FUNCTION TABLE
(EACH FLIP-FLOP)

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

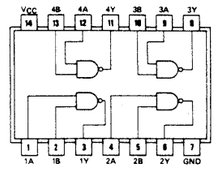
H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated steady-state input conditions were established.
† = '175, 'LS175, and 'S175 only

HEX INVERTERS

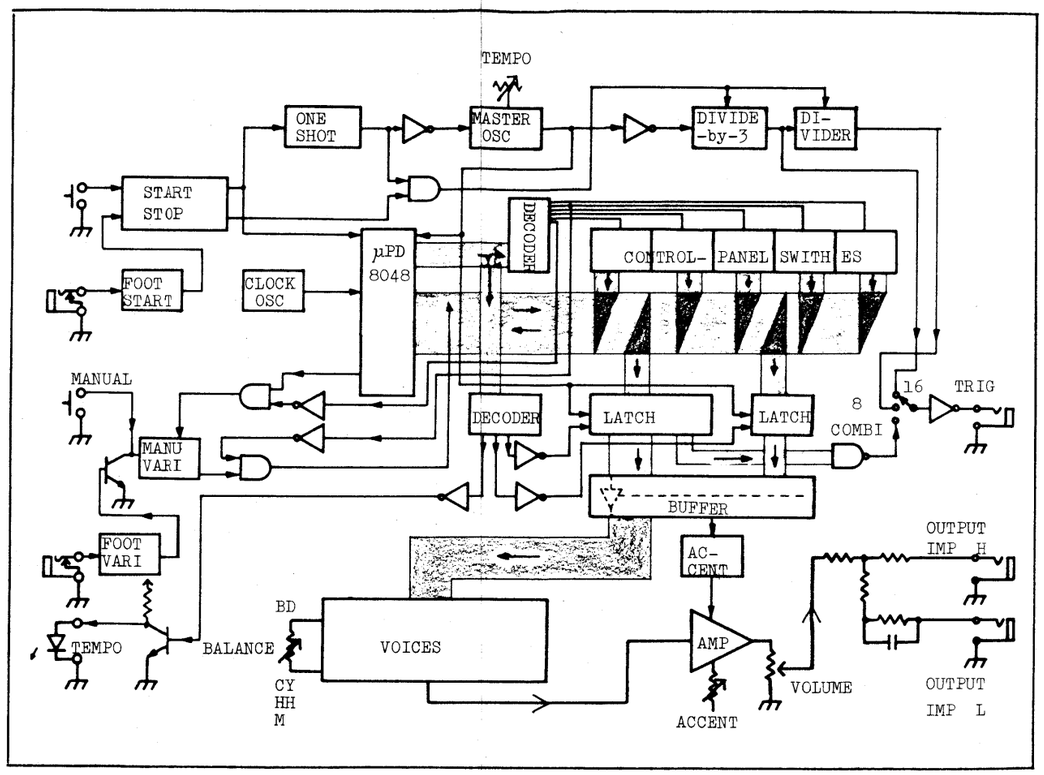


SN5404 (J)	SN7404 (J N)
SN54H04 (J)	SN74H04 (J N)
SN54L04 (J)	SN74L04 (J N)
SN54LS04 (J W)	SN74LS04 (J N)
SN54S04 (J W)	SN74S04 (J N)

QUADRUPLE 2-INPUT POSITIVE-NAND GATES



SN5400 (J)	SN7400 (J N)
SN54H00 (J)	SN74H00 (J N)
SN54L00 (J)	SN74L00 (J N)
SN54LS00 (J W)	SN74LS00 (J N)
SN54S00 (J W)	SN74S00 (J N)



CIRCUIT DESCRIPTION

COMPUTER BOARD GL-10

The uPD8048 is an 8-bit parallel computer fabricated on a single sillicon chip. The 8048 contains a 1k x 8 ROM program memory, a 64 x 8 RAM memory, 27 I/O lines, an 8-bit timer/counter and clock circuits.
Used on this board is a uPD8048C-015 version in which program and data dedicated to the CR-68 are stored in the program memory.

1. SCANNING for IDENTIFYING PANEL SWITCH SETTINGS

The uPD8048 reads panel switch settings by scanning the lines through Port 2 (P24-P27) of IC10, IC8 (74LS-138, Decoder) and Port 1 (P10-P17) of IC10. The output from IC8 (Binary-to-octal decoder) goes through one of properly arranged switches and matrix to port 1. For example let's assume that SWING switch is depressed. When A input of IC8 is high and B, C and G2B inputs are low as shown in Fig. 1. The output of 1 goes low and other outputs go high.
Since Port 1 (P10-P17) functions now as an input port and 1 of IC8 is low with SWING switch on, only P10 of IC10 goes low. IC10 reads this condition of Port 1 and identifies that SWING switch is depressed. By repeating such scanning, the computer can identify every switch setting in sequence.
This scanning and reading, in STOP mode, are performed continously in very short periods by pulses with durations of several microsecons, bur after START switch is pressed, this scanning is performed once a measure -- just before the measure is initiated.

2. SENDING OUT RHYTHM PATTERNS

After panel settings are identified as described above, the data corresponding to the identification is selected from contains of the ROM and fed into Port 1 and Port 2.
Tow 74LS138's (IC8 and IC9) are used in parallel to constitute a binary-to-hexadecimal decoder. In this case, Port 1 of IC10 functions as an output port.

3. VARIATION TURNED ON WITH MANUAL BUTTON

Since the computer reads data once in one measure, if MANUAL button is pressed during the period between one reading and another, a circuit is required to memorize the switching, which consists of IC4 (74LS00) and other components.
IC4a and IC4b constitute an RS flip-flop which is reset when START/STOP button is tapped to start the rhythm unit. When reset in this way, pin 3 of IC4a goes high, and pin 6 of IC4b goes low and hereafter this condition is held.
In reading, with MANUAL button off, pin 6 of IC4b remains low and pin 8 of IC4c is held high independent of the condition of pin 10 of IC4c. When MANUAL button is pressed, pin 5 of IC4b immediately goes low and RS flip-flop is set. Pin 3 of IC4a goes low and pin 6 of IC4b goes high and this condition is held.
When a negative going pulse is sent out from 4 of IC8 while reading switch positions, the pulse is inverted by IC2c and this inverted positive pulse is fed to pin 10 of IC4c. Since pin 9 of IC4c is kept high, a negative going pulse is sent out from pin 8 of IC4c and fed into Port 1 through D209. Thus, the computer detects that MANUAL button has been pressed.
Immediately after reading, the computer sends out a negative going pulse from 0 of IC8 to reset RS flip-flop. To prevent malfunction, this pulse (after invertion by IC2a) and a pulse from ALE of IC10 are NANDed to produce a reset pulse. see Fig. 2

4. CLOCK GENERATOR IC3e, IC3f

This circuit, a clock generator from which pulses are emitted to synchronize the operations carried out by the computer, is a CR oscillator consisting of IC3e, IC3f and other components. The oscillator generates clock signals of about 3MHz which are fed to XTAL pin of IC10.

5. MASTER OSCILLATOR Q101, Q102

This oscillator determines the tempo of the rythm and is a multivibrator consisting of Q101, Q102 and other components, whose oscillation period is variable from 10ms - 200ms with TEMPO control VR2.

6. START CIRCUIT IC5b, IC1a - IC1d, IC2b

This circuit consists of IC5b (D flip-flop) and other components. The output "Q" on pin 1 of IC5b is connected to T1 of IC10.
Immediately after POWER switch is set to ON a short positive going pulse with the time constant of R212 and C208 is generated at pin 11 of IC1d and resets IC5b. Q on pin 1 goes low and $\overline{Q}$ on pin 2 goes high. Consequently, when POWER switch is set to ON, IC10 is always set in the idling mode. (When T1 of IC10 is low, the computer stops all functions except scanning).
When START button is pressed, a positive pulse is generated at pin 4 of IC1b which is fed into pin 3 of IC5b. Q goes high and $\overline{Q}$ goes low. Then T1 of IC10 goes high to start the rhythm unit.
The one shot pulse generator consisting of IC1a, IC1c, IC2b and other components detects the leading edge of an output waveform from Q on pin 1 of IC5b and generates a pulse with a duration of about 30ms which resets the master oscillator when the rhythm unit starts. see Fig. 3

7. FOOT SWITCH CIRCUIT IC3a - IC3d

The foot switch circuit for START/STOP consisting of IC3a, IC3b and other components, and that for VARIATION consisting of IC3c, IC3d and other components, are almost the same circuit. A CR time constant circuit combined with a schmitt trigger circuit is used to prevent malfunction caused by foot switch chattering.

8. DIVIDER IC7a, IC5a, IC6a, IC6b

To send out clock pulses with 8 beat and 16 beat to TRIGGER OUT jack, a circuit is required to divide the output signals from the master oscillator into 1/3 and 1/6. The circuit consists of four MC14013B's (D flip-flop, IC7a, IC5a, IC6a, and IC6b) and other components. IC7a, used as an inverter, shapes output waveforms from the master oscillator to prevent the divide-by-3 circuit from malfunctioning. The singals are fed into the divide-by-3 circuit consisting of IC5a and IC6b to be converted to signals with 16 beat and sent from Q on pin 1 of IC6b.
Signals fed from $\overline{Q}$ on pin 2 of IC6b to CP on pin 11 of IC6a are divided again to be converted to signals with 8 beat and sent out from Q on pin 13 of IC6a.
see Fig.4

VOICING BOARD VG-12

1. LATCH IC1 -- IC3

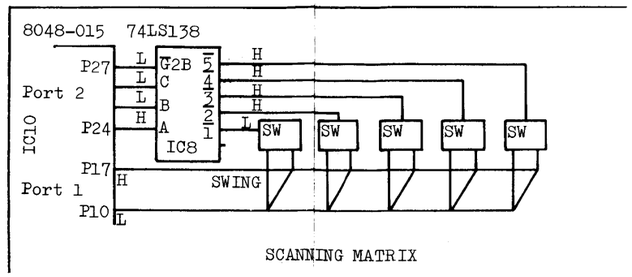
This circuit, consisting of three 74LS175 flip-flops, take output pulses to be latched from Port 1 and Port 2 through IC2d and IC2e (clock), and take pulses from the master oscillator to clear the preceding latch, producing 5V positive going pulse, i.e. rhythm pattern, with the same duration as output pulse of the master oscillator.
The output pulses from the flip-flops are converted by Q25-Q35 into negative going pulses with a +15V-0V swing and fed into inputs of the voicing circuits.
see Fig. 5

2. ACCENT CIRCUIT Q21, Q24, VR14

This circuit is used to add accent to a rhythm according to a preset accent pattern by changing the sound level at the output amplifier. The circuit consists of the ACCENT (VR14), Q21, Q24 and other components. An accent pulse from $\overline{Q}$ on pin 3 of IC1 passes through Q21 and then is differentiated and intergrated to be converted to a proper envelope signal which is fed into the gate of FET (Q24).
Q24 is off when a signal is not provided at the gate. In this case, the voltage of the output signal from Q9 is divided by the ratio of R137 (68k-ohm) to the input impedance of Q10 and is fed into Q10. When a signal is fed into the gate, Q24 is turned on.
With ACCENT control at 10, most the signal flows into the accent potentiometer and Q24, but very little into R137, giving a high level output signal which is used to add accent.

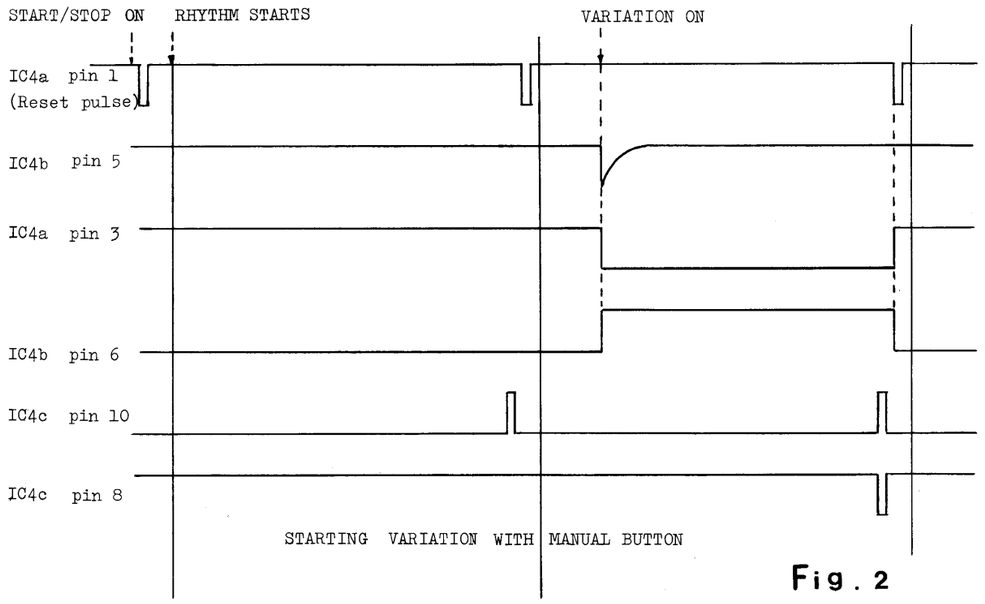
3. LEAKAGE SOUND KILLER Q20, Q23

These circuits are designed to kill sound from the voicing circuits generated by transient voltage when power is turned on or off. When power is on, Q20 will not function normally until C79 charges enough in respect to the emitter.
The voltage drop at the gate of Q23 is quicker than it is at the drain or source after trun, so that Q23 is shut off.



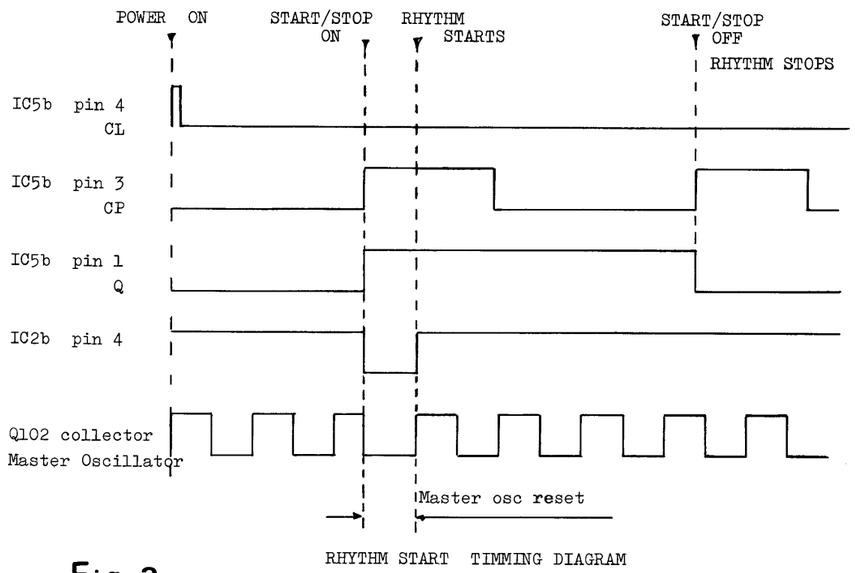
SCANNING MATRIX

Fig.1



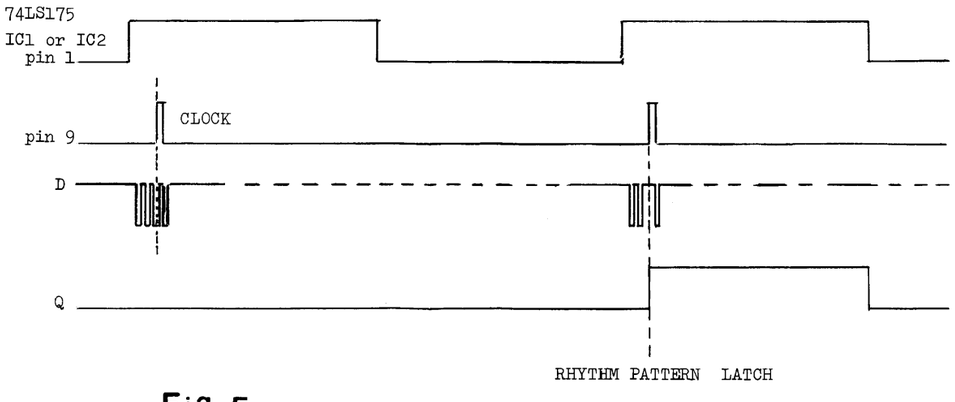
STARTING VARIATION WITH MANUAL BUTTON

Fig.2



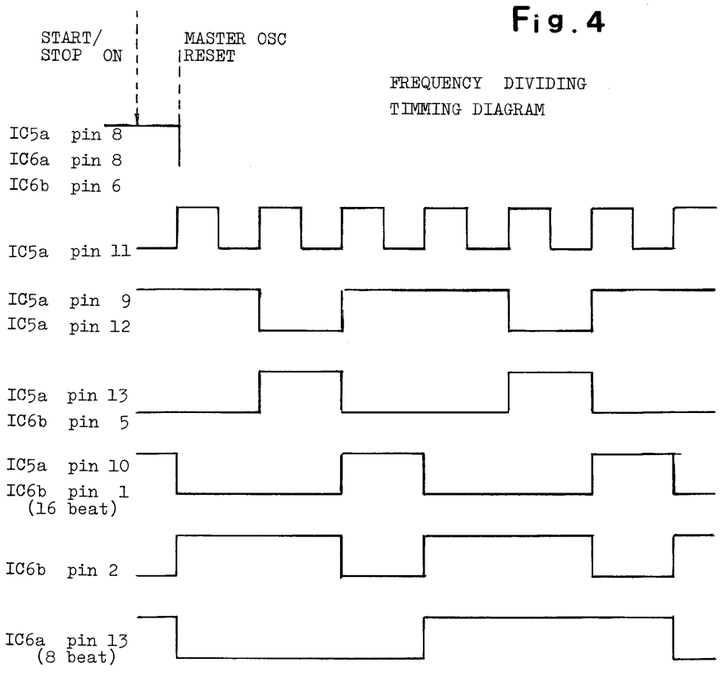
RHYTHM START TIMMING DIAGRAM

Fig.3



RHYTHM PATTERN LATCH

Fig.5

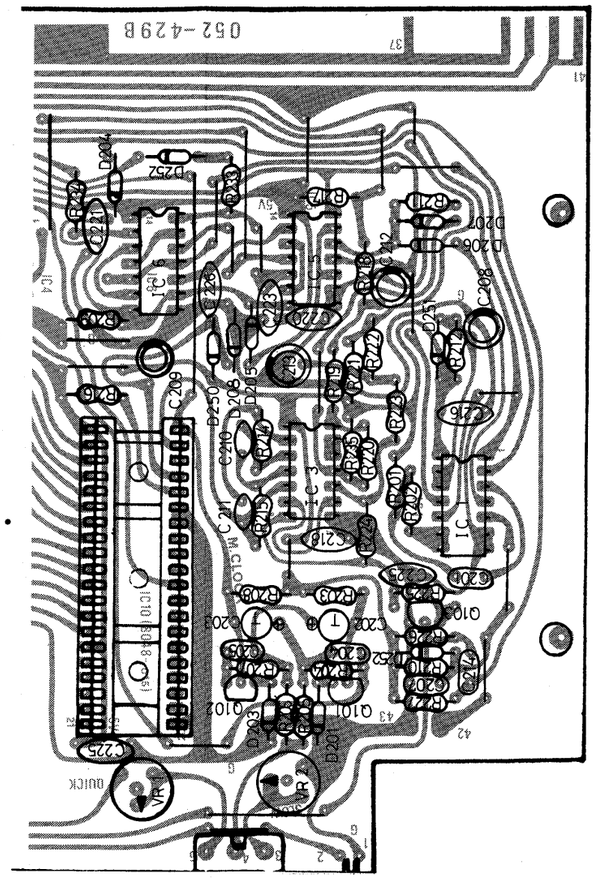


FREQUENCY DIVIDING
TIMMING DIAGRAM

Fig.4

Refer to the function table on page 1

GL-10B(142-010B) VIEW from FOIL SIDE Serial No.822000 and up



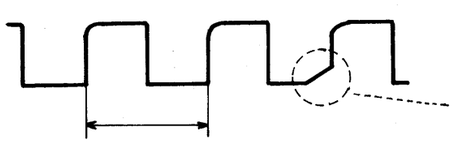
Portions of pattern not shown remain unchanged.

Both GL-10A and GL-10B correspond to the same circuit diagram since some components are attached on the foil side or connected in series in the form of pyramid on GL-10A and accommodated on GL-10B in place.

CAUTION: Always handle MOS ICs while wearing an earth grounded wristband to prevent failure of ICs due to electrostatic discharge. All test equipment must also be earth grounded.

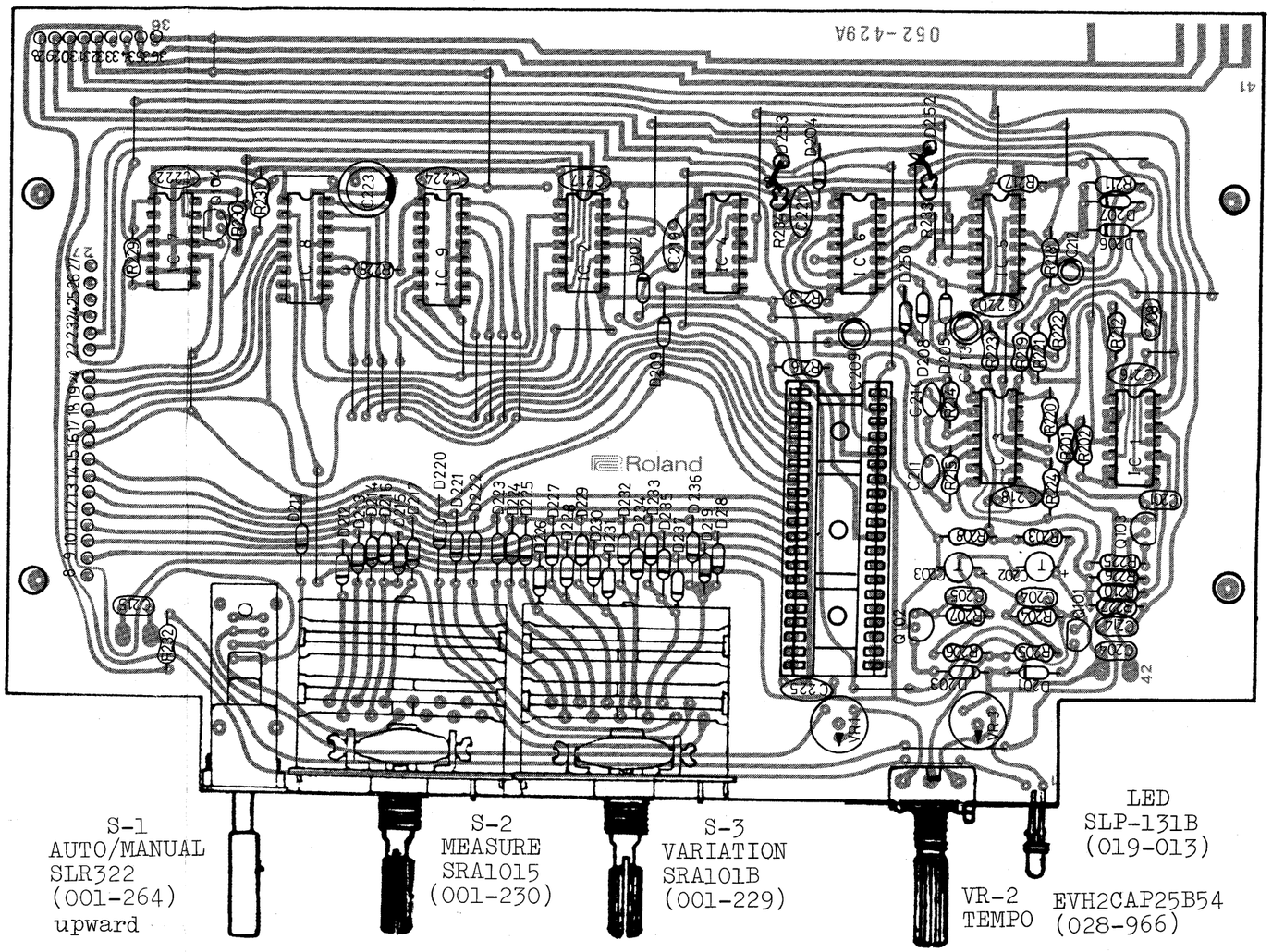
RHYTHM TEMPO ADJUSTMENT

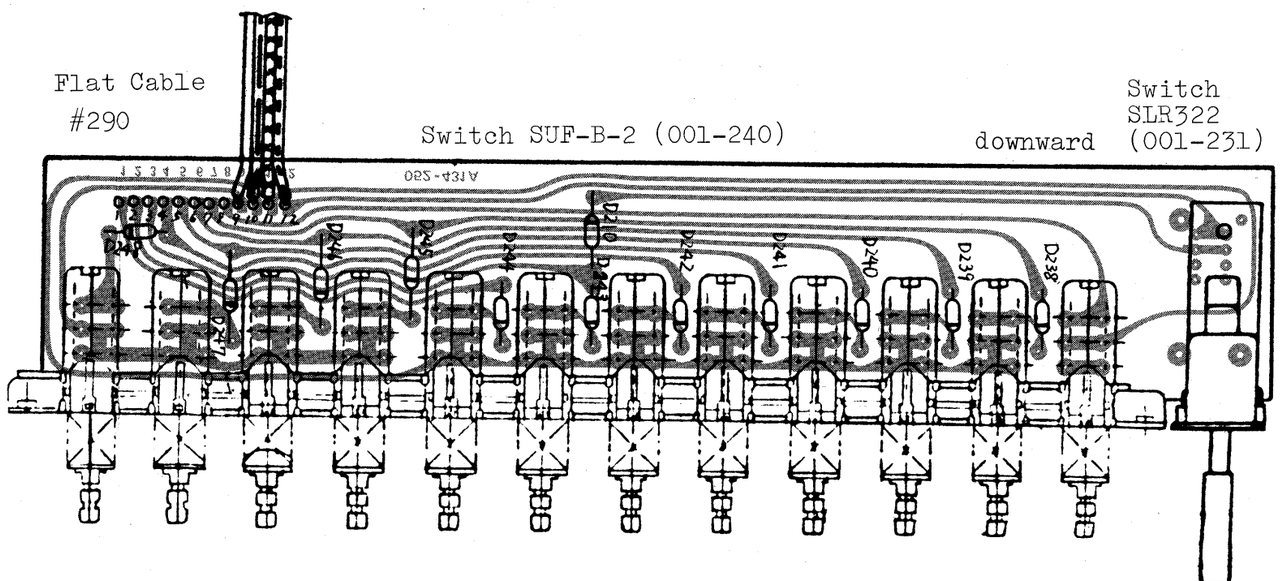
1. Connect scope to Q102 collector (Master Oscillator).
2. Turn TEMPO knob full clockwise (QUICK).
   Adjust VR1 for 10ms between fall or rise of squares.
3. Turn TEMPO knob full counterclockwise (SLOW).
   Turn VR3 in the direction in which the period becomes shorter than 200ms. Stop, then rotate VR3 slowly in the reverse direction until the period is 200ms.
4. Repeat steps 3 and 4.



10msec (QUICK)
200msec (SLOW)

If bottom portion is insuficiently saturated, replece Q101 and Q102 with a new pair of the same rank.





RS-16A(148-016A)

GL-10

clear
clock
clock

OP-133
Serial no. up to 760899

Components shown in OP-133 are located on GL-10 Serial no. 770900 and up.

MASTER OSCILLATOR

ONE SHOT PULSE GENERATOR

INVERTER

DIVIDE-by-3

OP-133

DIVIDER

TEMPO LATCH

OP-133

TEMPO LED

SLP-131B

QUICK

SLOW TEMPO

DECODER

VARIATION SW

RHYTHM PUSH SW

See below for switch rhythm names

D238 D239 D240 D241 D242 D243 D244

RS-16

VG-12

RESET (power on)

CLOCK OSC

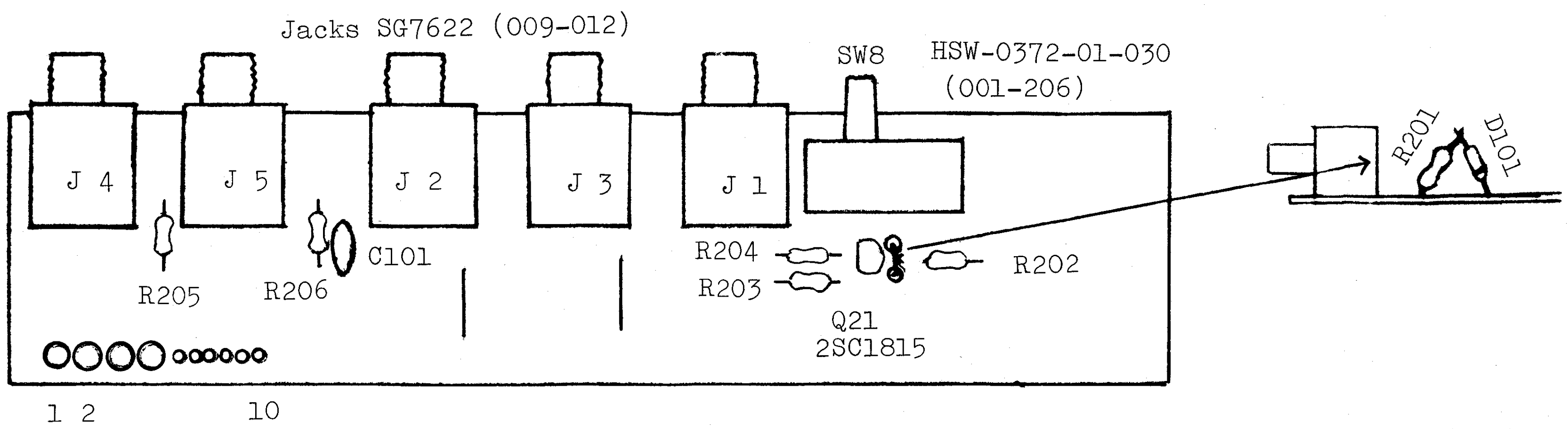
START STOP F SW

VARI F SW

MANUAL VARIATION

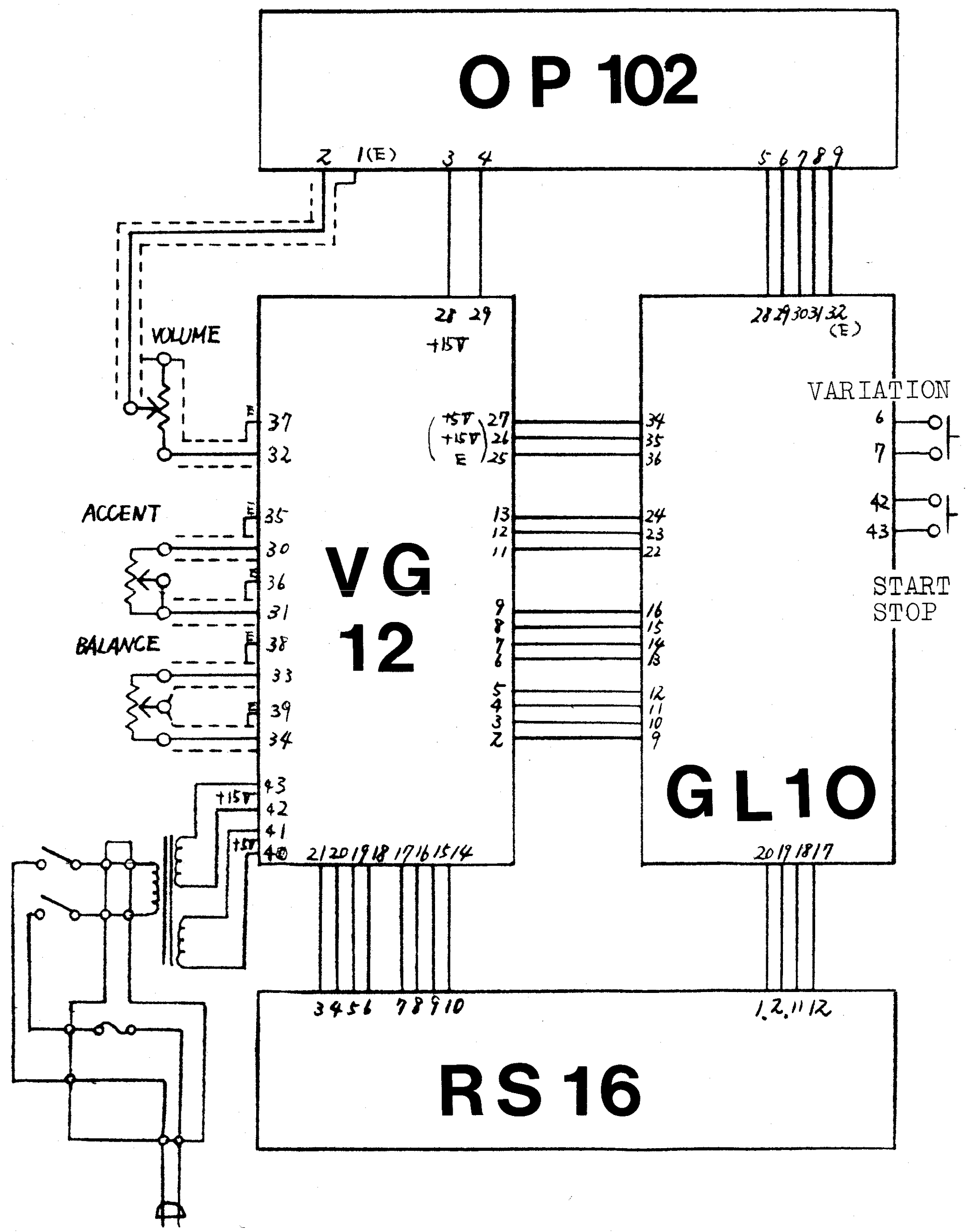
[A] BEGUINE [B] RHUMBA	[A] MAMBO [B] CHA CHA	SAMBA	BOSSA NOVA	ENKA	BOOGIE	[A] FOX TROT [B] TANGO
SWING	SLOW ROCK	SHUFFLE	WALTZ			

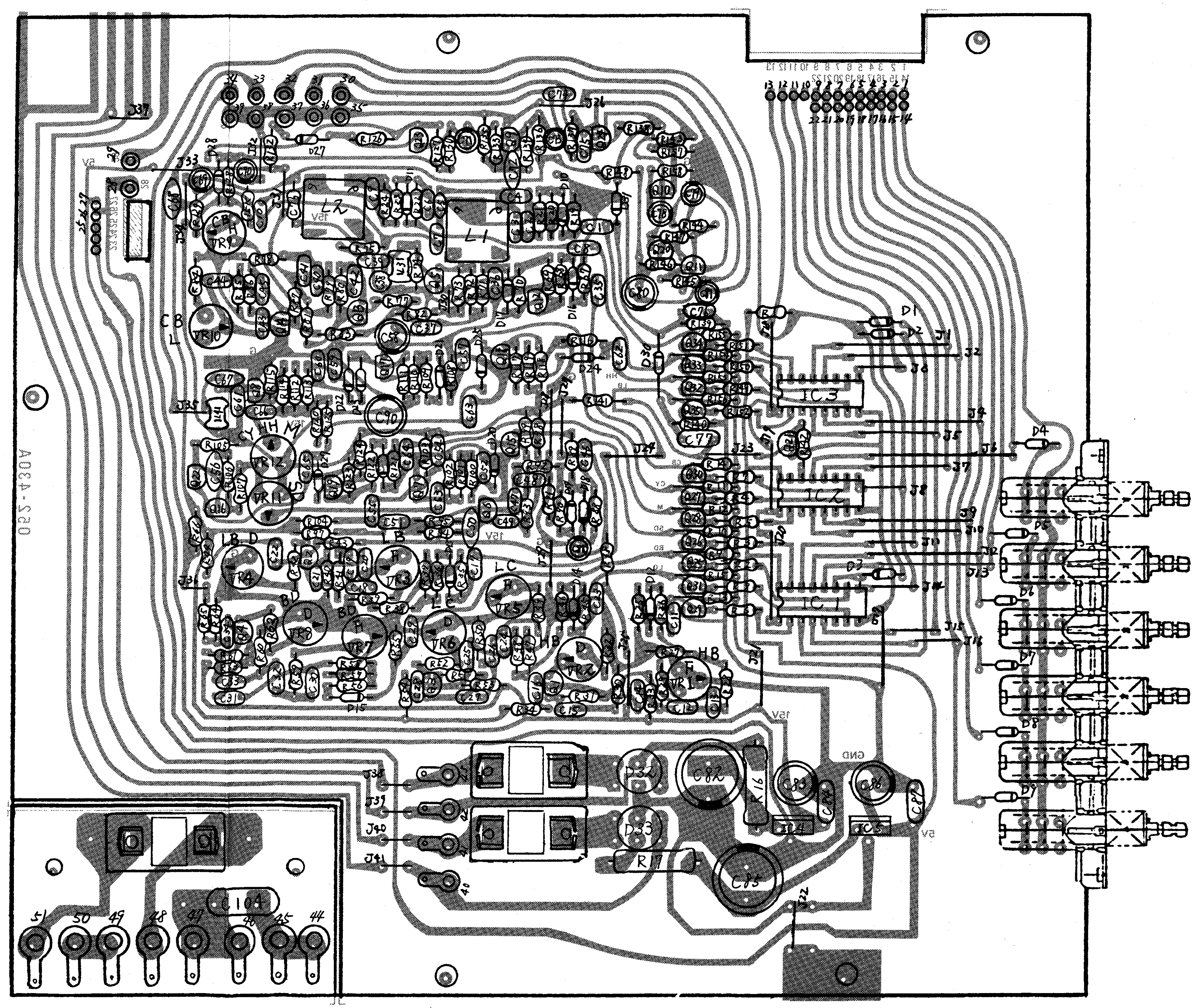
Q101 -- 104: 2SC1815-GR
D201 -- 248: 1S1588 or 1S2473
IC1 : MC14001B
IC2 -- 3: 74LS00N
IC5 -- 7: MC14013B
IC8 -- 9: 74LS138N
IC10 : MPD-8048C-015

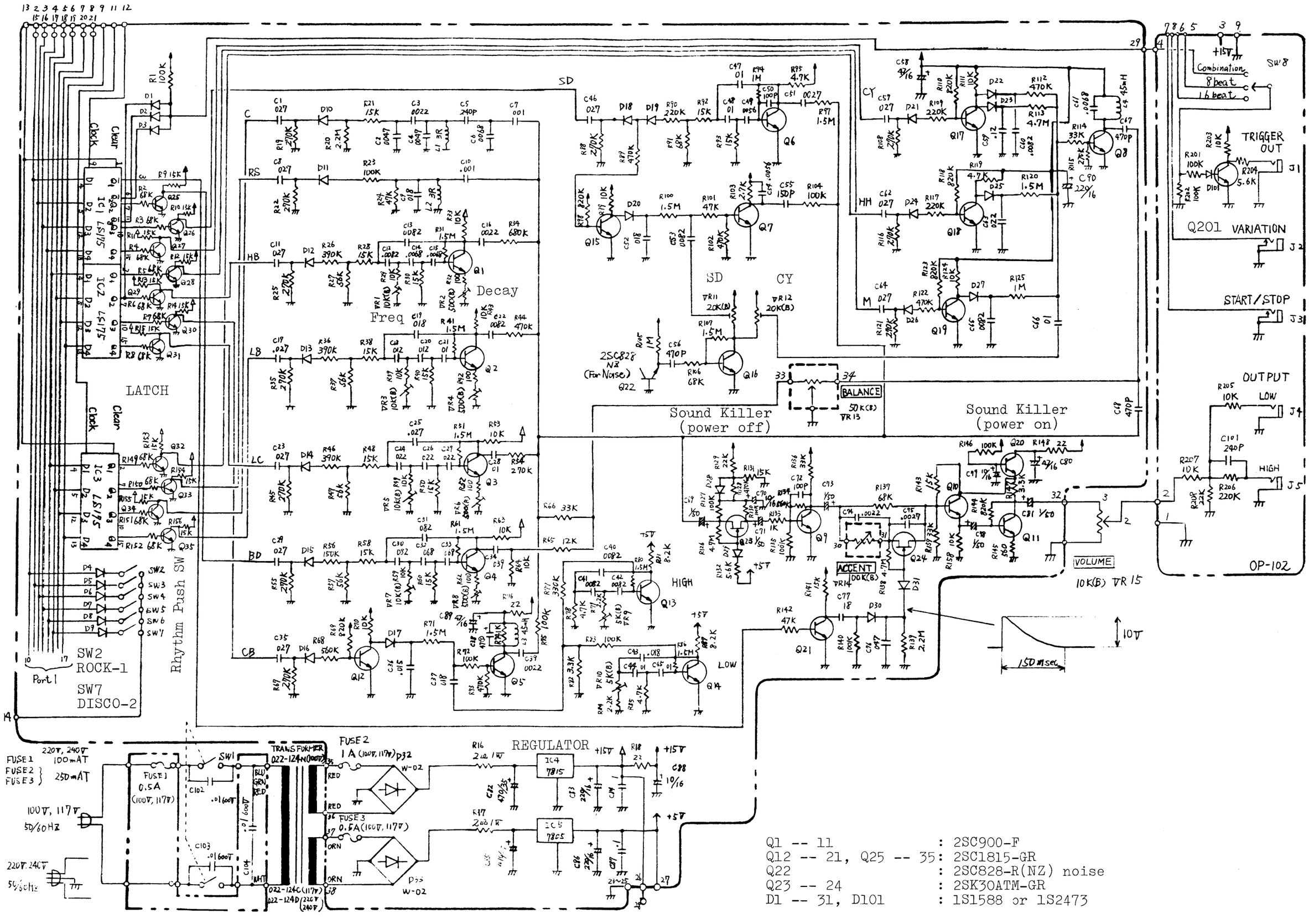


OP-102(149-102)

VG-12A(143-012A)

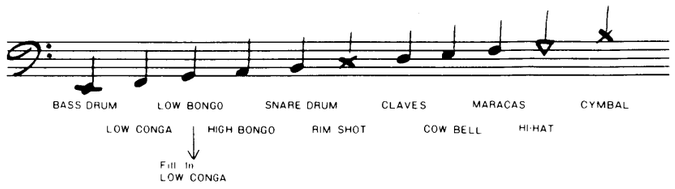




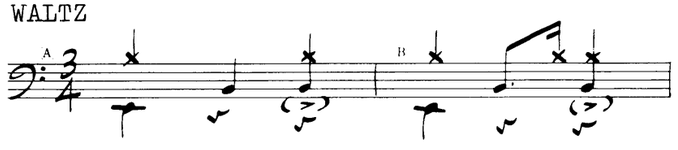


Q1 -- 11 : 2SC900-F
Q12 -- 21, Q25 -- 35: 2SC1815-GR
Q22 : 2SC828-R(NZ) noise
Q23 -- 24 : 2SK30ATM-GR
D1 -- 31, D101 : 1S1588 or 1S2473

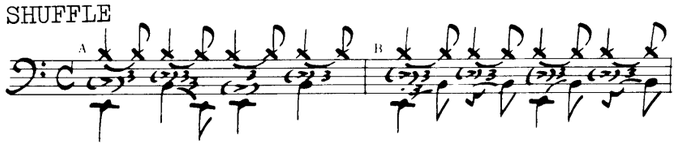
RHYTHM PATTERNS



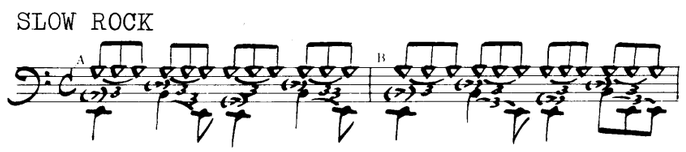
WALTZ



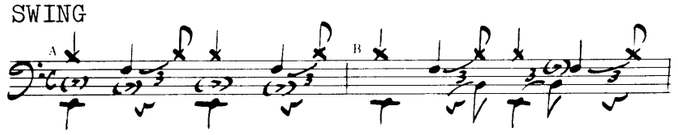
SHUFFLE



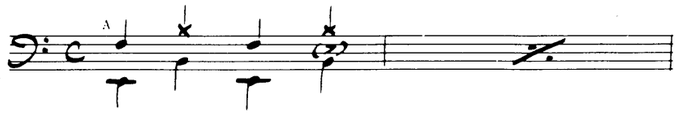
SLOW ROCK



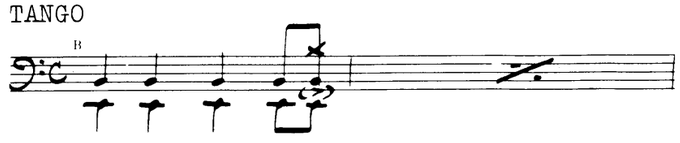
SWING



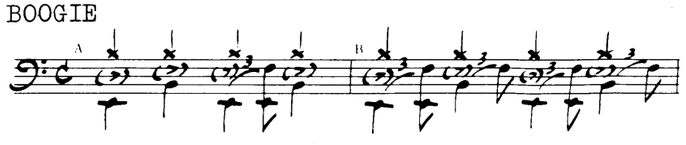
FOX TROT



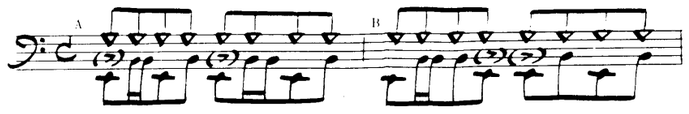
TANGO



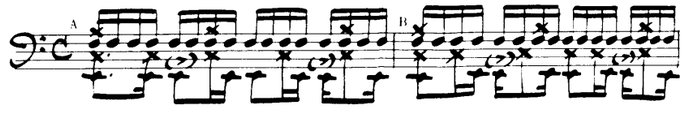
BOOGIE



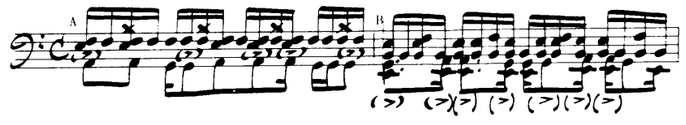
ENKA



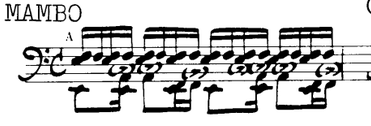
BOSSA NOVA



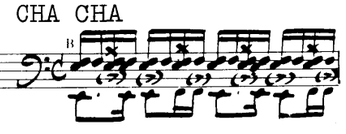
SAMBA



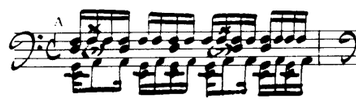
MAMBO



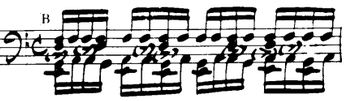
CHA CHA



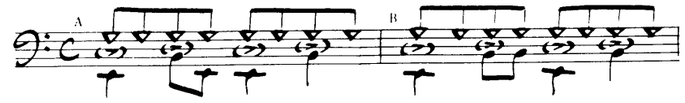
BEGUINE



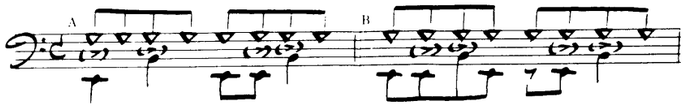
RHUMBA



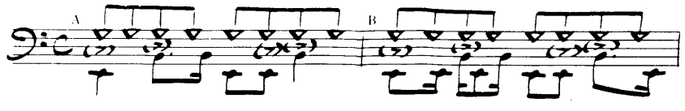
ROCK-1



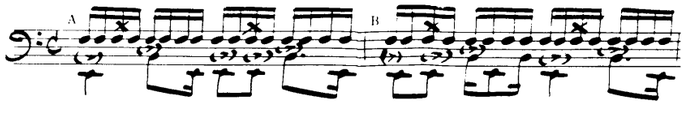
ROCK-2



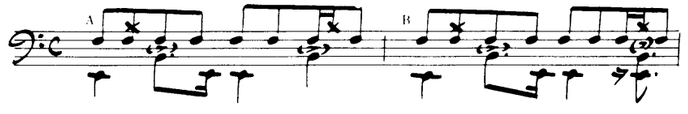
ROCK-3



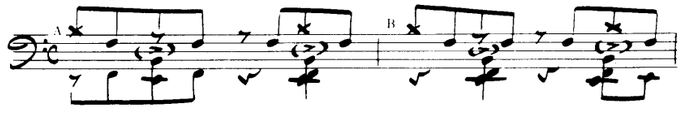
ROCK-4



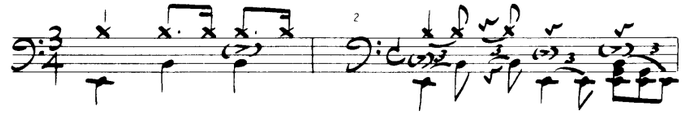
DISCO-1

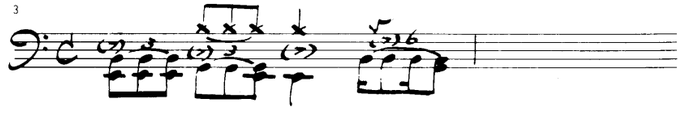


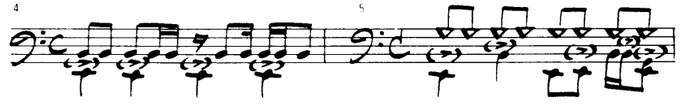
DISCO-2

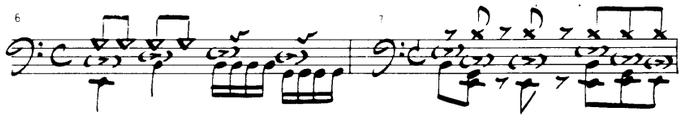


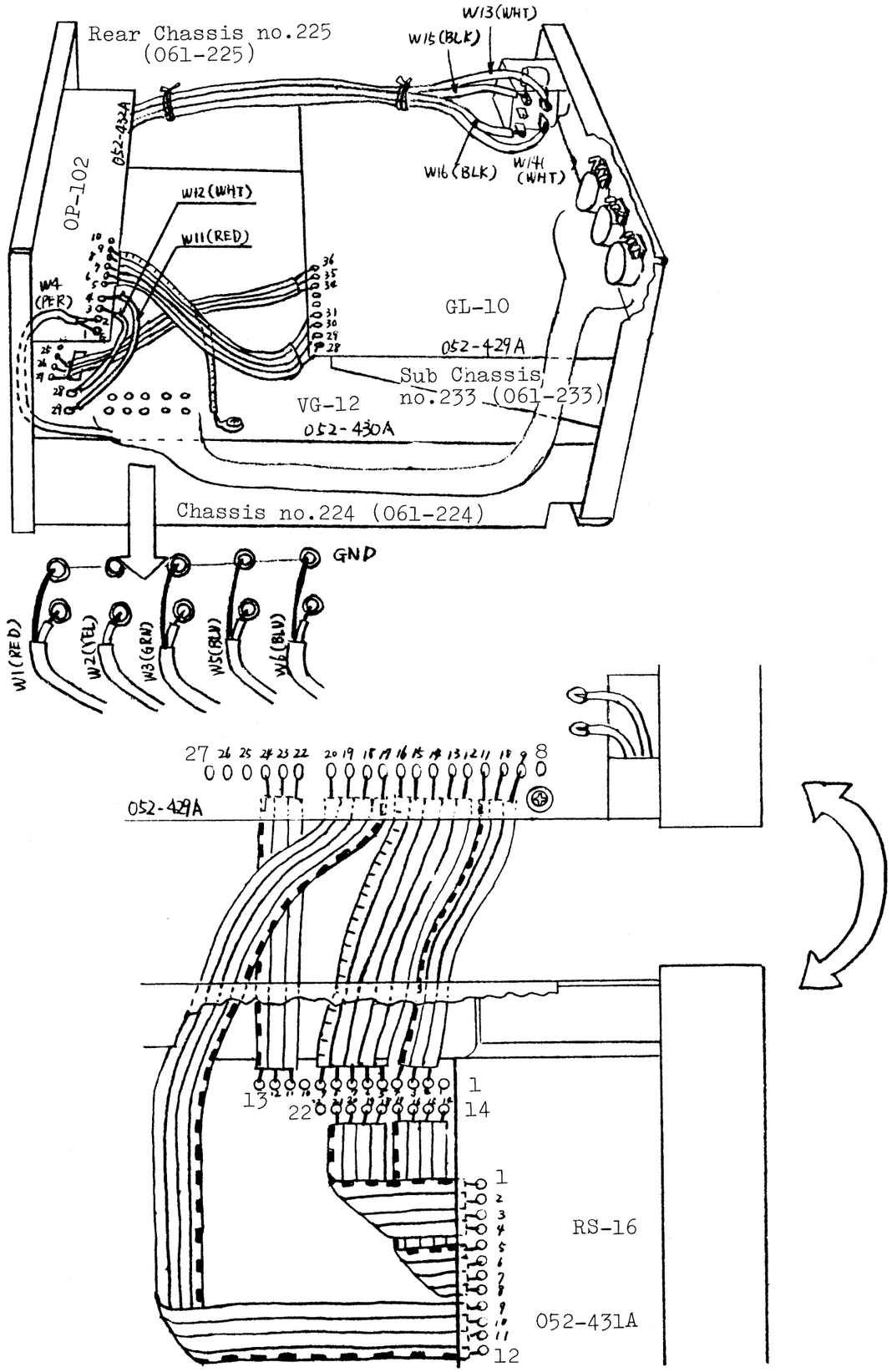
FILL IN



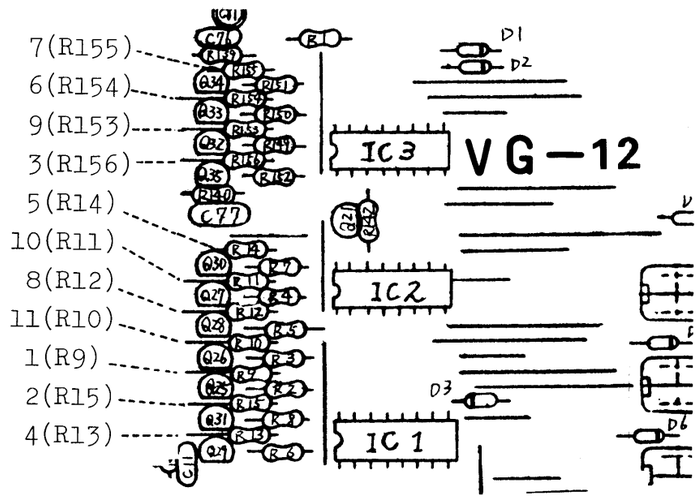




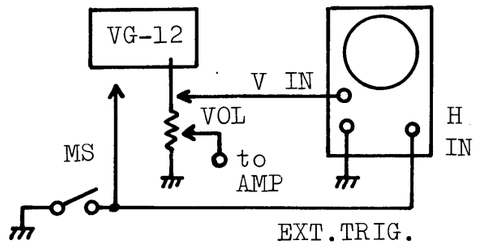




CHECK & ADJUSTMENT

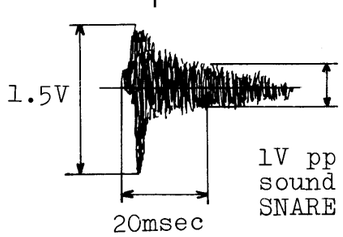


The switch MS (keyboard switch is preferable) serves as a gate to supply negative going pulse for triggering individual voice circuit since individual pulses are not available from the computer respectively.

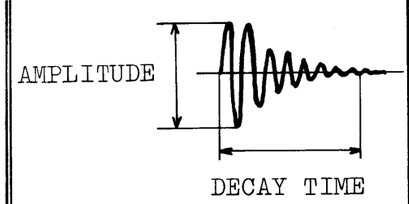


SCOPE CONNECTION
1 through 11: as illustrated
Q13, Q14 : V IN -- to collector. H -- Internal TRIG with proper time base.

VOICE to be adjusted	Connect scope to	FREQUENCY Adjust	for ms	for Hz	DECAY TIME Adjust	for ms	AMPLITUDE Adjust	for V-pp	set BALANCE at
BASS DRUM	1	VR7	16	62.5	VR8	100	*	1.4	full-counter-clockwise
LOW CONGA	2	VR5	4.8	208	VR6	100	*	1.4	
LOW BONGO	3	VR3	2.5	400	VR4	40	*	0.6	
HIGH BONGO	4	VR1	1.66	600	VR2	40	*	0.7	
COW BELL H	Q13 C	VR9	1.25	800	shift scope V IN from VOLUME, H IN to Internal				"*" non-adjustable: just check
COW BELL L	Q14 C	VR10	1.8	555					
COW BELL	5	restore scope connection to previous			*	60	*	0.5	
RIM SHOT	6	C9	0.676	1,480	*	5	*	4.4	
CLAVES	7	C4	0.38	2,630	*	18	*	0.7	
MARACAS	8	adjusting VR12 on any one voice makes all			*	18	VR12	1.5	full-clockwise
HI-HAT	9				*	50	VR12	1.5	
CYMBAL	10				*	250	VR12	1.5	
SNARE DRUM	11				*	60	VR11	1.0	

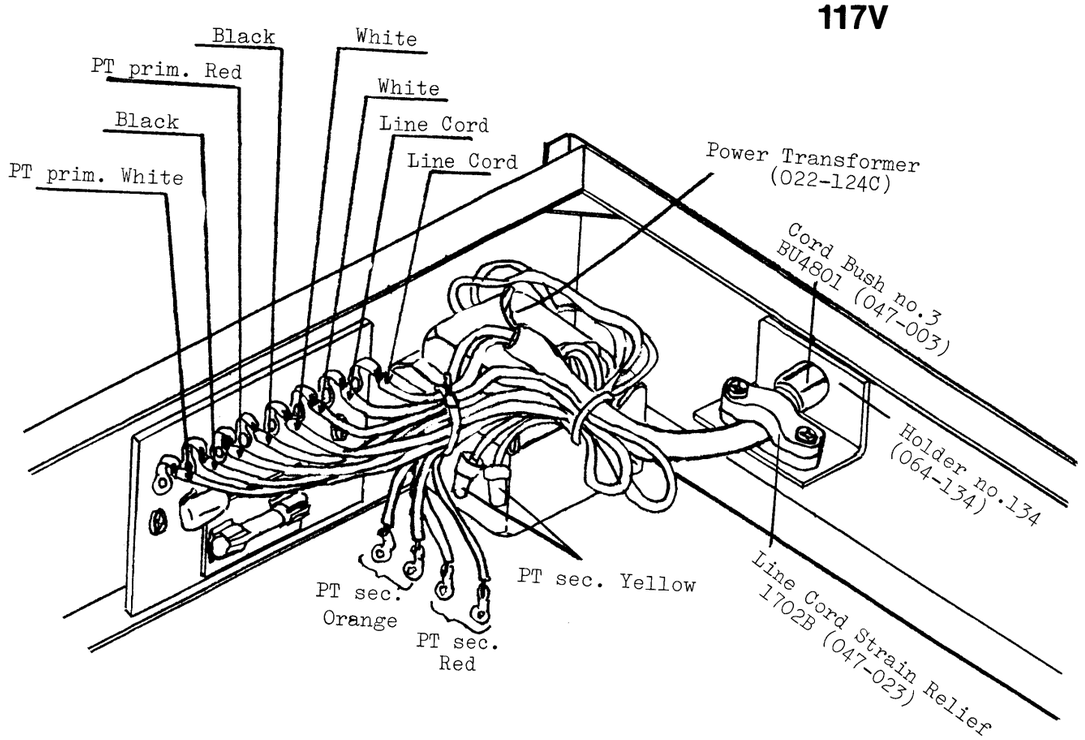


1V pp 20msec after sound initiation; SNARE only

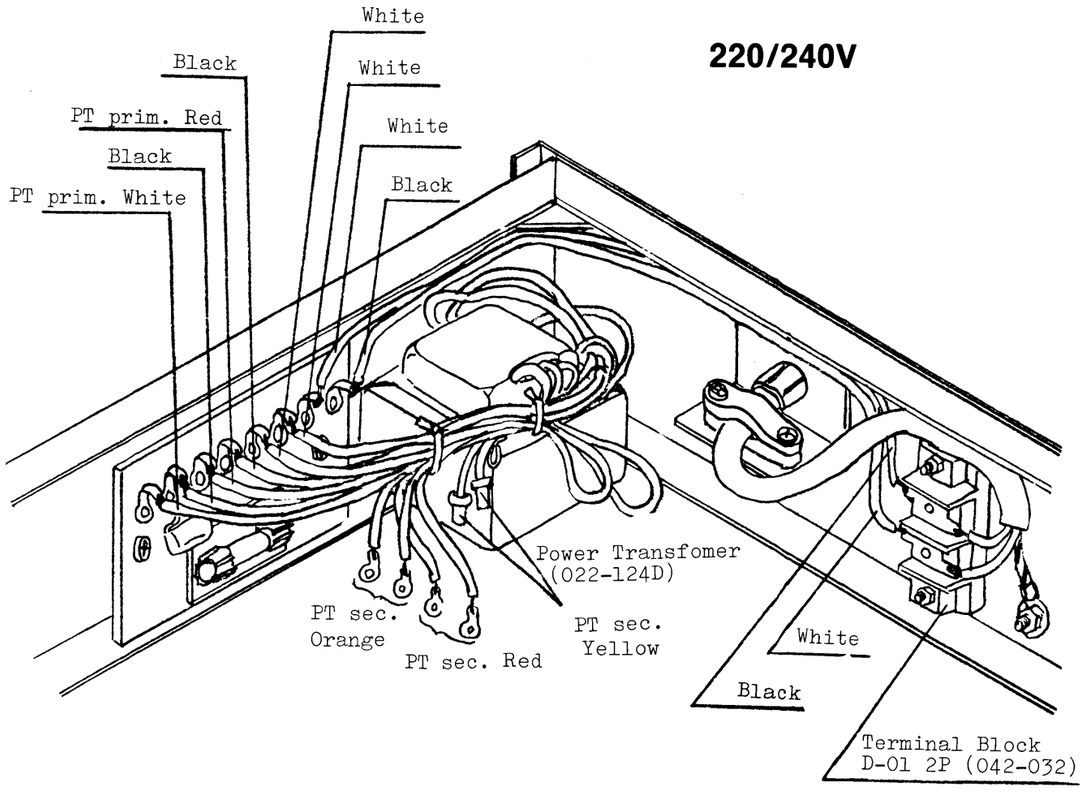


Figures in the table show factory standard and may be slightly deviated for personal taste or to meet frequency response of an amlifier being used.

117V



220/240V



PARTS LIST

081-117	Cabinet no.117
111-020	Base no.20 (foot)
072-240	Panel no.240
076-356	Nameplate no.356 rear above jacks
061-224	Chassis no.224 main
061-233	Chassis no.233 sub GL-10 mounting
061-225	Chassis no.225 rear

KNOBS PUSH BUTTONS

016-043	no.43 TEMPO
016-044	no.44 rotary
016-081	no.81 blk power switch
016-008	Button no.8 gray
016-085	no.85 white
016-086	no.86 red
016-087	no.87 green
016-088	no.88 yellow
016-089	no.89 blue

COILS & TRANSFORMERS

022-030	Coil no.30 45mH
022-033	Coil no.33 3R 700mH
022-124N	PT no.124N 100V
022-124C	PT no.124C 117V
022-124D	PT no.124D 220/240V

PCBs

148-016A	RS-16A etch mask 052-431A
142-010A	GL-10A etch mask 052-429A
143-012A	VG-12A etch mask 052-430A
149-102	OP-102 etch mask 052-432

ICs

020-141	74LS175N or CMOS40175
020-106	7805UC regulator +5V
020-108	7815UC regulator +15V
020-138	74LS138N
020-124	74LS04N
020-120	74LS00N
020-169	MC14001BCP
020-041	MC14013BCP
179-022	MPD-8048C-15

TRANSISTORS

017-106	2SC1815-GR
017-021	2SC900-F
017-046	2SC828-R NZ selected for noise
017-016	2SK30A-GR FET

DIODES

018-059	1S1588
018-082	W-02 bridge 1.5A
019-013	SLP-131B LED

SWITCHES

001-180	SDG-5P power
001-273	SCK-41097 keyboard
001-206	HSW-0372-01-030 slide TRIG OUT
001-230	SRA1015 rotary MEASURE
001-229	SRA101B rotary FILL IN
001-263	SUF-6-2 push gang ROCK--DISCO-2
001-240	SUF-B-2 push gang WALTZ--
001-231*	SLR322 lever RHYTHM A/B
001-264*	SLR322 lever AUTO/MANUAL

*oposite throw directions

POTENTIOMETERS

026-023	EVHCOAP25B54 50kB BALANCE
026-024	EVHCOAP25B15 100kB ACCENT
026-021	EVHCOAP25B14 10kB VOLUME
028-996	EVH2CAP25B54 50kB TEMPO PC

Trimmers

028-001	EVTR4A00(SR19) 500-ohm
028-003	EVTR4A00(SR19) 5k
028-004	EVTR4A00(SR19) 10k
028-005	EVTR4A00(SR19) 20k
028-006	EVTR4A00(SR19) 50k

CAPACITORS

032-095	0.47uF 35V K tant.
035-109	ECQM6103KZ 600V polyester

FUSES

008-024	SGA 0.5A prim/sec +5V 100/117V
008-026	SGA 1A sec +15V 100/117V
008-056	CEE 100mAT prim 220/240V
008-060	CEE 250mAT sec 220/240V

MISCELLANEOUS

012-003	Fuse Clip TF-758
012-040	IC Socket ICC30-040-350G 40 pin
009-012	Jack SG7622
064-134	Holder no.134 line cord
047-003	Line Cord Strain Relief
047-023	Line Cord Clamp 1702B
120-001	Long Nut no.1 3x10mm stand-off
053-289	Flat Cable no.289 5 pin
053-290	Flat Cable no.290 4 pin

* Resistors, mylars and ordinary electrolytic capacitors are omitted.