Gentle Electric
Carl Fravel
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(408) 423-1561

Model 101
Trim procedure
16 May, 1977

For best results, with an untrimmed unit, turn it on, test the 4 supply voltages (±15 and ±13), perform a rough trim. Then let it run for an extended time, like 30 minutes, with an input sufficient to turn the gate indicator on, before final trimming. If the unit is completely out of trim, it is best to set all trimmers to their center positions before beginning.

0db is here defined as .775v rms sine wave (2v peak-to-peak). But note that this is applied to the circuit through the line level attenuator, so that the circuit will be receiving 6db less (see below). For trimming the amplitude portion of the circuit, use a tone in the range 400Hz to 1kHz. Measurements should be taken with a high impedence VOM or Scope.

AMPLITUDE BOARD:

1 Put a 0db signal (2v pp) into the "line in" jack.

2 Adjust the "line level" pot so that its wiper (or point E on the board edge) is at -6db(1v pp). FROM NOW ON, DO NOT ADJUST THIS POT. Perform level adjustments at the tone generator. (note: if no input attenuator is being used, or if measurements are being made at the line input point on the board, subtract 6db from all the following input level specs)

3 Adjust trimmer 2 (T2) until test point 1 (TP1) is at -10v.

4 Change input level to -60db or less (off is ok). Adjust T1 counterclockwise (CCW) until TP1 voltage jumps to the positive supply, then back it off until TP1 is at about -4 to -4.5 volts.

5 Repeat steps ~~3 and 4~~ 3 to 4 if necessary

6 Step the input level from 0db to -30 db in 10db steps. The voltage at TP1 should make roughly equal, 1 volt changes. Below -30db, the size of the changes will decrease, but at no point should the voltage jump to the positive supply. Make slight adjustments to T1 if necessary.

7 Reset the signal level to 0db input, and recheck that TP1 is at 10v. If T3 is used, adjust it for 10v at tp3.

8 Adjust T4 for a 10v pp level at Compressor output.

9 Observe TP2 (this is compressor output before output capacitor) Note the amount of DC offset for a 0db input. (it should be less than 3 volts). Reduce input to -60db or less and adjust T5 for the same DC offset at TP2.

10 If there is a significant high frequency oscillation at TP2 with low input levels, adjust T1 slightly CW just until oscillation ceases. This change will cause a decrease in gain at low levels. However, it should be possible to get a steady 10v pp output for signals from -6db to at least -26 db

11 optional. T6 sets the gate threshold. Note that there is about 6db hysteresis between gate on and gate off levels. This is normally set for gate on at -20db.

PITCH BOARD

There are two adjustments here, high frequency tracking and v/octave. There are two trimmers for high frequency tracking, T101 (course) and T102 (fine). High frequency tracking is difficult to trim, and should not be readjusted arbitrarily on a previously trimmed unit. The v/octave trimmer can be located either on the board (T103) or on the panel, via connection to edge points V and W (only one trimmer should be used....) V/octave may need to be readjusted whenever this system is used with a different oscillator, to adjust for the v/octave variations between different oscillators, but high frequency tracking, once set correctly, should not need changing with good oscillators. Trimming is best performed with an accurate DVM connected to the pitch voltage and an oscillator applied to the input (so that the gate indicator is on) with a frequency counter on the oscillator. In this case the high frequency tracking trim is adjusted to give equal voltage increments to octaves at the input (it especially effects the high end) while v/octave is adjusted to make those increments equal to 1 v.

The trimming can be done with two oscillators, however, if the above test equipment is not available, but the accuracy of the tracking will only be as good as that of the oscillator. The following procedure is for 2 oscillators:

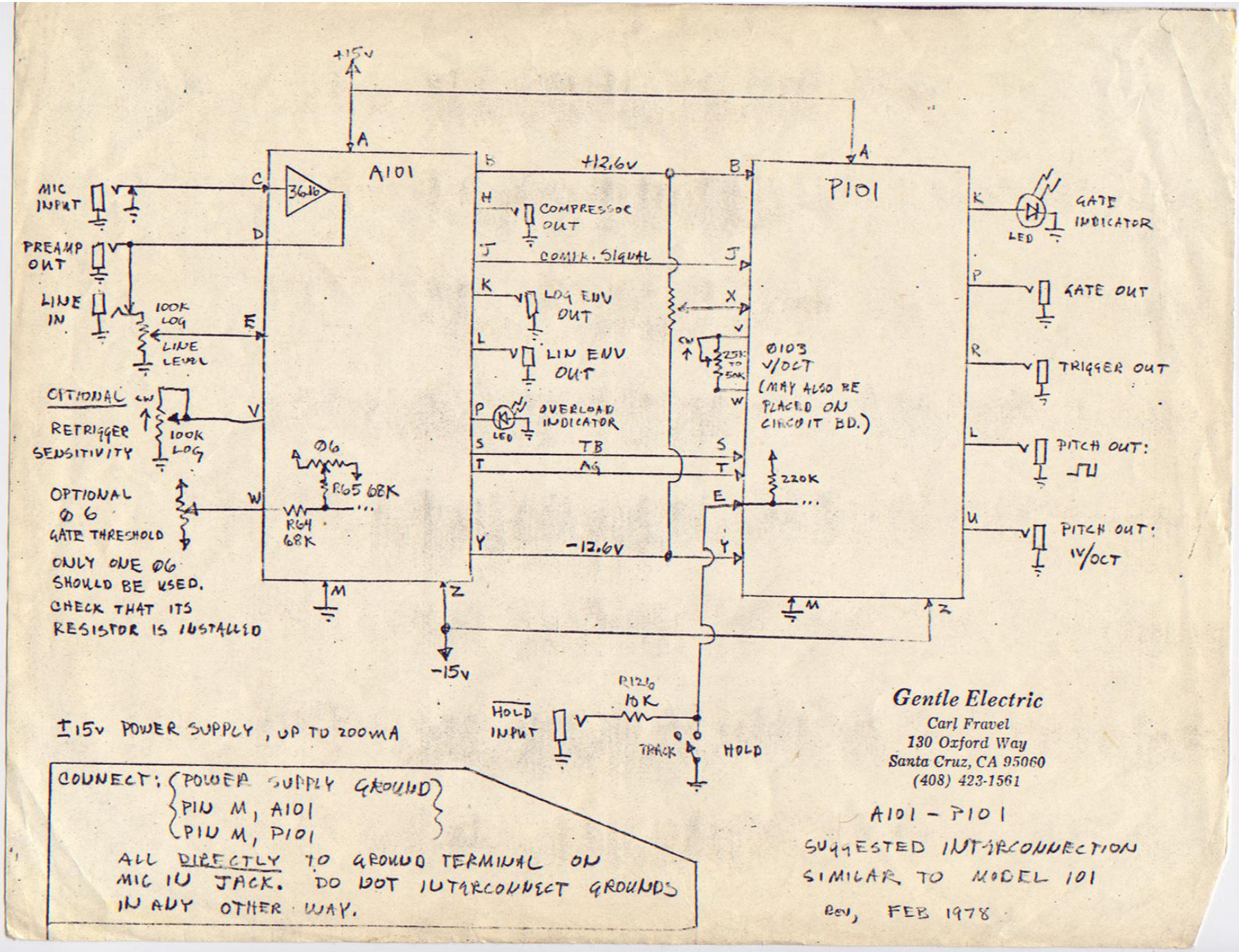
1 Set all three trimmers to center position.

2 Put oscillator 1 signal into line in with sufficient level to turn gate on, but not overload. Set tuning control to middle position.

3 Set oscillator one to 15khz to 20 khz. Adjust T101 for an output pitch voltage of approximately 5 volts.

4 Set oscillator 1 to the frequency which gives 0v out. This is the best reference from which to adjust v/octave, as the trimmer has minimum effect on pitch here. Connect oscillator 2 (an accurate, v/octave type) to pitch output, and tune for zero beat frequency between 2 oscillators.
5 Change osc. 1 to 40 Hz approx. Adjust v/octave for a zero beat.
6 Change osc. 1 for 0v output. Tune oscillator 2 for a zero beat.
7 Set osc. 1 to 2 khz. check that "GP" (edge point H) is high. Adjust T101 for a zero beat.
8 Set osc. 1 for 0v out. Tune osc 2 for zero beat.
9 Set osc. 1 for 30 hz. Adjust v/octave for a zero beat.
10 Perform steps 6 - 8, except go up to 4 kHz.
11 Perform them again, going up to 6khz, then 8khz, then 10 khz. When T101 no longer has enough resolution, begin using T102. V/octave trimming may now be done for frequencies above the 0v reference, but stay well below the frequency at which the high frequency tracking is being adjusted, and always retune the oscillators at the 0v output reference after each adjustment of either trimmer.

This procedure optimizes the tracking of this unit to the particular oscillator used as osc. 2. For perfect results, use perfect equipment...



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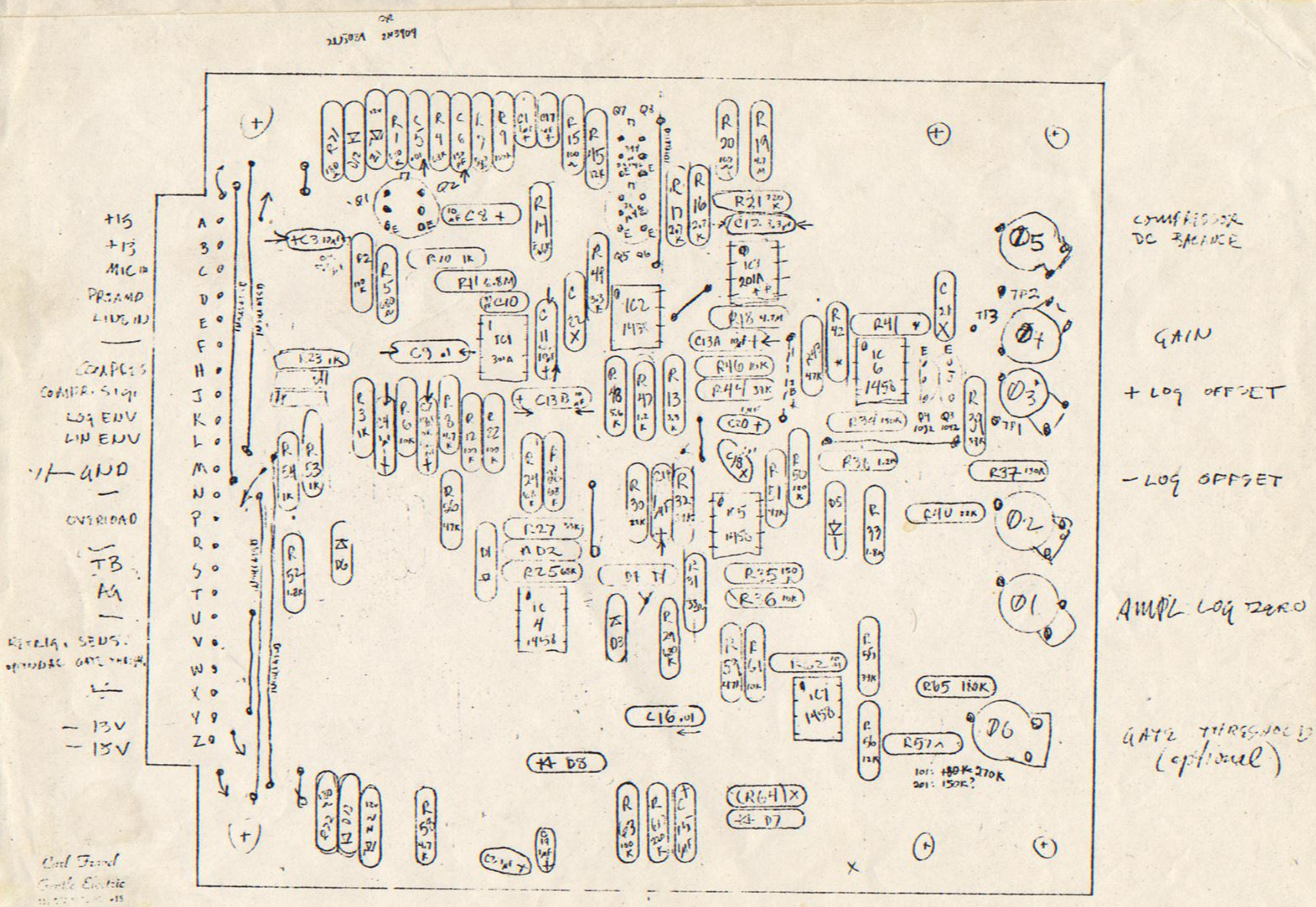
A101 - P101
SUGGESTED INTERCONNECTION
SIMILAR TO MODEL 101
Rev, FEB 1978

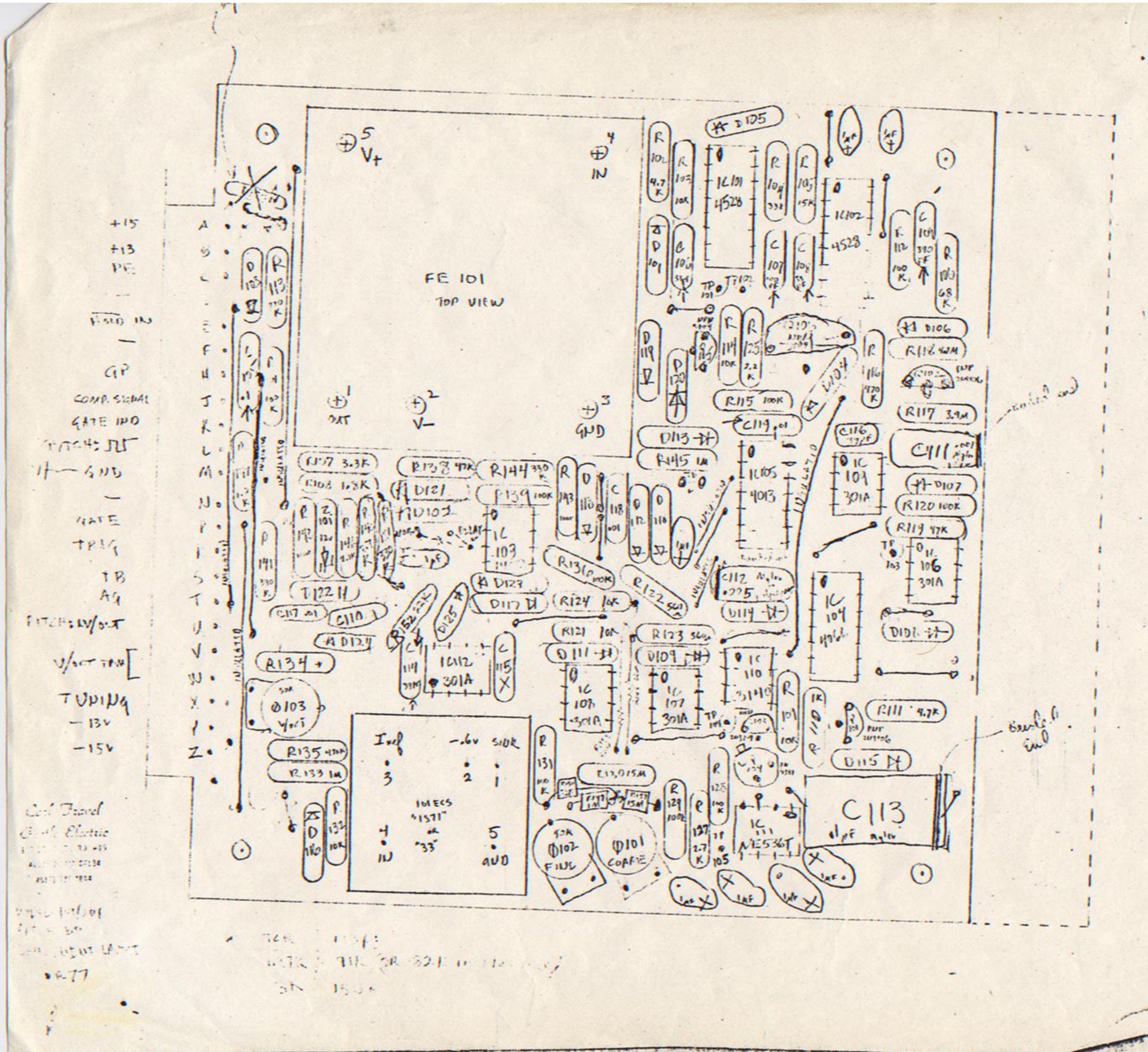


Carl Frederick
Gentle Electric

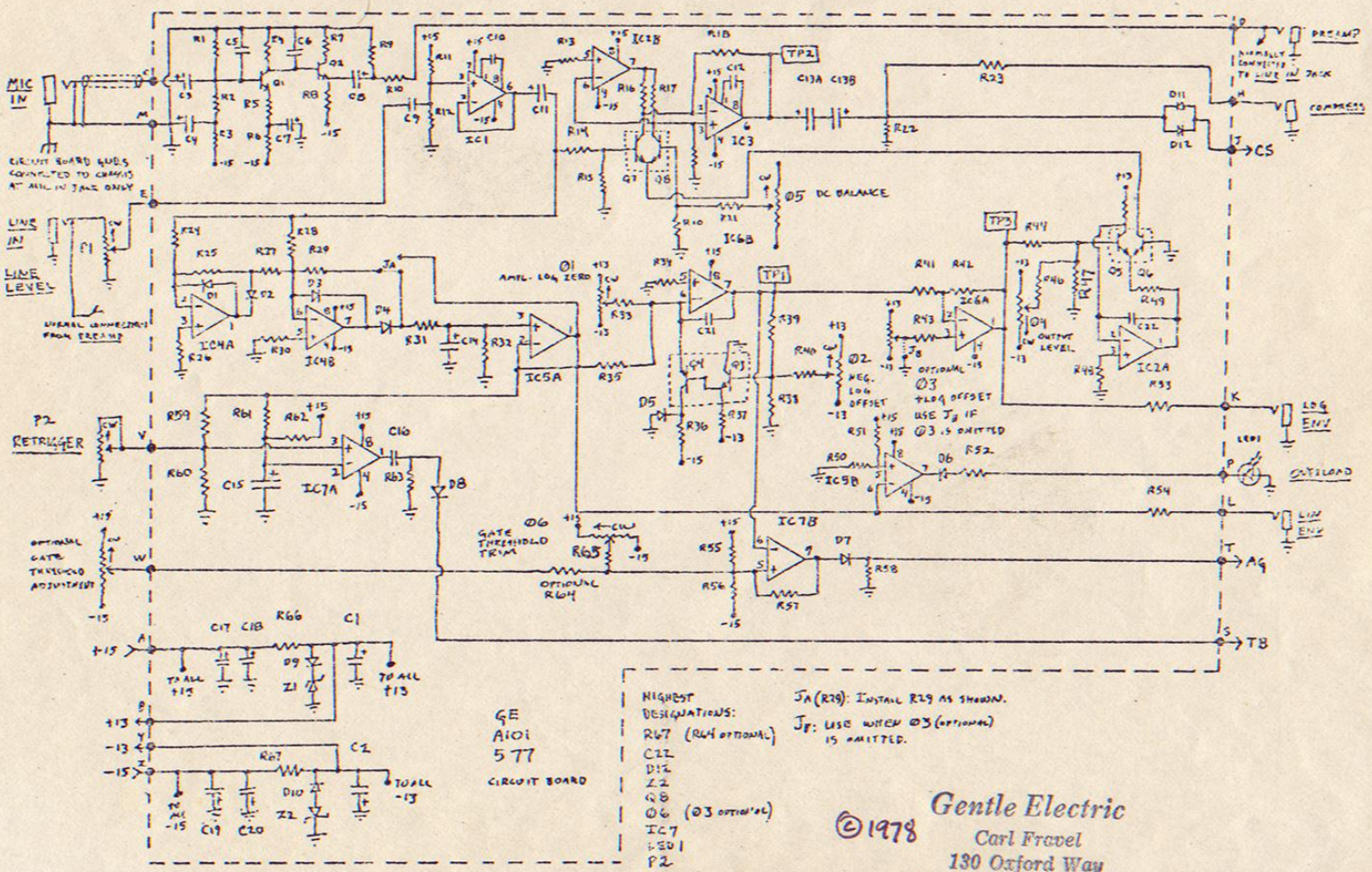
* R11,R12 Nom 100K Matched ±2% * 101 SB 201 D3

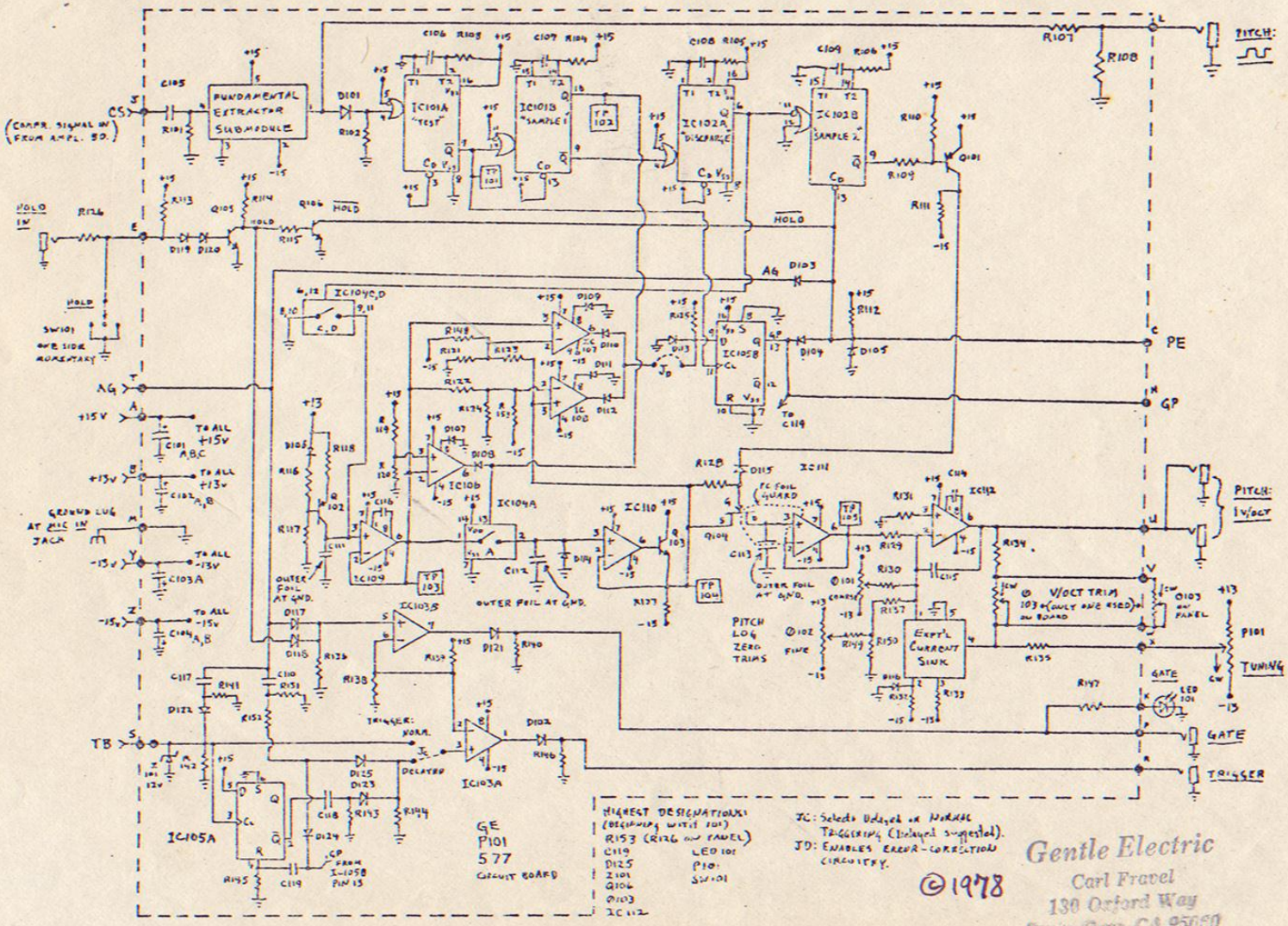
** IC3 201A (or 301A selected for <2mv offset v)

MODEL 101/201 23 APRIL 77
CNTRL BD
COMPONENT LAYOUT


FE 101
TOP VIEW
V+
IN
V−
GND
OUT
IC101 4528
IC102 4528
IC105 4013
IC104 4016
IC103
IC106 301A
IC112 301A
IC108 301A
IC107 301A
IC110 3140
IC111 NE536T
C113
C111
D105
D106
D107
R117 3.9M
R120 100K
R119 47K
R111 4.7K
D115
R115 100K
D113
R145 1M
R138 47K
R144 330
R139 100K
R137 3.3K
R108 6.8K
D121
D127
D117
R124 10K
R121 10K
R123 560
D111
D109
D114
R134
R135
R133 1M
Φ103
Φ102 FINE
Φ101 COARSE
Inf
−.6v
SIDE
INLECS "1371"
IN
GND
+15
+13
PE
GP
COMP. SIGNAL
GATE IND
GATE
TRIG
TUNING
−13v
−15v
A
B
C
E
F
H
J
K
L
M
N
P
S
T
U
V
W
X
Y
Z

- 408 -




FUNDAMENTAL EXTRACTOR SUBMODULE
(COMPR. SIGNAL IN FROM AMPL. SD.)
IC101A "TEST"
IC101B "SAMPLE"
IC102A "DISCRIMINATE"
IC102B "SAMPLE 2"
IC105B
IC104C,D
IC104A
IC104B
IC109
IC110
IC111
IC112
IC103B
IC103A
IC105A
HOLD IN
HOLD
SW101 ONE SIDE MOMENTARY
AG
PE
GP
+15V
+13V
-15V
TO ALL +15V
TO ALL +13V
TO ALL -15V
GROUND LUG AT MIC IN JACK
OUTER FOIL AT GND.
OUTER FOIL AT GND.
PITCH LOG ZERO TRIMS
FC FOIL GUARD
EXP'L CURRENT SINK
V/OCT TRIM
PITCH: 1V/OCT
PITCH:
TUNING
GATE
LED 101
TRIGGER
TRIGGER: NORM.
DELAYED
TB
GE P101 577 CIRCUIT BOARD
HIGHEST DESIGNATIONS (BEGINNING WITH 101)
R153 (R126 ON PANEL)
C119
D125
Z101
Q106
Q103
IC112
LED 101
P101
SW101
JC: Selects Delayed or Normal Triggering (Delayed suggested).
JD: Enables Error-Correction Circuitry.
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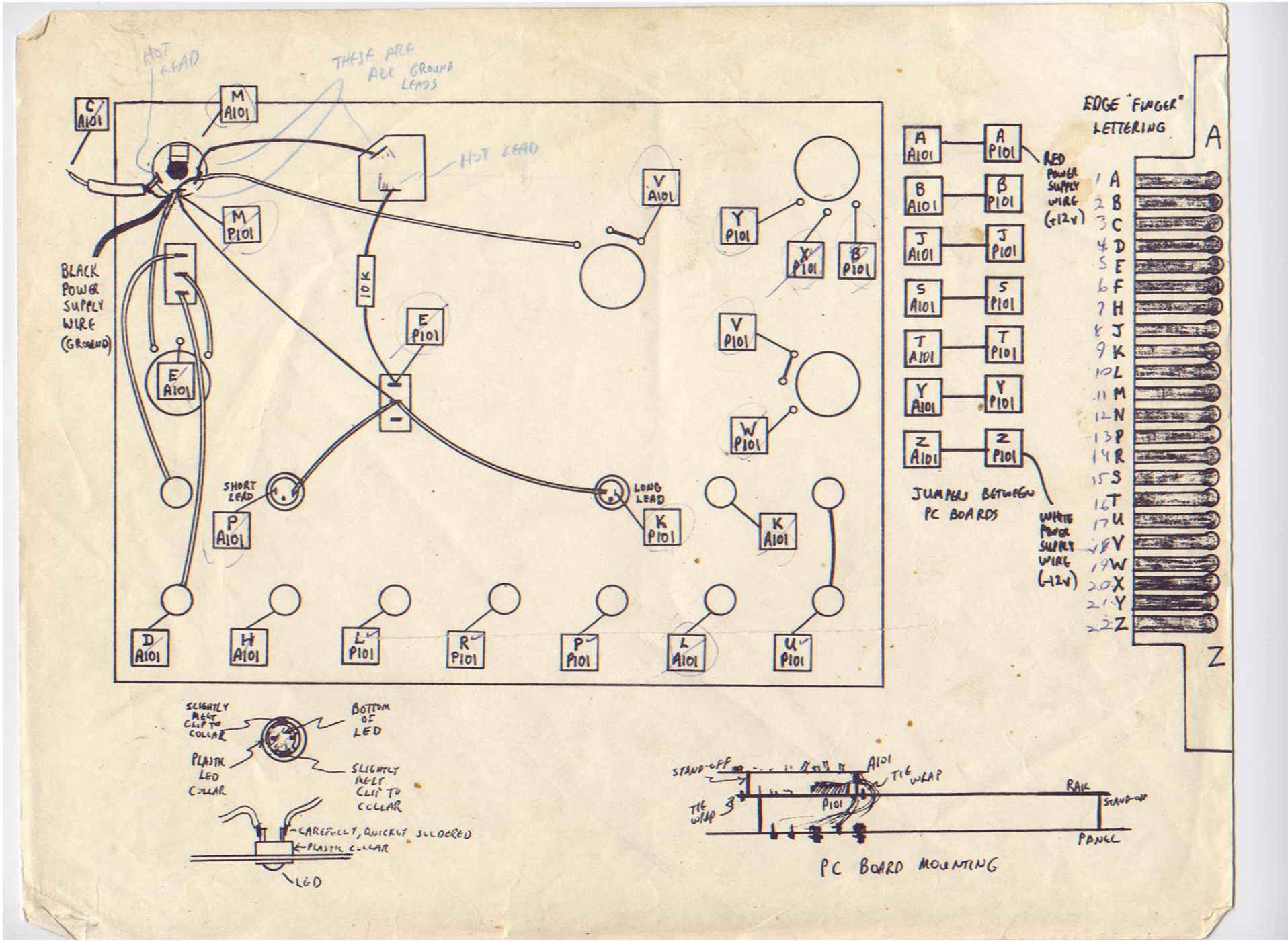
HOT LEAD
THESE ARE ALL GROUND LEADS
C A101
M A101
M P101
HOT LEAD
BLACK POWER SUPPLY WIRE (GROUND)
E A101
10K
E P101
V A101
Y P101
X P101
B P101
V P101
W P101
SHORT LEAD
P A101
LONG LEAD
K P101
K A101
D A101
H A101
L P101
R P101
P P101
L A101
U P101
A A101
A P101
B A101
B P101
J A101
J P101
S A101
S P101
T A101
T P101
Y A101
Y P101
Z A101
Z P101
RED POWER SUPPLY WIRE (+12V)
JUMPERS BETWEEN PC BOARDS
WHITE POWER SUPPLY WIRE (-12V)
EDGE "FINGER" LETTERING
A
Z
SLIGHTLY MELT CLIP TO COLLAR
BOTTOM OF LED
PLASTIC LED COLLAR
SLIGHTLY MELT CLIP TO COLLAR
CAREFULLY, QUICKLY SOLDERED
PLASTIC COLLAR
LED
STAND-OFF
A101
TIE WRAP
RAIL
TIE WRAP
P101
STAND-OFF
PANEL
PC BOARD MOUNTING

This module uses two PC boards stacked together with long plastic stand-offs. The wiring to this board differs from the wiring of other SERGE modules in that there are no pads labelled for connecting wires from the panel components to the PC boards. Instead, there are edge connector "fingers" which are soldered to. If desired, 22-pin edge connectors can be used, but they are not supplied with this kit. There are holes drilled on or near the inside of each of the "fingers". Wires are inserted into these holes and soldered like the wires to the pads on other SERGE modules. Care should be taken to insure that the insulation is not stripped too far back where wires can short out against traces on the PC boards or against other wires.

The boards are mounted as shown in the lower right of the wiring diagram. Edge "fingers" point to the right as seen from this diagram. Do not mount the stand-offs until last.

The P101 board should be mounted in the rails with the rest of the PC boards for this panel, and it should be wired to the places indicated in the diagram.

The LED's are mounted without our standard LED driver PC board. Use the plastic collar on the rear of the panel to hold the LED assembly firmly in place. Sometimes it is necessary to carefully touch the clip and collar with the tip of a hot soldering iron to fuse them permanently. Be very careful not to touch the LED with the soldering iron. The leads should be cut to about 3/8 inch and soldered directly to the wires as shown. Keep the stripped portion of the stranded wire short (1/8"), and try not to heat up the leads of the LED any more than absolutely necessary. Excessive heat will melt the LED. Also the leads should not have too much stress on them, since they can easily break the plastic LED package.

The wiring should be fairly straightforward. The ground connection of the microphone jack has a lot of wires, but if you are neat, the lug should accomodate all of them. Note that the black power supply wire is connected to this point rather than to the PC boards.

After all the boards in the rails have been wired, wire up the A101 PC board. The wires will have to be long enough to reach around the P101 board and up to the A101 mounted on stand-offs, so make sure they will reach after the boards are stacked and folded onto the panel in the final assembly.

After the A101 is wired, wire the inter-board jumpers as shown in the diagram. These should be about 1-1/2" each. Then install the stand-offs.

The shield strands on the shielded wire is connected on one end only. Make sure that no strands can short against other wiring on the PC board. The strands should be cut flush with the outer insulation, slightly pulling on the insulation will pull it over to completely cover the shield strands. Then use plastic electrical tape to cover the shield strands.

AR-333 PITCH AND ENVELOPE FOLLOWER
NOTES ON OPTIMUM PITCH-EXTRACTOR PERFORMANCE IN THE REAL WORLD

Although there are some applications where errors in the pitch follower are useful and desirable, here we assume that you want to get the best pitch follower behavior possible. For the pitch extraction to work well a fair amount of care must be taken with the signal. For best results the signal should be strickly monophonic and should be low-noise and should have a fair amount of signal present at the fundamental frequency or a broad spectrum of harmonics. More specifically:

MONOPHONIC Instruments producing a mix of more than one pitch at a time such as piano or mono guitar will be very difficult to pitch follow. On pianos, harpsichords, harps, and the like, it is just about impossible to play only one note at a time in the sense that even when only one key is depressed at a time, the instrument still reverberates the previously-played notes. Somewhat better results can be had with normal guitars (normal being defined here as those not having seperate outputs for each string), or stringed instruments like violins. However, care must be taken in the playing technique to only play one string at a time and to damp any other strings that were previously vibrating (sympathetic vibrations are not generally so harmful).
When more than one pitch is present, the pitch follower may either behave totally erratically, or try to follow the "greatest common denominator" frequency (i.e. try to treat the pitches as both being harmonics of some lower fundamental). Pitches tuned to some perfect interval (such as a perfect fifth or a just third) are especially good at eliciting the latter response.

LOW NOISE Any signal components which are extraneous to the actual pitch will cause the pitch output to be rough or erratic. Noise in this context can refer to any of the following:

1) Noise or hum introduced in the pickup or its preamp;
2) Plucking, stricking, tongueing, bowing, or key noise;
3) Wind, either from the instrument or the weather;
4) Misc. extraneous sounds (other instruments, traffic noise, talking, etc.);
5) Reverberation, including that introduced by the room acoustics; and
6) Feedback, either of the instrument sound, or from the synthesizer.

For these reasons, best results with instruments will be had with high-quality pickups designed specifically for the instrument, and for winds, those pickups located near the mouthpiece will be better than those in the bell.
If an air microphone must be used, place it where the pitched sound will be strongest in relation to any other noise produced by the instrument. For flutes and voice, this means keeping the microphone out of the breath stream. The best pitched sound in the woodwind generally comes out of the instrument near the first open holes. If the player is willing to move the instrument around to keep a fixed microphone near the holes of the instrument while playing, reasonably good results can be had. (This also allows the player to control the synthesizer volume somewhat independently of the straight sound volume.) The sound coming out of the bell is generally not quite so good, and often contains a "pop" when a key is depressed.

HARMONIC CONTENT The ideal signal for pitch following would have most of the sound energy in the fundamental, and any harmonics present would be "phase locked" to the fundamental (as in a steady-state timbre. The most notable exceptions are the shifting harmonics of a string, or in the voice during a vowel change). The AR-333 is quite good with handling harmonics, and is not confused by phase-shifting harmonics. For this reason it does perform quite well with voice, or strings. However, the worst sort of signal is when some particular harmonic strongly predominates over the fundamental, in which case the pitch follower may occasionally jump to the harmonic frequency. For this reason one should generally avoid the use of cheap pickups which have strong resonances which therefore may favor some harmonic over the fundamental. Also for this reason,

it is best to derive the signal from as large of area of an instrument as possible because each separate part will tend to resonate at certain frequencies. When placing a contract pickup on a string instrument, it is generally best to place it on or near the bridge (before the body resonances affect it) while exciting the string as close to the center of its vibrating part as possible. However, for electric string pick-ups, like those on electric guitars, or for microphones which actually pickup directly from the string, it is best to locate these near the center of the string (i.e. on an electric guitar use the neck pickup in preference to the bridge pickup).
Some sounds, like certain bells, in which the tones are not harmonically related, may be hard to pitch-follow.