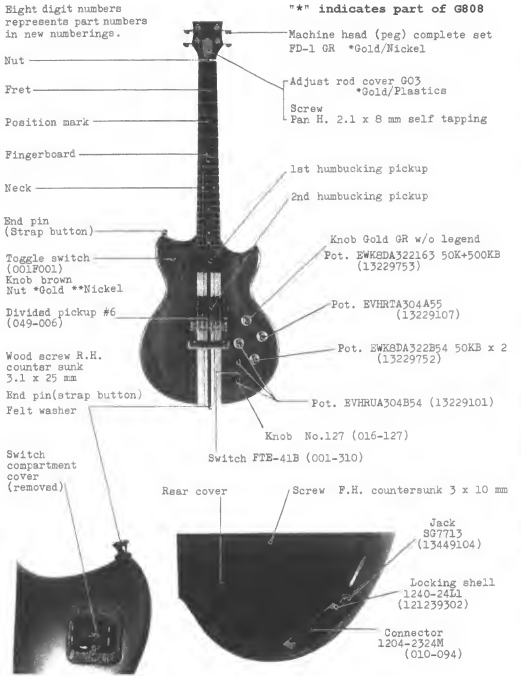
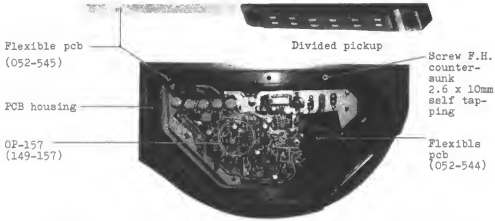
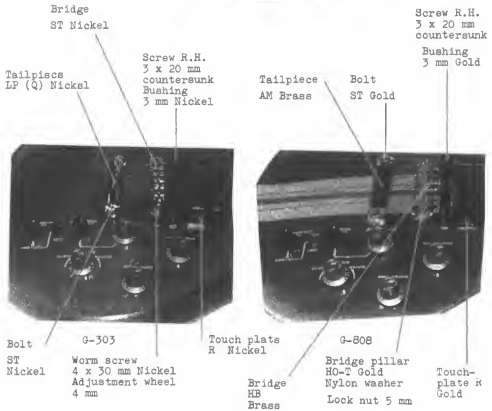

Eight digit numbers represents part numbers in new numberings.
"*" indicates part of G808
Machine head (peg) complete set FD-1 GR *Gold/Nickel
Nut
Fret
Position mark
Adjust rod cover G03 *Gold/Plastics
Screw Pan H. 2.1 x 8 mm self tapping
Fingerboard
Neck
1st humbucking pickup
2nd humbucking pickup
End pin (Strap button)
Toggle switch (001F001) Knob brown Nut *Gold **Nickel
Knob Gold GR w/o legend
Pot. EWK8DA322163 50K+500KB (13229753)
Divided pickup #6 (049-006)
Pot. EVHRTA304A55 (13229107)
Wood screw R.H. counter sunk 3.1 x 25 mm
Pot. EWK8DA322B54 50KB x 2 (13229752)
End pin(strap button)
Felt washer
Pot. EVHRUA304B54 (13229101)
Knob No.127 (016-127)
Switch FTE-41B (001-310)
Switch compartment cover (removed)
Rear cover
Screw F.H. countersunk 3 x 10 mm
Jack SG7713 (13449104)
Locking shell 1240-24L1 (121239302)
Connector 1204-2324M (010-094)


Flexible pcb (052-545)
Divided pickup
Screw F.H. countersunk 2.6 x 10mm self tapping
PCB housing
OP-157 (149-157)
Flexible pcb (052-544)

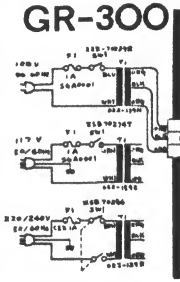

Bridge ST Nickel
Screw R.H. 3 x 20 mm countersunk Bushing 3 mm Nickel
Screw R.H. 3 x 20 mm countersunk
Bushing 3 mm Gold
Tailpiscs LP (Q) Nickel
Tailpiece AM Brass
Bolt ST Gold
Bolt ST Nickel
G-303
Worm screw 4 x 30 mm Nickel Adjustment wheel 4 mm
Touch plate R Nickel
G-808
Bridge pillar HO-T Gold Nylon washer Lock nut 5 mm
Bridge HB Brass
Touch-plate R Gold

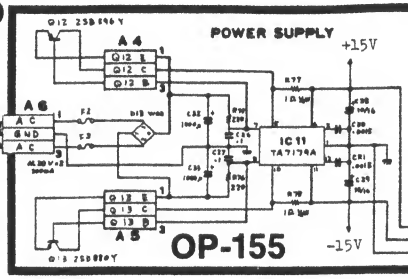
Guitar Synthesizer

CIRCUIT DIAGRAM

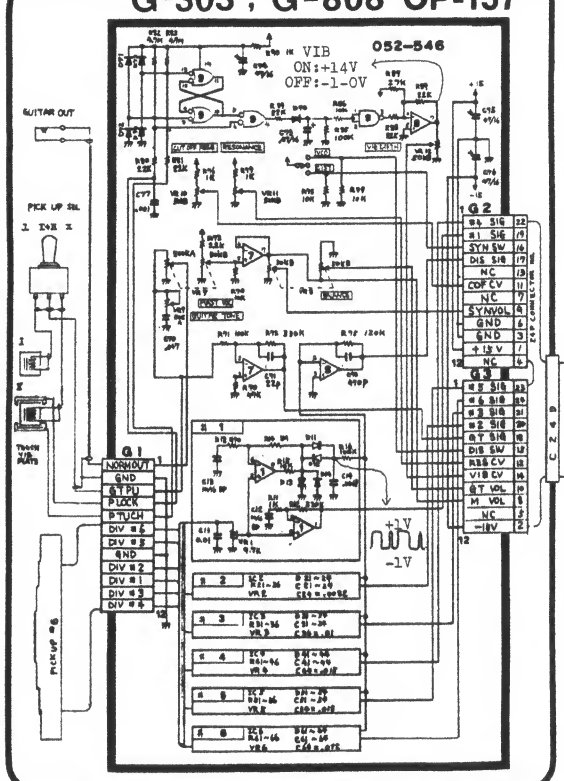
Roland

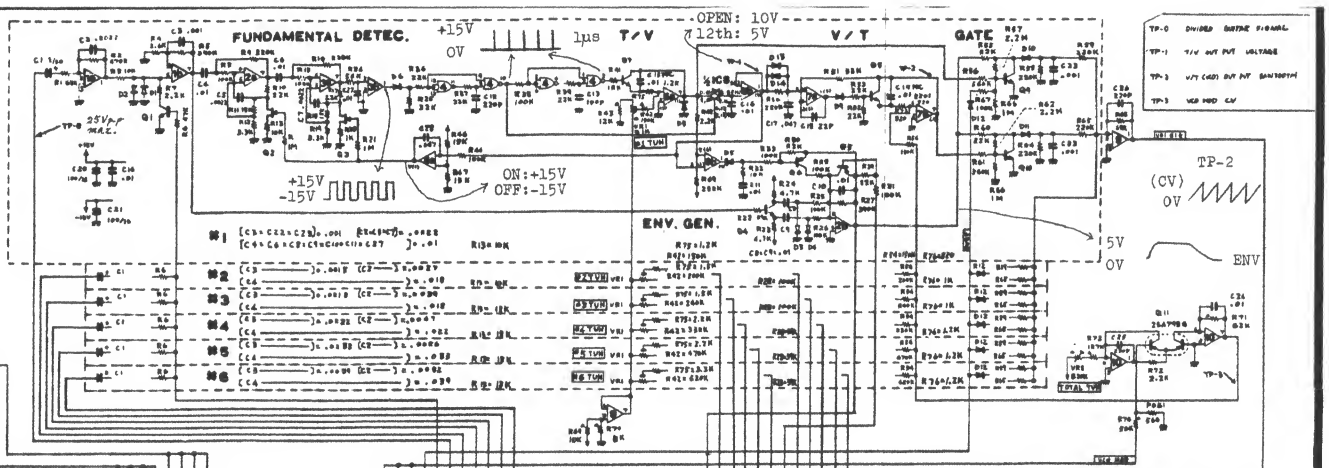
GR-300

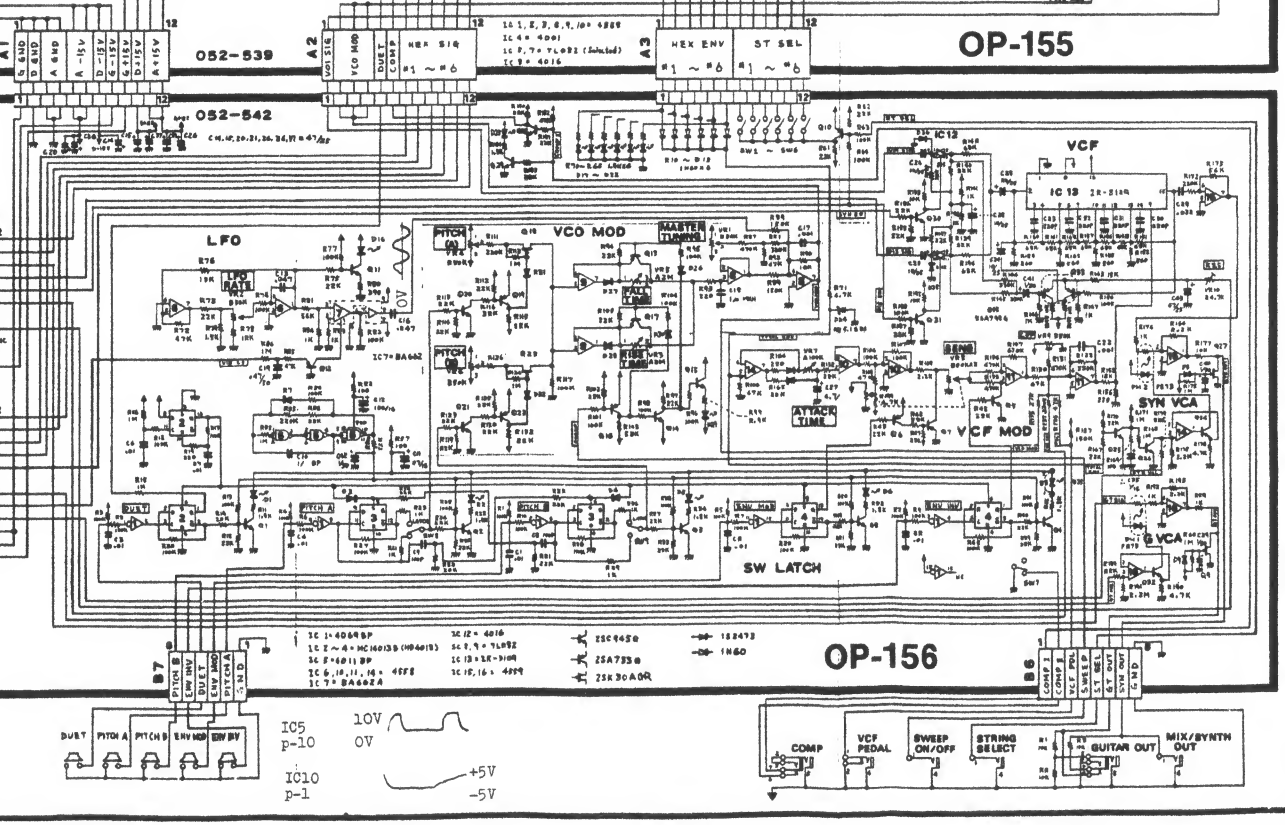




G-303 , G-808 OP-157







Circuit Description

GR-300 circuits are mostly built on two circuit boards: VOICE Board OP-155 and GATE Board OP-156.

VOICE BOARD OP-155

1. FUNDAMENTAL DETECTOR
2. T/V CONVERTER
3. V/T CONVERTER
4. ENVELOPE GENERATOR
5. CHOPPER GATE
6. POWER SUPPLY

1. Fundamental Detector

This detector, the heart of the GR-300 guitar synthesizer, stripe the incoming signal off harmonics and leavee fundamental. In the following, only channel #1 circuit is described since this detector is composed of the same six circuits. The output signal coming from the divided pickup is applied through LPF/Buffer IC1a to COMPRESSION circuit consisting of switching transistor Q1 and clamp diodes D1 and D2.

With Compression at control panel "off", the signal potential is divided by R3 and R7 when "on", the signal remains unchanged and is applied to LPF IC1b.

1-1. Band-Pass Filter (BPF). A two-stage filter, consisting of cascaded IC2a and IC3a, largely changes its frequency response when a string is plucked with lower fretting and then with upper fretting, and vice versa.

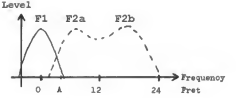
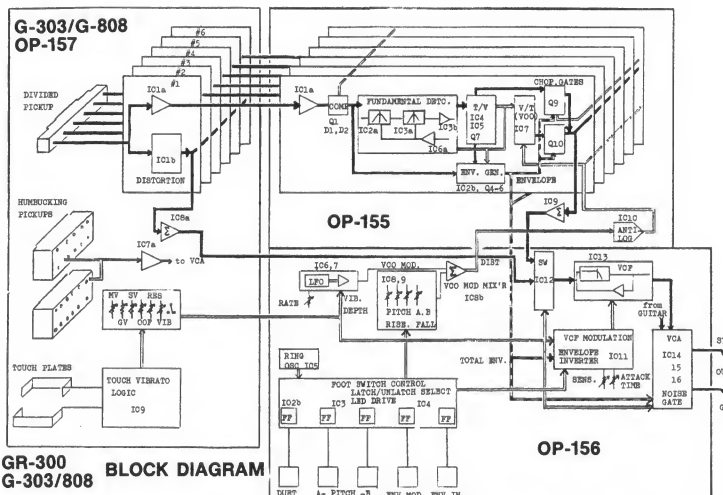


Fig. 1 Filter changes frequency response according to the fret position.



When channel #1 string pressed at lower fret (0-6th)is played, Q2 and Q3 are cut off by the potential at output of IC6a which sense T/V output (IC5b) and applies forward biases to Q2 and Q3 when the string pressed at a fret higher than point A of the figure above is played (more detail about IC6a in later section ENV. GENERATOR).

Q2 and Q3, during off, make 1st and 2nd filtere' component values equal to each other to provide overall peak frequency at F1 corresponding to fundamental of the open string. The filter attenuates let overtones or harmonics by 24dB when fretted-notes lower than point A are played.

The switching FETs Q2 and Q3 with R13 and R20 connected hold two filters differently during their conducting period. This results in two discrete peak frequencies: F2a (frequency around 5-6th frets) from IC2a and F2b (around 18th fret frequency) from IC3a.

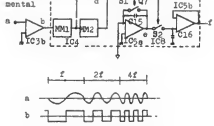
Second harmonics of the fret-notes in this region are also rolled off by 24dB.

NOTE: These response curves do not affect sound volume since signal passing through the filter is used only for pitch dicision.

The fundamental is trimmed into square wave through comparator IC3b, and is applied to the next stage, T/V converter IC4.

2. T/V Converter

This circuit is composed of two stage mono-stable multivibrator IC4(MM1,MM2),constant-current integrator Q7, IC5a, D8, and sample and hold circuit IC6a, IC5b.
MM1 and MM2 output 1μs wide positive-going pulses c and d upon receiving edges of respective inputs. There is some time difference between pulses c and d due to the time constant of R3B and CMOS's input capacitance.



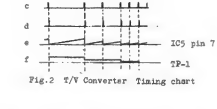


Fig.2 T/V Converter Timing chart

The voltage across capacitor C15 increases linearly when charged at a constant rate,and decreases to zero when pulse d triggers Q7. The voltage across D8 (pin 7 of IC5a) takes the shape of sawtooth e. Its maximum value is proportional to the interval length between two pulses: 0-10V at open string, and 0-5V at 12th fret.
The sawtooth waveform serves as a fundamental when DUET is on.
The waveform is sampled by ½IC6 each time pulse c is applied and is held by C16 before being reset by pulse d. Dc output from IC5b is then applied to IC7a.

3. V/T Converter (VCO)

This V/T converter is similar to the T/V converter in operation. When the charge on C19 increases constantly and reaches the potential equal to that on C17, it causes output from IC7a to conduct Q8 taking the shape of sawtooth waveform whose amplitude is invarsely proportional to fret frequency, that is, the lower the fret, the higher the amplitude. This VCO waveform can be modulated or shifted by varying the current flowing into C19. The more the current, the faster C19 charges up to the level on C17. As a result, VCO frequency increases with its amplitude held constant.

4. ENVELOPE GENERATOR

This is an envelope follower with reset function added -- comparator IC6b and switching transistors Q5, Q6 across C10.
IC6b compares the signal levels between input and output terminals of S/H circuit. When the waveform at IC5a output includes 1st overtone component to some degree, IC6b outputs negative-going voltage, conducting Q6 to discharge C10 so that the generator does not output signals. While transients are smoothed out by C11 in the circuit.
IC6a, as described in section BFF, turns Q2 and Q3 on or off when output from IC5b jumps up or down from the predetermined level across R47, which corresponds to point A in figure 1. When a string is stroked powerfully with a fret higher than point A is pressed, it vibrates transiently at very low frequency, which causes the filter switch to F1 response,then to F2a, F2b as the string vibrates at inherent frequency. However, abrupt change of filter response is not favorable because it produces click-like sound. Intergrating capacitor C28 absorbs the initial transient.

Control Board OP-156

The following are main circuits on the board.

1. FOOT SWITCH CONTROL
2. LFO
3. VCO MOD (PITCH SHIFT)
4. VCF
5. ELECTRONIC VOLUME CONTROL

1. FOOT SWITCH CONTROL

Pressing the footswitch (momentary-close type) applies trigger pulse to C (clock) pin of flip-flop IC2b (IC3,4) through buffer IC1. In this configuration D-F/F is connected as type T-F/F. Capacitor 0.01μF across the switch prevents contact bounce (chattering) which could cause false triggering.
IC2a generates initial reset pulse for other F/F's when the power switch is turned on.
Outputs from Ring Oscillator IC5 and the F/F are ORed at the base of LED driver Q8 (Q1-4). LED blinks at the rate of oscillator output when F/F is reset.

2. LFO

One half of IC6 forms hysteresis comparator and the rest half acts as a miller integrator, generating triangular output waveform. The waveform is applied to VCO MOD mixer via IC7, whose gain is current-controlled by VIB DEPTH.

3. VCO MOD (PITCH SHIFT)

When PITCH A (B) is pressed, Q18 (Q23) turns on, and the voltage determined by VR4 (VR5) is fed to IC8 via ideal diode IC9. When PITCH is shifted from A (B) to B (A) by pressing the PITCH footswitch with FALL (RISE) TIME turned partly.The RC time constant of pot and C18 causes voltage to change slowly which is supplied to pin 2 of IC8. When external footswitch plugged into SWEEP ON/OFF jack is turned on, forward voltage is applied to bases of Q13 and Q17, allowing them to disenable Sweep Time setting by shutting the VR5 or VR3.

4. VCF

One chip VCF comprising anti-log circuit makes up 24dB/oct LPF along with its external R's and C's. The output is positively fed back to its input for resonance effect via Q33 VCA whose gain or amount of regeneration is controlled by RESONANCE on the guitar controller.
When emphasis is high at a frequency, resonance curve lower than the peak frequency decreases in level, resulting in relatively small VCF output in this region. This detrimental effect is compensated for by parallely feeding the audio signals via VCA which controls amount of feedback and signals at the same rate.
Besides various control voltages, VCO MOD is fed to VCF control pin via IC11b to shift VCF cutoff point in accordance with pitch shift at VCO to maintain unchanged tonal.
With ENVELOPE MODULATION "on", individual envelope outputs on VOICE board can be used to modulate VCF.After its rise time set by ATTACK TIME, envelope signals are routed to IC11a which inverts the envelope slope when ENV IN is "on" because its non-inverting pin is grounded via Q5.

5. ELECTRONIC VOLUME CONTROL

Before being output from OUTPUT jacks, the audio signals are controlled their volumes electronically by PH1 and PH2 which are in turn remote-controlled on the guitar controller.
Output from NOISE GATE Q25, Q26 is also applied to PH2 through IC14. This configuration, when ENV GEN outputs zero volt, disenables IC15, shutting off the residual noise in the synthesizer channel.

1. Preliminary Adjustment

If pickups, tailpiece, truss rod and/or bridge appear(s) to have been readjusted or replaced on a given Guitar Controller, the following adjustments must be properly completed before carrying out the individual adjustments now being required.

1-1. TAILPIECE - Fig. 1 -

Using an appropriate straight-blade screwdriver, lower the tailpiece by turning Height Adjustment screws, but high enough to avoid flange backs (1) being in contact with guitar top, which would cause damage to surrounding finish when strings are brought to full tension.

Fig. 1

1-2. BRIDGE (coarse) - Fig. 1 -

(Action height at the higher fret)

When the bridge is a replacement for orginal one, adjustments for centering the bridge(p.7) precede the following.

. Tighten the strings to eliminate slacks.

The distance between bottom of each string and higher frets must be within 2-4 mm, if not, adjust the bridge height:

G-303 -- Raise or lower the bridge by turning the wheels on the studs, use hand tool (long-nose pliers will suffice) if stiff.

G-808 -- Turn slotted bridge pillar. If frozen, loosen lock nut before screwing.

If any string is coming to touch a pickup, lower the pickup.

Adjustments must be carried out in order, as follows: (1) TRUSS ROD; (2) ACTION HEIGHT; (3) STRING LENGTH.

2. TRUSS ROD

Checking the fingerboard and neck for cambered, warped, pulled or twisted - Fig. 2 -

1. Hold the neck joint with one hand (1); with the other hand, gently hold the guitar head (2). Position the guitar on the table.

2. View the curve of the fingerboard and neck across the top of the head from both edges alternately (3).

B to ii in Fig. 2 are examples of would be occured. Of course any cominations of these examples might be found on the guitar.

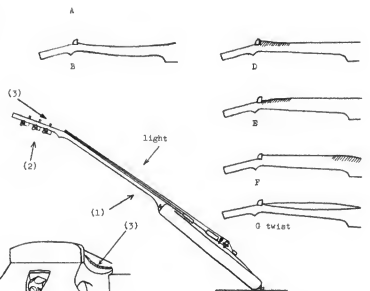


Fig. 2

To adjust truss rod, remove the rod cover.

When adjusting, tighten or loosen the nut (4),with an 8 mm wrench, small amount at a time while checking the result. DO NOT OVERTIGHTEN.

A ------ Ideal.

B, C, D -- Adjust truss rod. Check that there is no buzzing when the string is played open. (Slighter curvature shaded in D can be ignored.)

E, F, G, H -- When possible action is cannot obtained after compensated for by truss rod adjustment, any adjustments it needs should be left to someone with experience on guitar repair.

3. ACTION (STRING) HEIGHT

(Bridge adjustment) - Fig. 3 -

Action height adjustments must be taken with a full set of strings on the guitar, the gauge and type will be used, tuned to playing pitch.

1. Hold the guitar perpendicular to the bench.

2. With the string open, measure the distance between 14th fret and the bottoms of 1st and 6th strings. Standard clearance: 1st -- 1.5 mm

6th -- 2.0 mm

3. To adjust, raise or lower the bridge in the same fashion described in preliminary adjustments1- 1-2 BRIDGE.

(G-808 -- Lightly wrench the lock nuts on the bridge.)

Pickup Height

4-1

Possible action on guitar pickup depends greatly on stringe and players, with stringe supplind 3-4 mm works well. However, pickups' top surfaces must be held parallel to the stringe and 1st and 2nd pickups must delivery an equal output sound in level.

4-2. Divided pickup - Refer to page 7 -

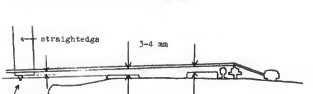


Fig. 3

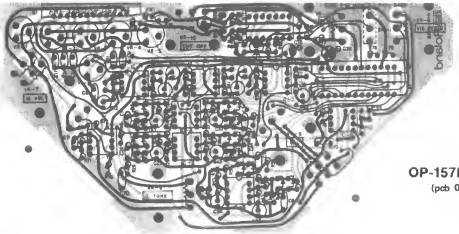
5. STRING LENGTH (OCTAVE ADJUSTMENT)

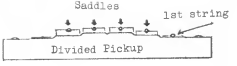
1. Test intonation at the 12th fret whether string is sharp or flat in terms of overall intonation.

2. If a string is going sharp at the 12th fret, move back the saddle to add string length by turning the intonation adjustment screw at the bridge frame. If flat, forwards.

REFERENCE FREQUENCIES

	STRING					
FRET	6	5	4	3	2	1
0	82.41	110.00	146.83	196.00	246.94	329.63
1	87.31	116.54	155.56	207.65	261.63	349.23
2	92.50	123.47	164.81	220.00	277.18	369.99
3	98.00	130.81	174.61	233.08	293.66	392.00
4	103.83	138.59	185.00	246.94	311.13	415.30
5	110.00	146.83	196.00	261.63	329.63	440.00
6	116.54	155.56	207.65	277.18	349.23	466.16
7	123.47	164.81	220.00	293.66	369.99	493.88
8	130.81	174.61	233.08	311.13	392.00	523.25
9	138.59	185.00	246.94	329.63	415.30	554.37
10	146.83	196.00	261.63	349.23	440.00	587.33
11	155.56	207.65	277.18	369.99	466.16	622.25
12	164.81	220.00	293.66	392.00	493.88	659.26
13	174.61	233.08	311.13	415.30	523.25	698.46
14	185.00	246.94	329.63	440.00	554.37	739.99
15	196.00	261.63	349.23	466.16	587.33	783.99
16	207.65	277.18	369.99	493.88	622.25	830.61
17	220.00	293.66	392.00	523.25	659.26	880.00
18	233.08	311.13	415.30	554.37	698.46	932.33
19	246.94	329.63	440.00	587.33	739.99	987.77
20	261.63	349.23	466.16	622.25	783.99	1046.50
21	277.18	369.99	493.88	659.26	830.61	1108.73
22	293.66	392.00	523.25	698.46	880.00	1174.66
23	311.13	415.30	554.37	739.99	932.33	1244.51
24	329.63	440.00	587.33	783.99	987.77	1318.51





CENTERING THE STRING
ON THE PICKUP HEAD

When bridge is replaced, it is necessary to check the strings that they are properly aligned with the center of the divided pickup heads. If not, the following adjustment must be done. This is a deceptively difficult operation that should be left to the hands of an experienced and skilled guitar repairman.

1. Remove the string from its notch, and slide it across the insert (saddle) surface until it reaches the center of the head.

2. Renotch the saddle or enlarge the groove by using a small tri-cornered file. Proceed to PRELIMINARY ADJ.

ADJUSTING DIVIDED PICKUP HEIGHT

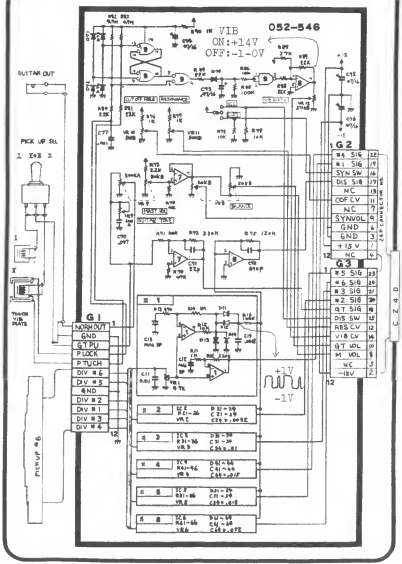
1. Tune strings to playing pitch.

2. Raise divided pickup by turning height adjust screws until 1st and 6th pickup heads touch the bottom of respective strings.

3. Check 2nd to 5th strings for contaction with the heads,if there is a clearance between them, slot the groove deeper until string touches the head.

4. After all strings rested on heads, lower the pickup. Press 22nd frets. 0.5-0.8 mm between each pickup and bottom of each string is specified action height.

G-303 / G-808 (OP-157)



NOTES: 1. VR1-VR6 are set in mid-position at factory and may be readjusted as required.
Maximum output at connector pin (e.g. #1 SIG) is typically 25 Vp-p when plucked powerfully.

VCF Adjustment

Do not attempt this adjustment prior to completion of VCO tune

CUTOFF FREQUENCY

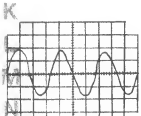
1. Turn RES VR10 full clockwise(FCW),through hole in the pcb from the foil side. VCF will oscillate when a string is plucked.

2. Play a string at open and adjust OSC VR9 for 6kHz -- Fig. 1.

RESONANCE

1. With RES VR10 set at FCW, reset CUTOFF FREQ on G-303/808 to 5.

2. Pluck 6th string at open. Adjust RES VR10 for A:B = 2:1 -- Fig.2.



50μs/div

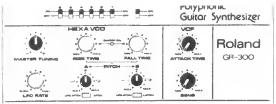
Fig. 1

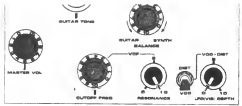
Guitar controller
CUTOFF FREQ.: 5
RESONANCE: 10
6th string: open

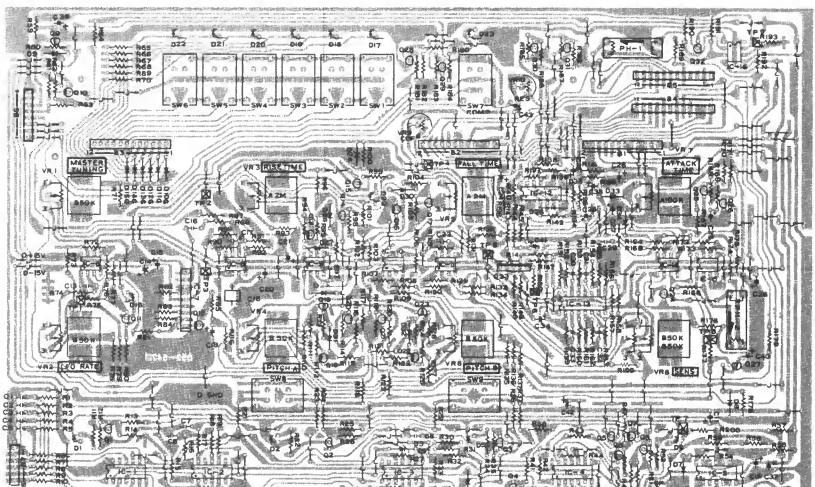
Fig. 2

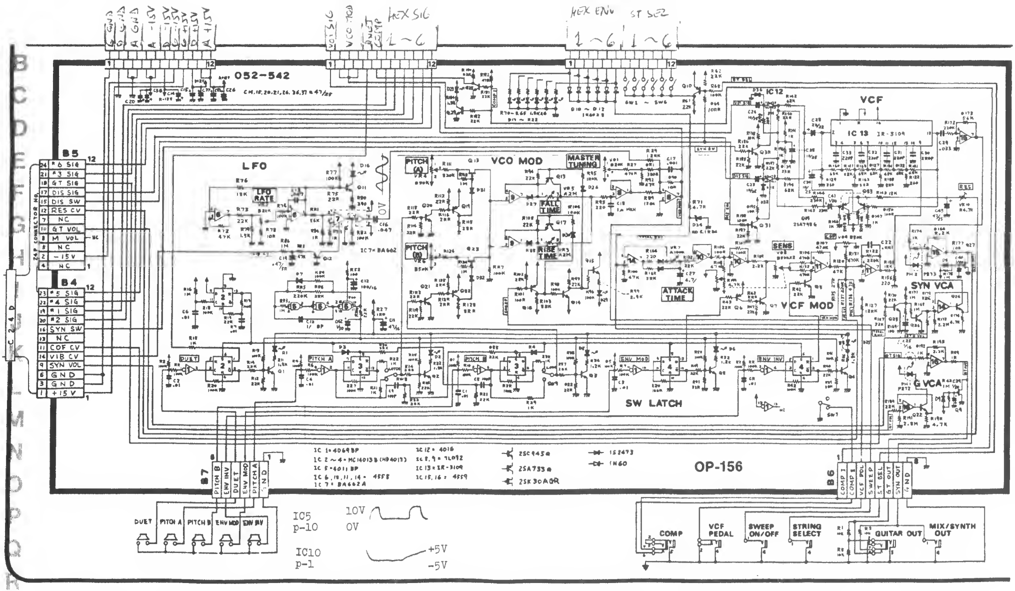
Set controls as illustrated at the right (footswitches: all off). Connect oscilloscope to MIX/SYNTH jack.

OP-156B (149-156B)
(pcb 052-542B)

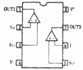




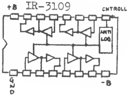




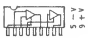
OP AMP
uPC4558, uPC4559
TL082



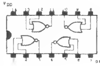
ONE CHIP VCF
IR-3109



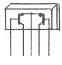
ONE CHIP VCA
BA662



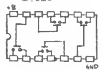
QUAD NOR
14001



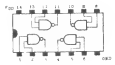
PAIR TRANSISTOR
2SA798

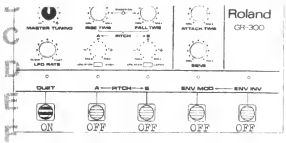


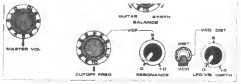
QUAD ANALOG SWITCH
14016



QUAD NAND
14011

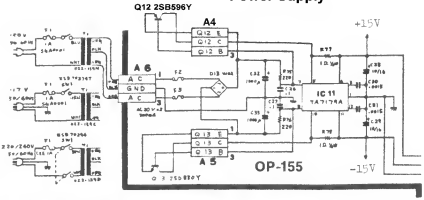






OP-155C (149-155C)(052-539C)

Power Supply



VCO TUNIG

1. Set controls on Guitar controller and GR-300 as illustrated above.

2. Set each TUN VR1 (#1-6) at its midpoint.

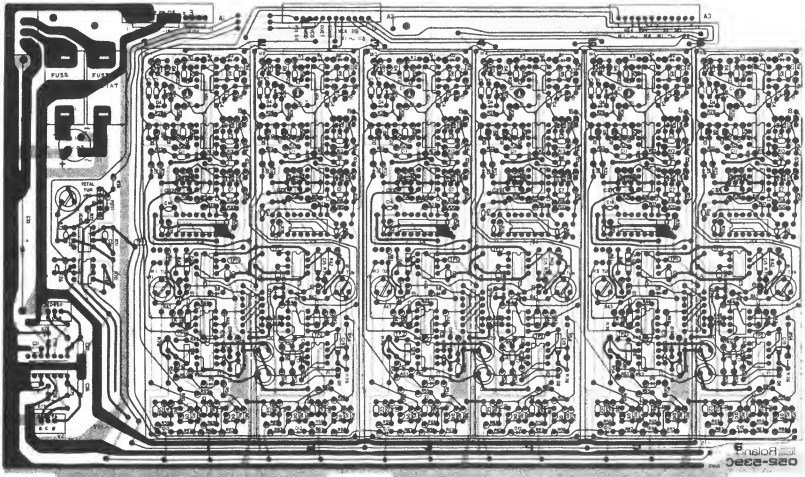
3. Play on 1st string 12th fret. A beat note will be heard.
Tune VCO by turning TOTAL TUN VR2 until the beat note reaches zero (#1 TUN VR1 is left untouched).

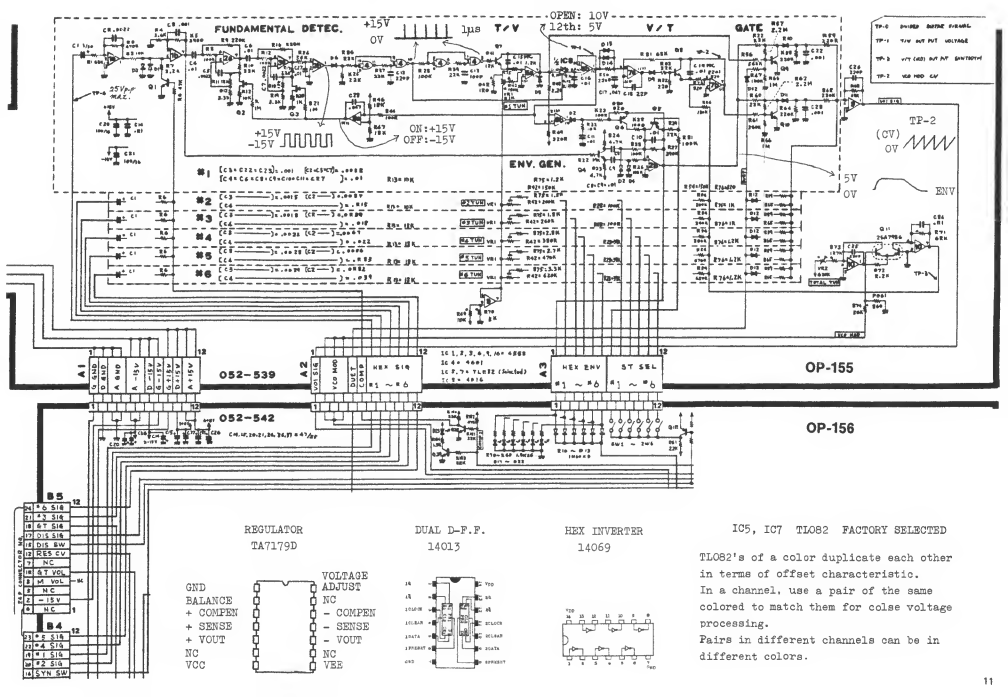
4. Pluck 2nd string with 12th fretting.
Tune VCO to zero beat with #2 TUN VR1.

5. In the same manner tune #3-6 VCOs.

6. Check all strings for detune at open string and 21st fret notes.

7. Fine tune every VCO with VR1 over a string scale.




FUNDAMENTAL DETEC.
+15V
0V
1μs
T/V
OPEN: 10V
12th: 5V
V/T
GATE
TP-0
TP-1
TP-2
TP-3
(CV)
0V
ENV. GEN.
5V
0V
ENV
052-539
052-542
OP-155
OP-156
HEX ENV
ST SEL
REGULATOR
TA7179D
VOLTAGE ADJUST
GND
BALANCE
+ COMPEN
+ SENSE
+ VOUT
NC
VCC
NC
- COMPEN
- SENSE
- VOUT
NC
VEE
DUAL D-F.F.
14013
HEX INVERTER
14069
IC5, IC7 TL082 FACTORY SELECTED
TL082's of a color duplicate each other in terms of offset characteristic.
In a channel, use a pair of the same colored to match them for colse voltage processing.
Pairs in different channels can be in different colors.