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Technical Document Distribution

Brand:	Crumar	
Model:	Performer	
Product:	Keyboard	
Description:	Service Manual	Dated: none

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TechTips: 0

Pages: 30

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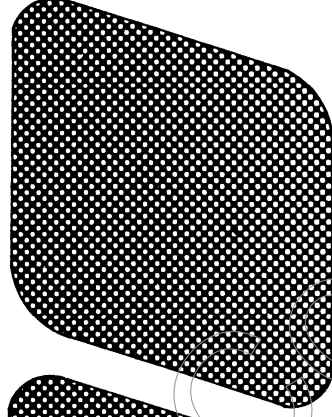
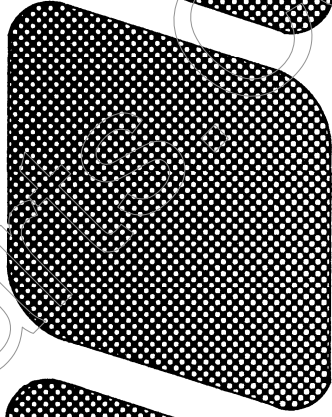
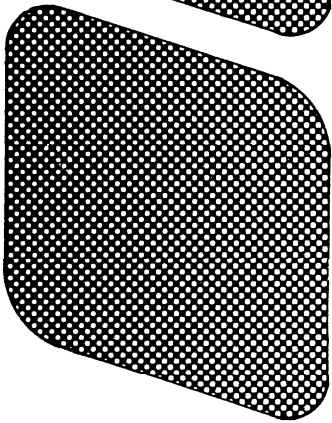
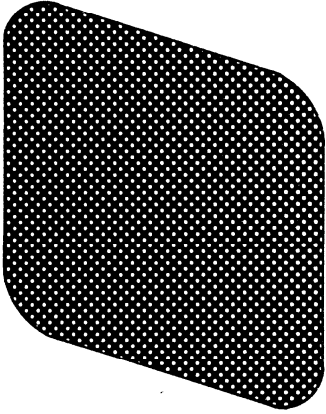
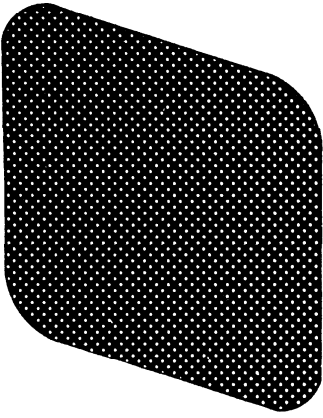
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MUSIC

CRUMAR[®]

Musical Instruments



mod.
Performer

CRUMAR PERFORMER OPERATING

DESCRIPTION

The Performer is a multivoice instrument incorporating an enormous amount of variability within a fairly simple format. It can produce a wide range of string and brass sounds quickly and accurately, but only through familiarization with the controls you will achieve maximum results.

THE PERFORMER PACKAGE

Your Performer comes complete with power cord, a mini-jack patch cord for synthesizer interfacing, a carrying bag and a standard patch cord used to hook the Performer to an amplifier.

AMPLIFICATION

Your Performer keyboard can be connected to any conventional power amplifier and speaker system that will accept a monophonic phone plug from the instrument's main output.

SETTING UP

Located on the rear right of the instrument is the on/off switch, fuse, and power cord connection. Plug the special power cord into the unit and run to the nearest available 110AC (or 220) outlet. On the rear left of the Performer is the main output panel. Using a standard phono plug, (supplied with the unit) run a line from the output marked « MAIN » to your amp. This will send both strings and brass through one channel.

For a stereophonic effect, plug another patch cord into the output marked « BRASS ». You now have total separation of the string and brass voices for individual equalization, stereo placement through PA's, and special effects. (The other two outputs are for interfacing with a synthesizer and will be explained later.)

Now you can switch the Performer on. A pilot light located on the on/off switch (as well as the LED's on the front panel) will signal that you are ready to begin.

SWITCHES

The four (4) switches or buttons found on your Performer are the on/off controls. By pushing the button in, the corresponding LED found on top of each switch will light up indicating the function is turned on. This allows for easy viewing in poorly lit playing situations.

VOLUME SLIDES

On the front panel there are three (3) slide controls marked « VOLUME ». Moving left to right, they are the volume controls for the Brass section; the Violin section, and the overall master volume. Collectively, these controls provide a simple mixing console for more accurate control of volume levels. Remember, the right master volume control must be kept on otherwise no sound will be heard. Use the two other slides for achieving the proper balance between the strings and brass sounds.

BRASS SECTION

The Brass section is activated by depressing the on/off position switch and moving the volume slide to « ON ». A large variety of sounds are attained through manipulation of the four sliders found to the left of the volume control. The Attack and Decay sliders serve as envelope controllers. They provide the various nuances or subtleties needed when expressing a note. The Range and Resonance sliders control the overall sound quality. They function as the filter controllers. Although, each slider has an independent function, they all work together to produce sounds that range from French Horns to Synthesizer filter sweeps.

STRING SECTION

To activate the string section, depress either the 16' or 8' foot switch. The 8' foot octave is considered a violin register, while the 16' foot is more cello like. Both the 8' foot and 16' foot can be used together to achieve a rich, full string section. The three (3) equalization controls, (low, mid, high) function as a three band graphic, coloring the entire range of string possibilities. They also serve as an excellent means of altering the string sounds directly from the keyboard. Most importantly, it gives the performer a vast array of sound combinations ranging from very mellow types of string sounds to those very bright. Each equalization control is brought in by moving the sliders upwards. The higher the position, the greater the effect or interaction. By manipulating the low, mid and high sliders you can achieve the string sound of your choice.

CRESCENDO CONTROL

In the « 0 » position the strings will be heard immediately. By moving the slider upwards the attack time will be increased accordingly. This slide is always

MODULATION SECTION

The modulation section is always on and when the selector is in upper position activates the V.C.F. modulation, while in down position activates the Frequency modulation (F.M.). The LED serves as a visual monitor of the modulation rate. The V.C.F. modulation is routed into the filter and operates only in conjunction with the brass section.

Necessarily, the brass section must be turned on when operating these controls.

The F.M. may be used with both brass and strings sections. The modulation effects are controlled by the depth and rate sliders. The delay slide determines how long after the key is depressed the preset effect will come in. The Resonance and Range controls in the filter bank have greatest effect on what types of modulation sounds will be achieved.

PITCH CONTROL

This raises or lowers the pitch of the entire keyboard by as much as 2 - 1/2 octaves. This is the master oscillator and it can never go out of tune with itself. Adjust for proper pitch on the rear panel.

IMPORTANT:

The range or octave you choose will greatly effect the total sound characteristics. Try varying the instruments pitch from low to high when determining your optimum setting.

INTERFACING WITH A SYNTHESIZER

The Crumar Performer will interface with any synthesizer that will accept a gate of +5V (no key or stand by) to ground (key depressed).

live, so take note of its position at all times since it will affect not only the sound of the strings, but their placement in the music.

WARNING:

If there is any question as to whether your synthesizer voltage is compatible, contact CRUMAR before attempting the interface. Improper connection will void the warranty and damage the unit. Once you are sure the voltages match, the interface procedure is easy:

- 1) Using the patch cord supplied with the unit, connect the Performer mini jack (located on back panel) to the «Gate In» on your synthesizer.
- 2) Connect a standard phono plug from the signal jack of the Performer into your synthesizer « External Input » (audio only).

After completing this simple two wire hook up, the Performer signal output can be controlled and modified by the synthesizer ADSR, voltage controlled filter and amplitude and filter (LFO) modulation. (The DS - 2 Digital Synthesizer with two ADSR's, two completely independent LFO banks and a four pole filter is an ideal mate for the Performer).

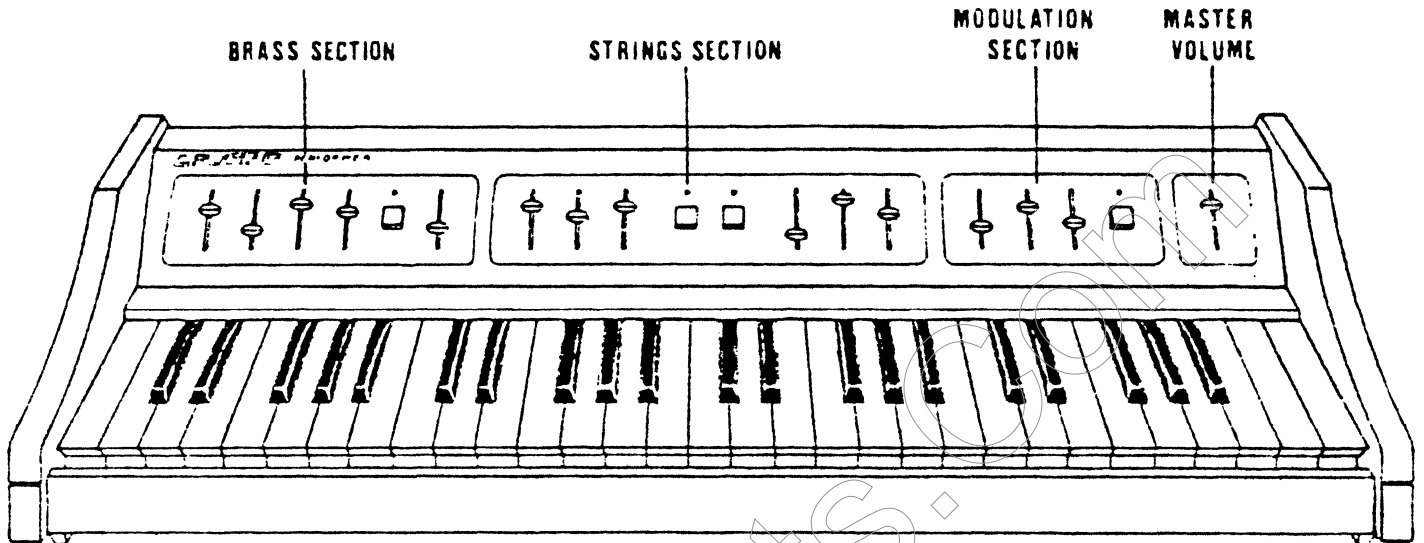
SUSTAIN SLIDE

This slide, found to the right of the Crescendo control, lengthens the time the note will sound after your hand is removed. It will increase or decrease depending on the position of the slide. In the « 0 » position, there will be no sustain and in the 8 position maximum sustain. (Note: the sustain feature is disabled or defeated when the brass button is depressed).

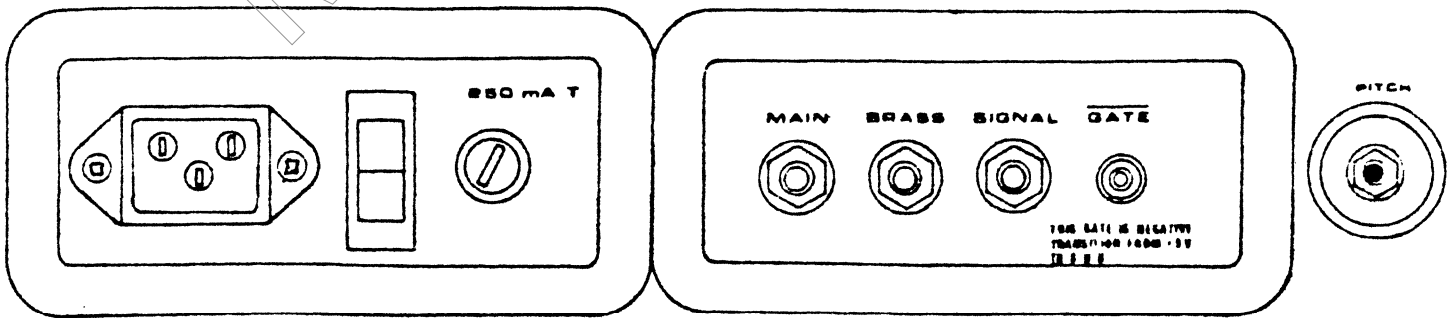
MAINTENANCE

Keep your Organizer T1 and its accessories clean and dry. Any internal electronic service should be performed by a certified warranty repair station.

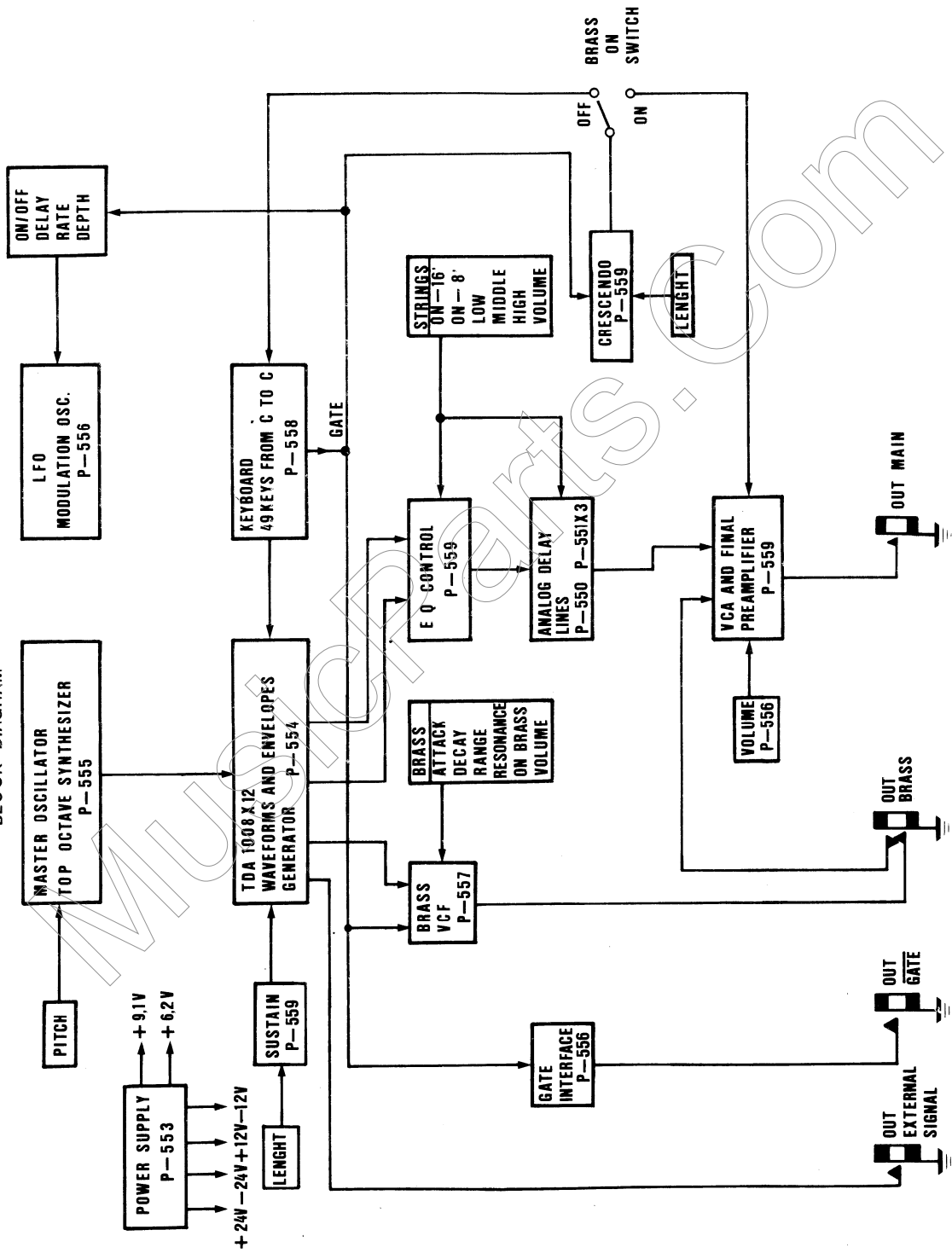
LOCATION DIAGRAM



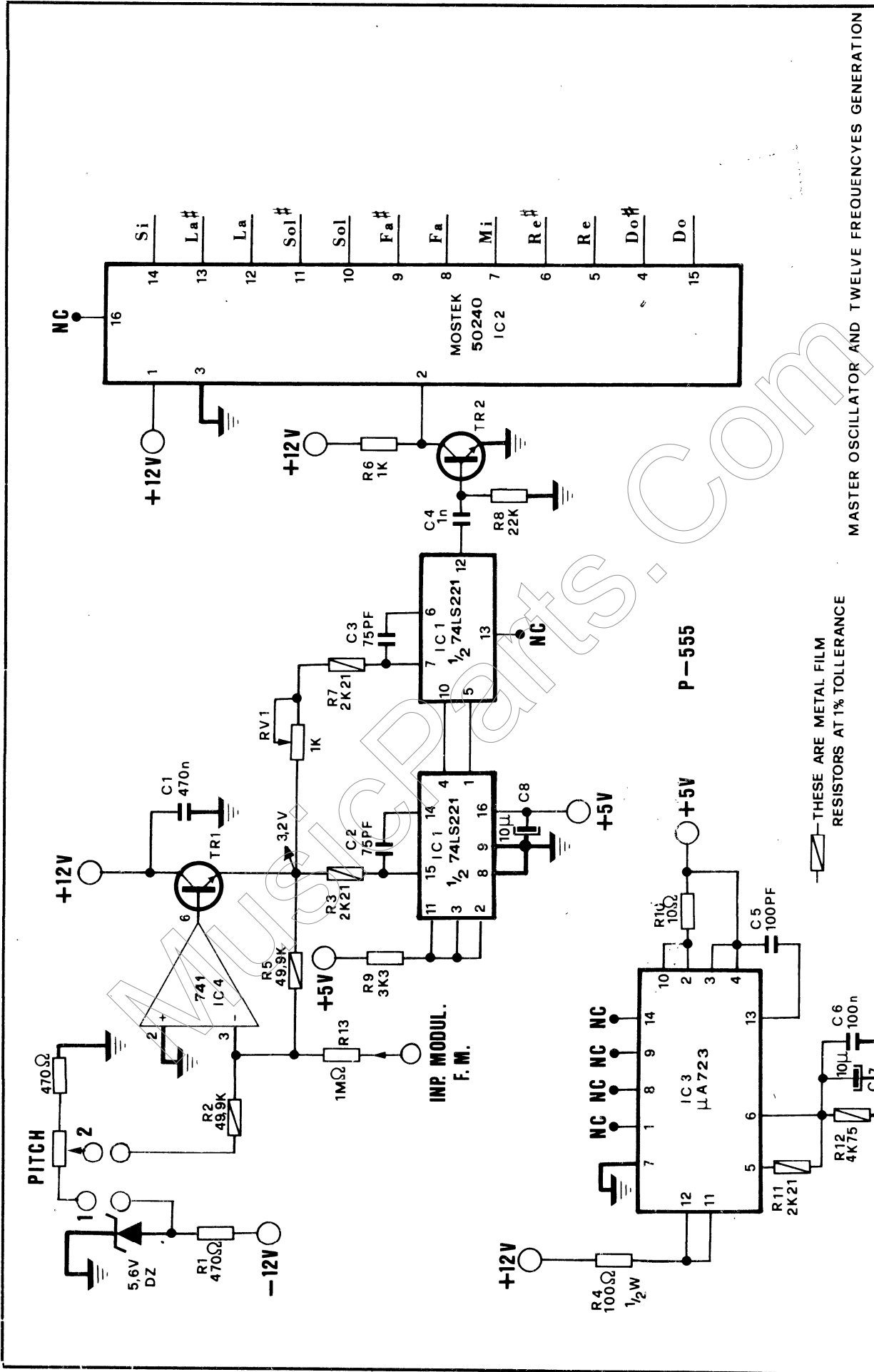
PEDALS - INPUT ——— INSTRUMENT OUTPUTS



BLOCK DIAGRAM

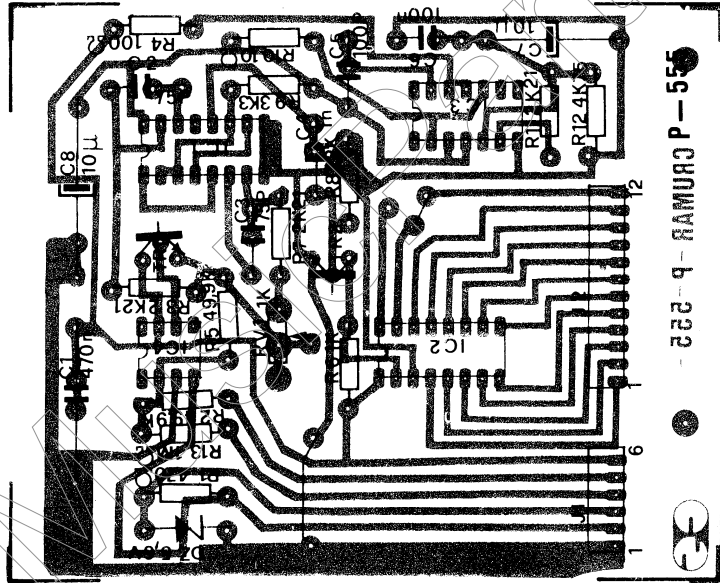


MODEL	PERFORMER	REVISION
DATE	DRAWN BY	DESIGNED BY
	Rev. 6. 6.	R. 3. 6. 6.
		DATE



MASTER OSCILLATOR AND TWELVE FREQUENCIES GENERATION

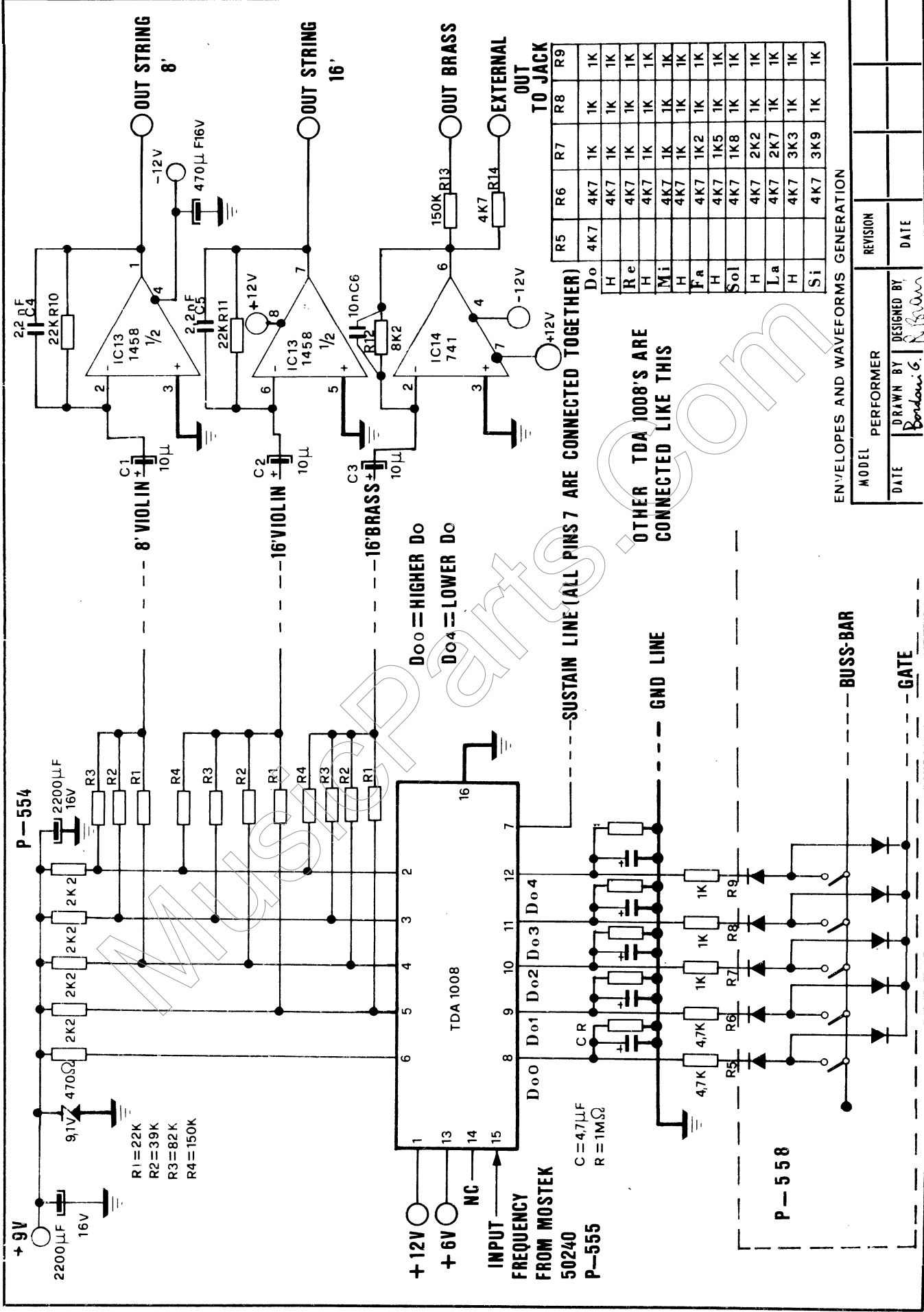
MODEL		PERFORMER		REVISION	
DATE	DRAWN BY	DESIGNED BY			
	Borden G. R. Brian				
		DATE			



55-9-8AMURCP-55

J 1		J 2	
1	GND	1	D ₀ #
2	-12V	2	R _e #
3	PITCH 1	3	R _e #
4	NC	4	Mi
5	PITCH 2	5	F _a #
6	+12V	6	F _a #
		7	Sol
		8	Sol#
		9	L _a #
		10	L _a #
		11	Si
		12	D ₀

MODEL PERFORMER		REVISION	
DATE	DRAWN BY	DESIGNED BY	DATE
	B. ...	R. ...	



ENVELOPES AND WAVEFORMS GENERATION

MODEL	PERFORMER	REVISION	
DATE	DRAWN BY	DESIGNED BY	
	Bondani G.	R. B. O.	
		DATE	

Do0 = HIGHER DO
 Do4 = LOWER DO

SUSTAIN LINE (ALL PINS 7 ARE CONNECTED TOGETHER)

GND LINE

BUSS-BAR

GATE

P-554

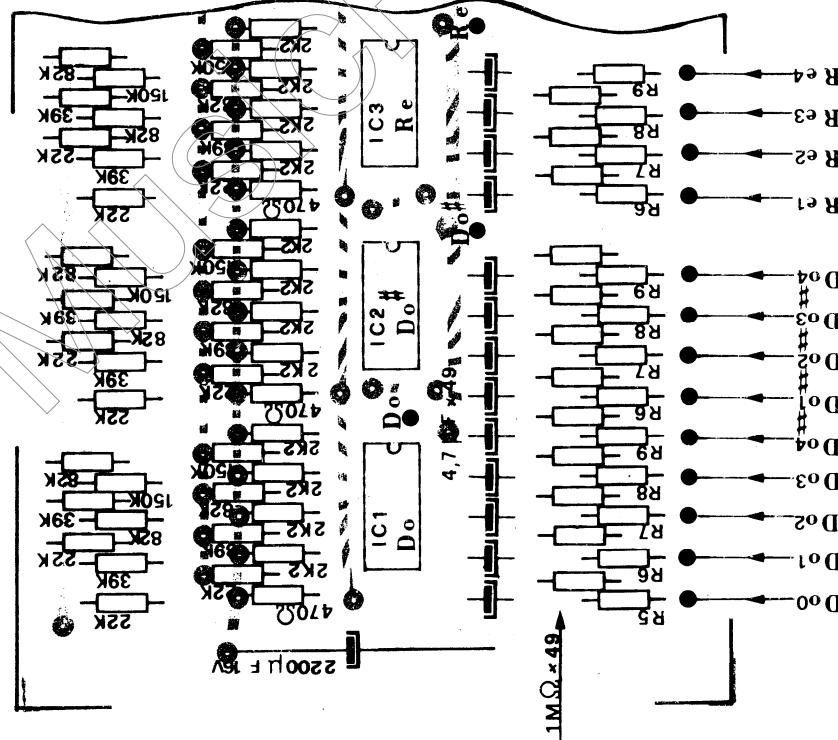
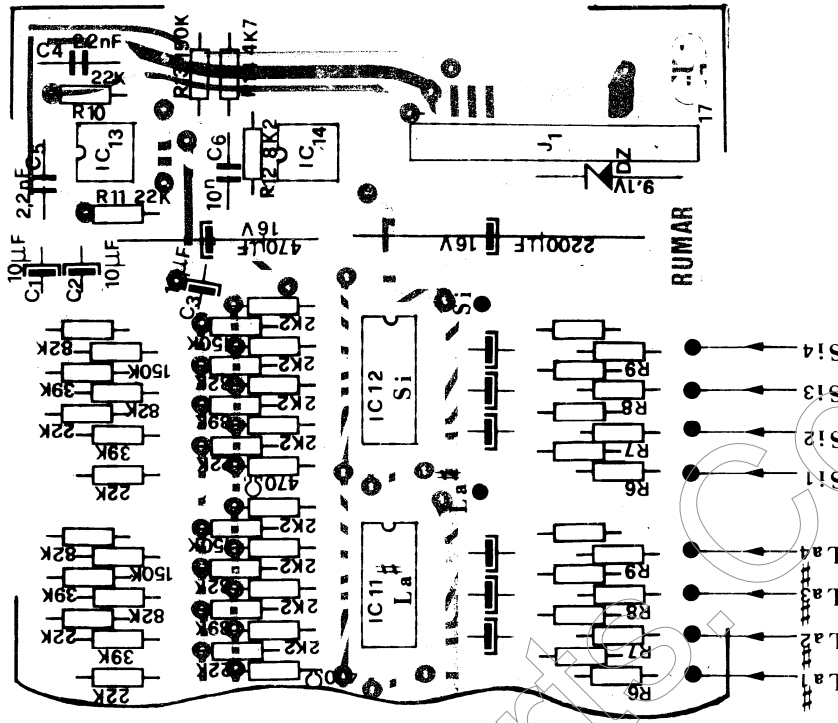
P-558

+12V INPUT
 +6V NG
 FREQUENCY FROM MOSTEK 50240
 P-555

R1 = 22K
 R2 = 39K
 R3 = 82K
 R4 = 150K

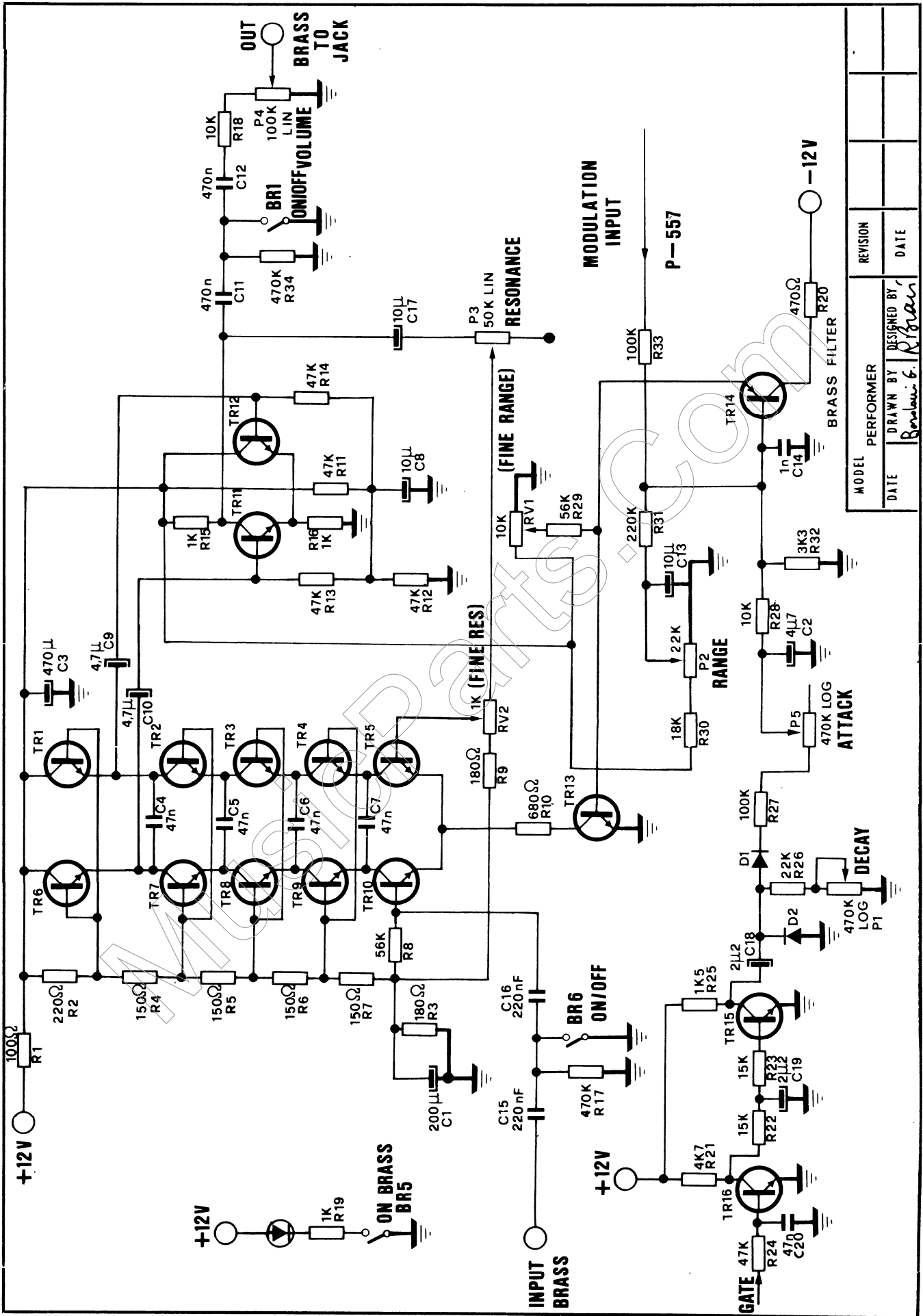
C = 47uF
 R = 1MΩ

P-554



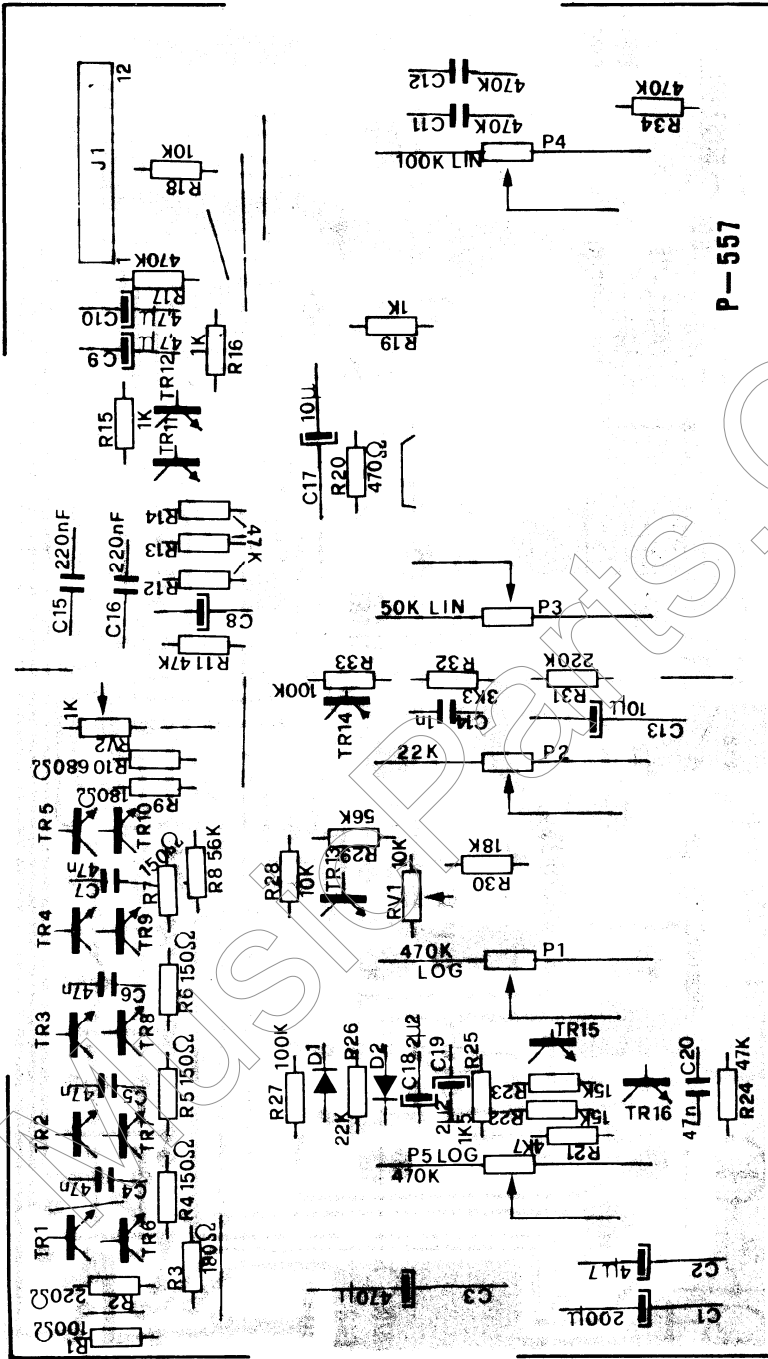
J1		FROM 11	TO 17
1	OUT STRING 8	+12 V	
2	GND	-12 V	
3	OUT STRING 16	+9 V	
4	OUT BRASS	SUSTAIN LINE	
5	EXT. OUT	+6.2V	
			GND

MODEL PERFORMER	REVISION
DATE	DATE
DRAWN BY <i>Bondwin R. Brown</i>	



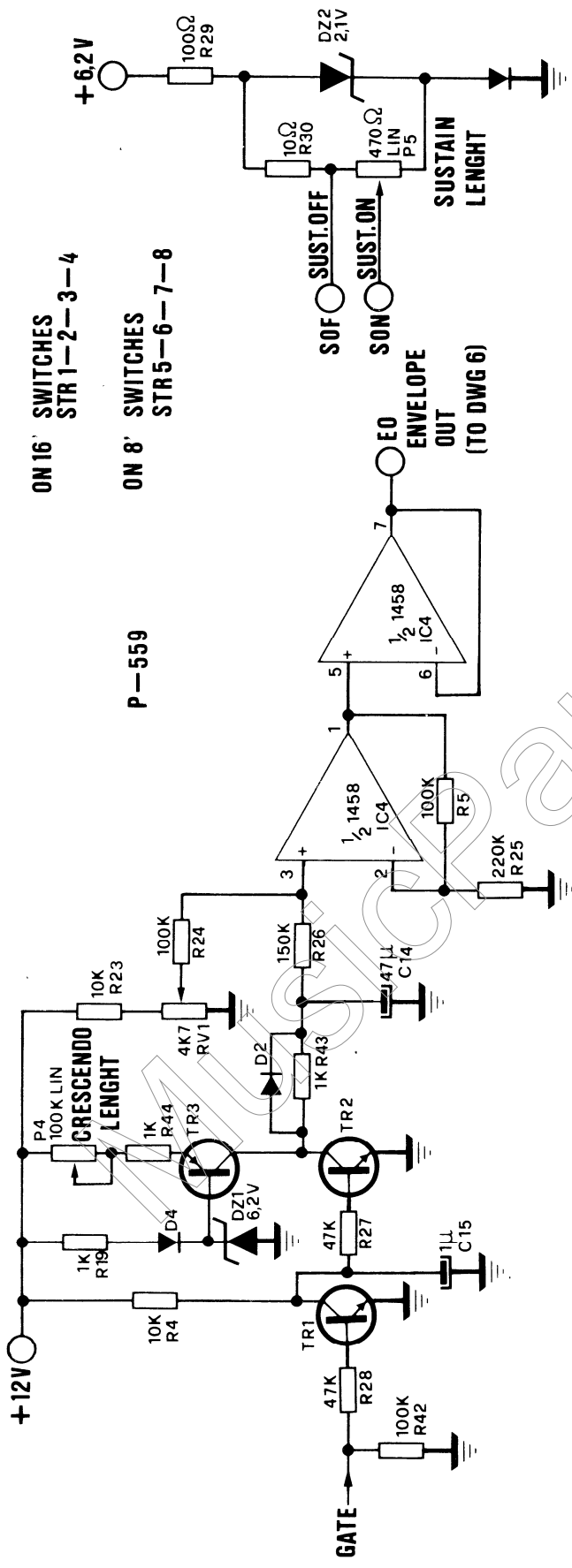
MODEL	PERFORMER	REVISION	
DATE	DRAWN BY	DESIGNED BY	DATE
	Bonshaw, G. R.		

P-557



J1	
1	BR6 ON/OFF
2	- 12V
3	INP BRASS
4	GND
5	GND
6	GND
7	GND
8	OUT BR TO JACK
9	+12V
10	BR5 ON/OFF
11	GATE
12	INP MOD.

MODEL PERFORMER		REVISION	
DATE	DESIGNED BY	DATE	
	Borjouis R. M. V.		



ON 16' SWITCHES
STR 1-2-3-4

ON 8' SWITCHES
STR 5-6-7-8

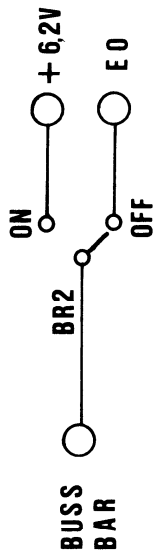
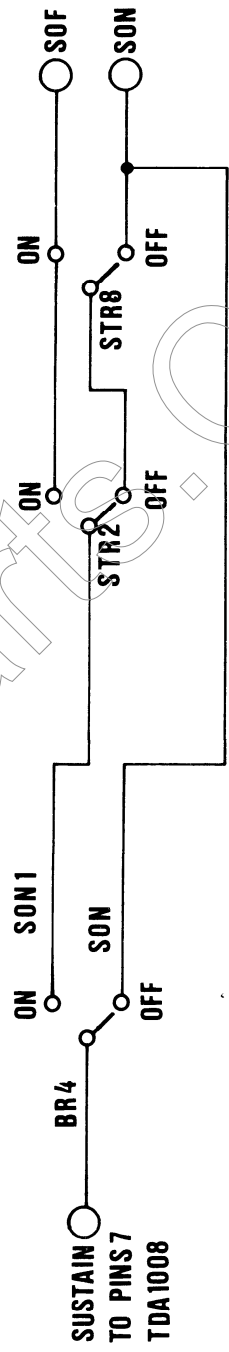
P-559

SOF ○ SUST.OFF

SON ○ SUST.ON

E0 ENVELOPE
OUT (TO DWG 6)

SUSTAIN
LEIGHT



ON BRASS

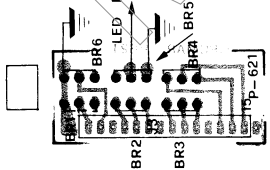
ON 8'

ON 16'

CRESCENDO

MODEL	PERFORMER	REVISION	
DATE	DRAWN BY DESIGNED BY	DATE	
	Borlan G. Koffen		

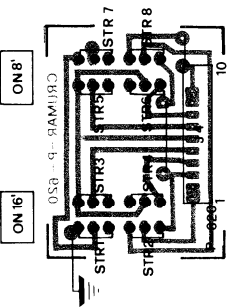
BRASS SWITCH



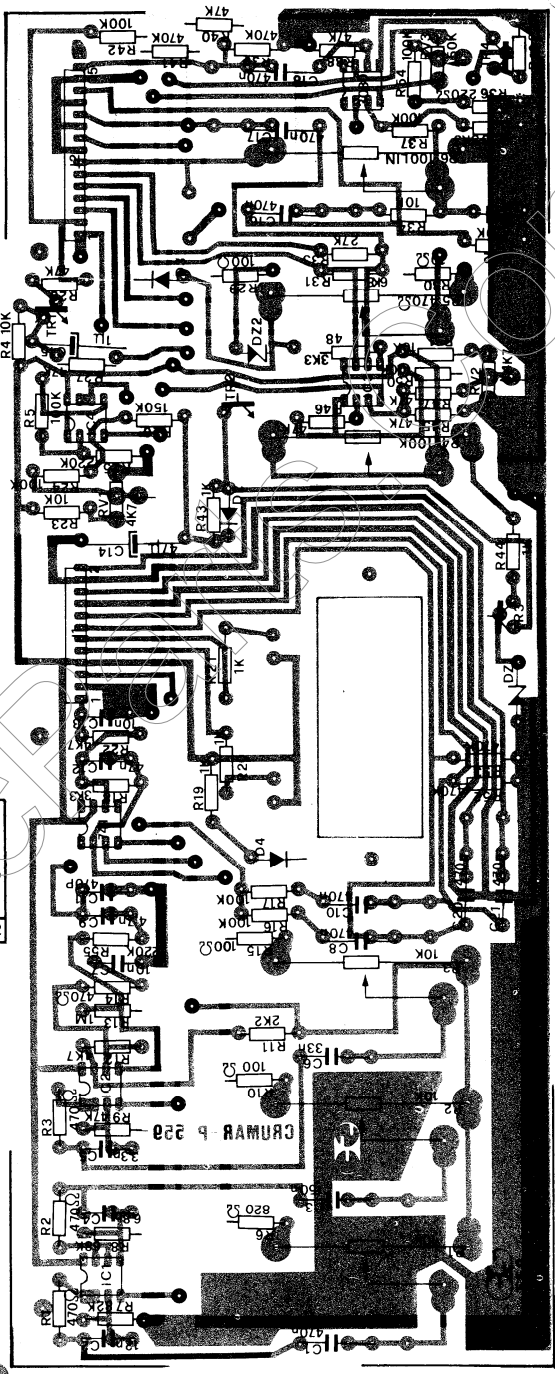
J3	
1	BR1
2	BR6
3	NC
4	EO
5	BUSS BAR
6	+62V
7	NC
8	BF
9	BNF
10	BN
11	NC
12	SON
13	SON1
14	SUSTAIN
15	NC

J4	
1	NC
2	SON1
3	SOF
4	LED16'
5	ON16'
6	GND
7	ON8'
8	LED8'
9	SON
10	SON

STRING SWITCH

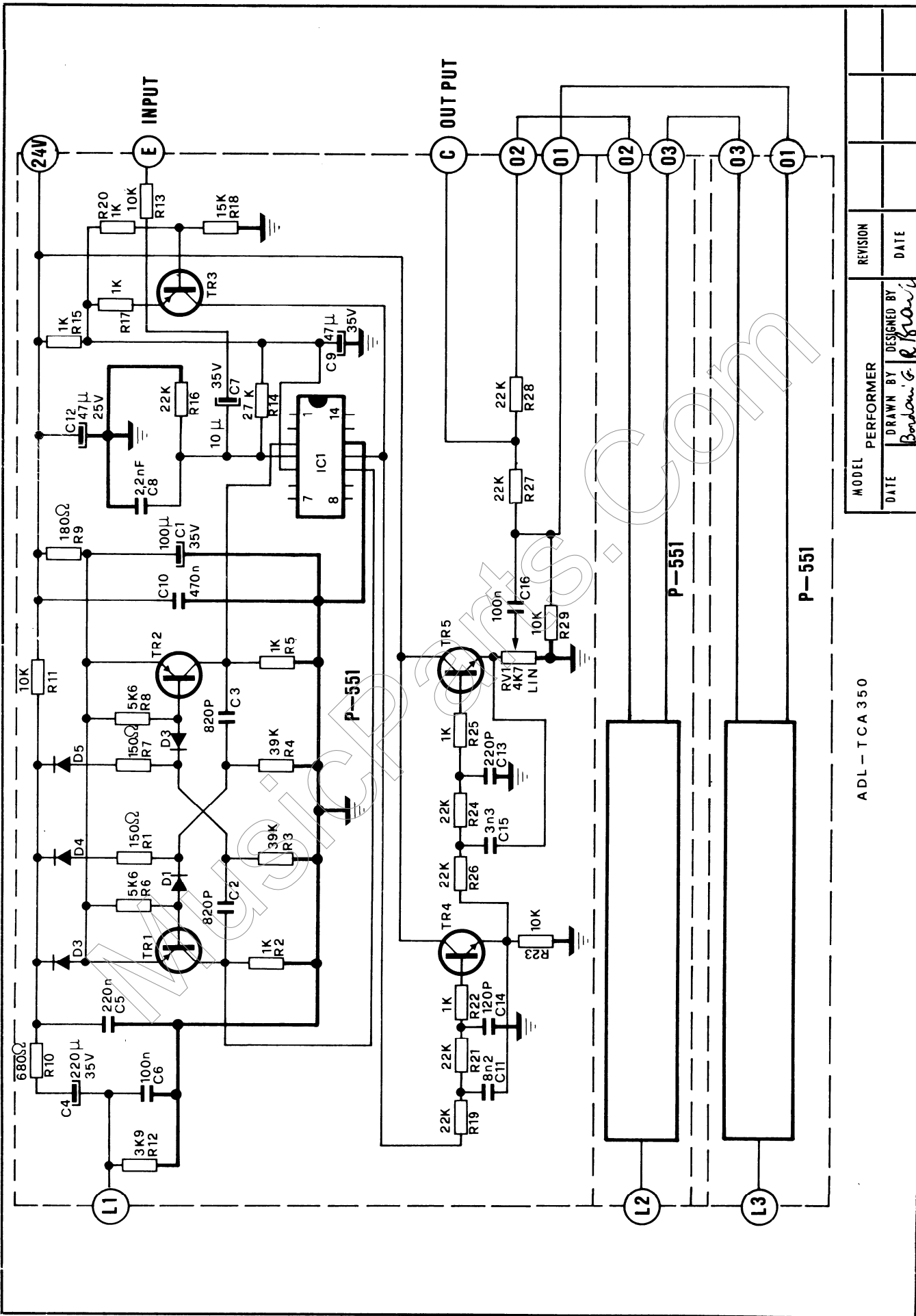


J1		J2	
1	E INPUT	1	EO
2	GND	2	GATE
3	-12V	3	SON
4	+12V	4	SOF
5	LED16'	5	OUT MAIN1
6	LED8'	6	INP BR FROM JACK
7	ON8'	7	C OUT
8	ON16'	8	GND
9	GND	9	+62V
10	INP STRING 8'	10	GND
11	GND	11	BNF
12	INP STRING 16'	12	GND
		13	BF
		14	GND
		15	BN



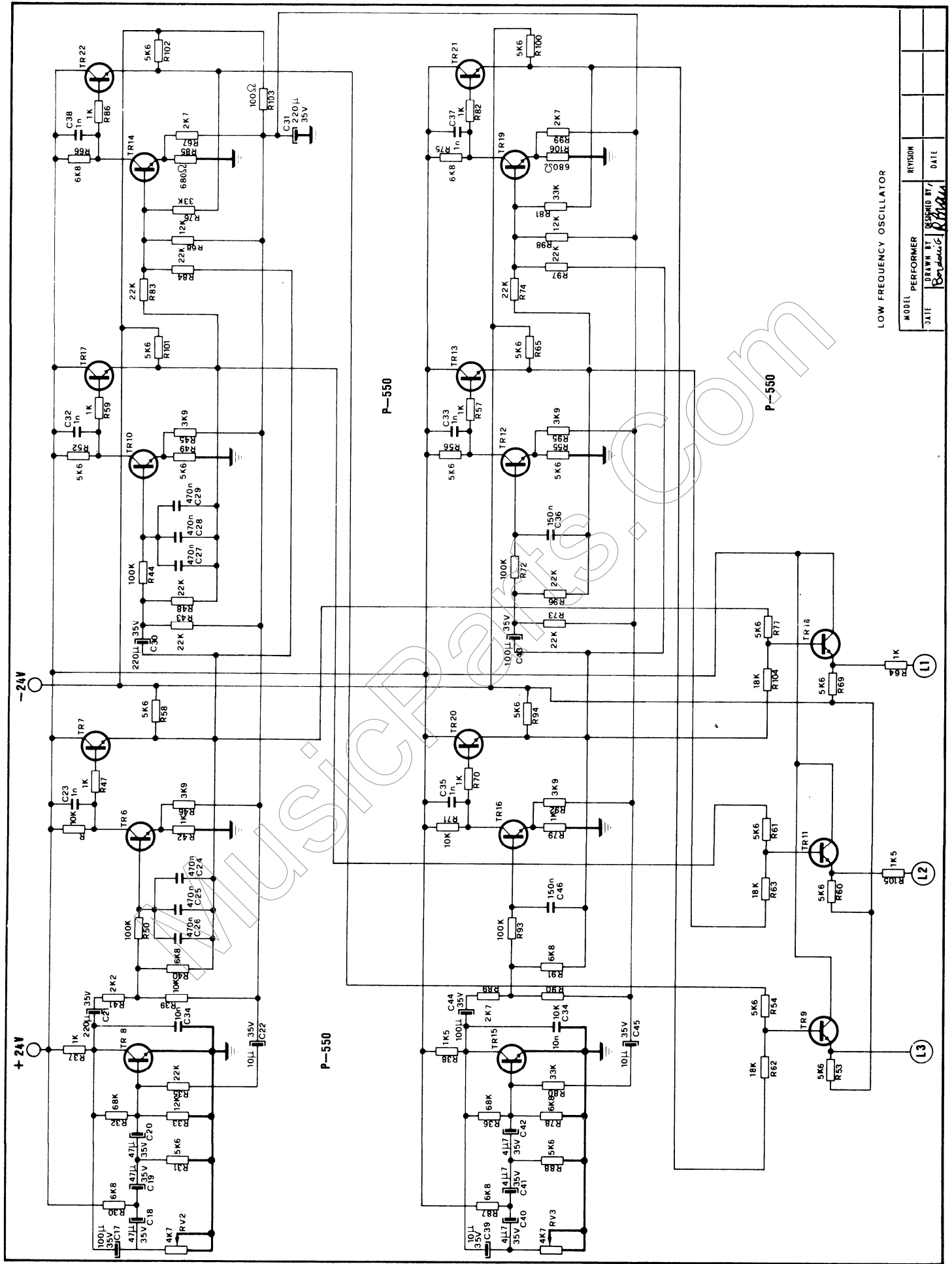
CRESCENDO STRING FILTERAND PREAMP.

MODEL PERFORMER	REVISION
DRAWN BY	DESIGNED BY
DATE	DATE



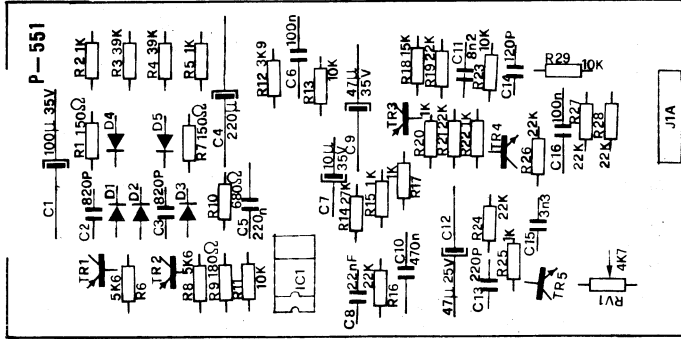
ADL - TCA 350

MODEL PERFORMER		REVISION	
DATE	DRAWN BY	DESIGNED BY	DATE
	Bendon G. Brown		



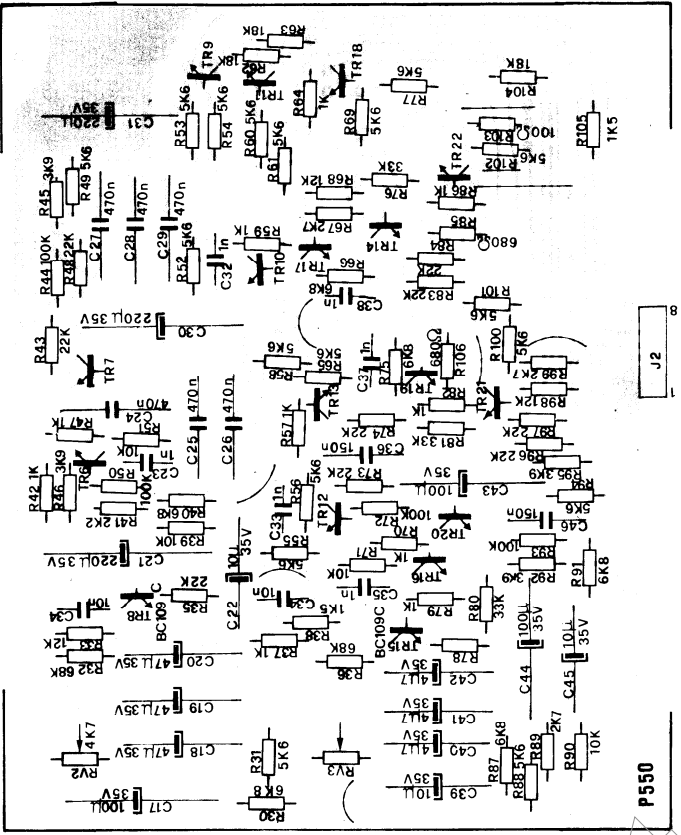
LOW FREQUENCY OSCILLATOR

MODEL	PERFORMER	REVISION
DATE	DRAWN BY	DESIGNED BY
	Bernard G. [Signature]	[Signature]
		DATE



J1A		J1B		J1C		J2	
1	GND	1	GND	1	GND	1	GND
2	+24V	2	+24V	2	GND	2	GND
3	+24V	3	+24V	3	+24V	3	GND
4	C	4	C	4	C	4	+24V
5	01	5	02	5	03	5	-24V
6	02	6	03	6	01	6	L1
7	E	7	E	7	E	7	L2
8	L1	8	L2	8	L3	8	L3

J3	
1	GND
2	+24V
3	C=OUT
4	GND
5	E=INP
6	-24V

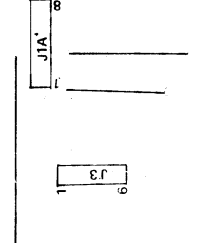
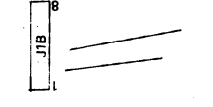
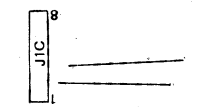
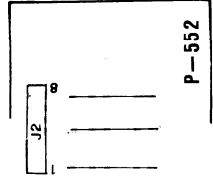


P-550

P-551

P-551

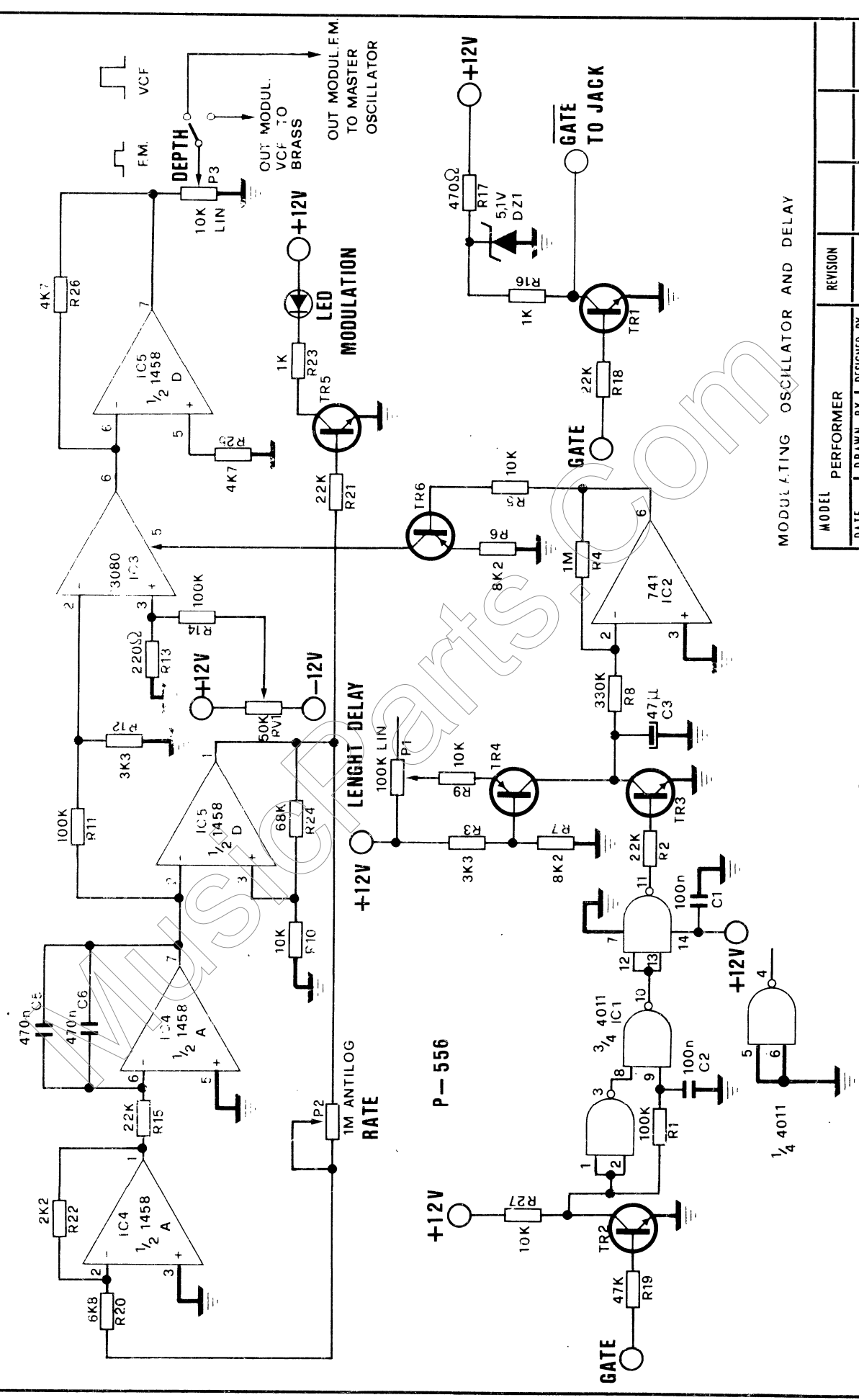
P-552



ADL-TCA LOW FREQUENCY OSCILLATOR

MODEL PERFORMER		REVISION	
DATE	DESIGNED BY	DATE	
6/12/66	K. J. L. W.		

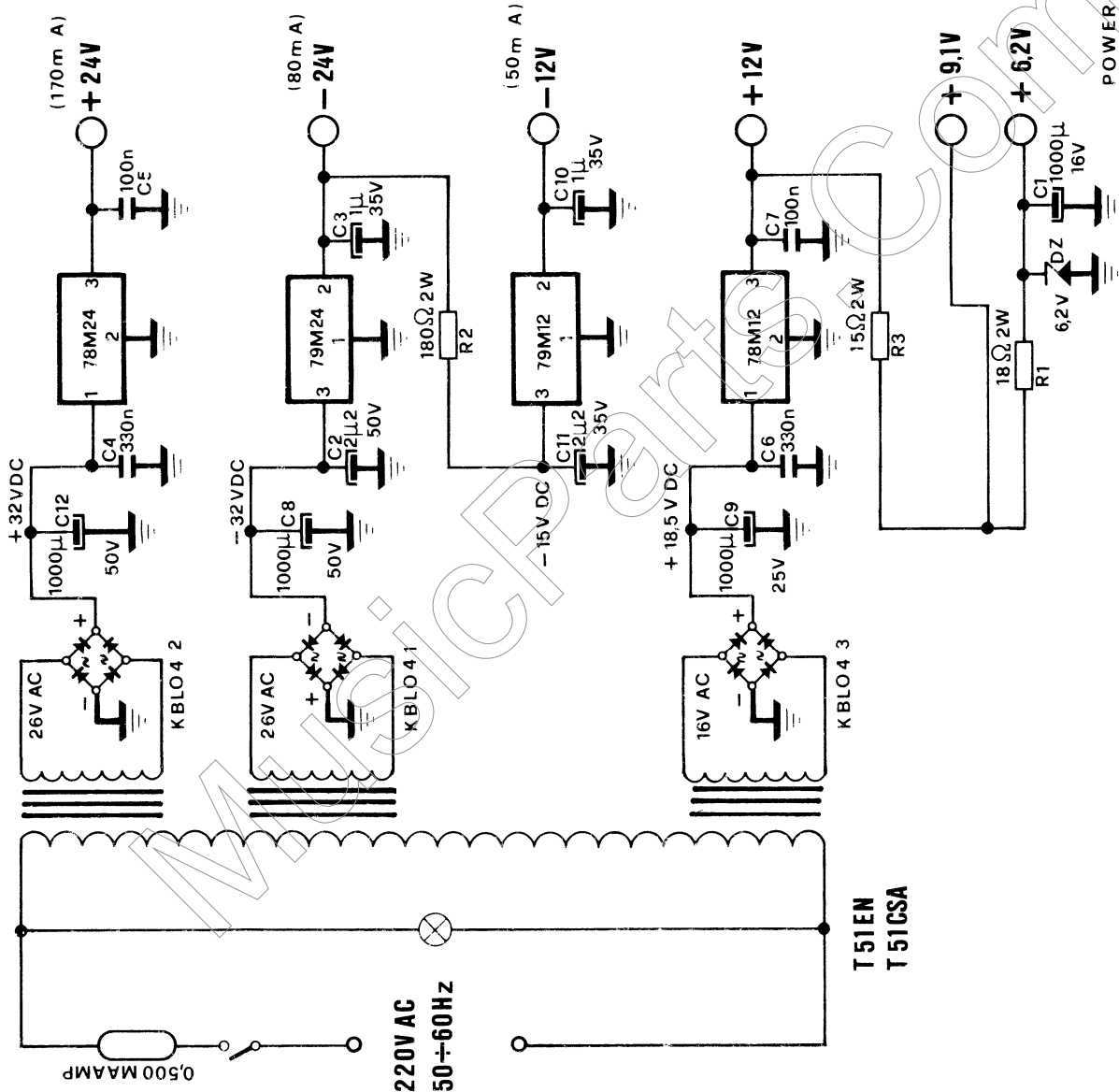
NOTE: OUT FM DOES NOT PASS THROUGH OUTPUT CONNECTOR



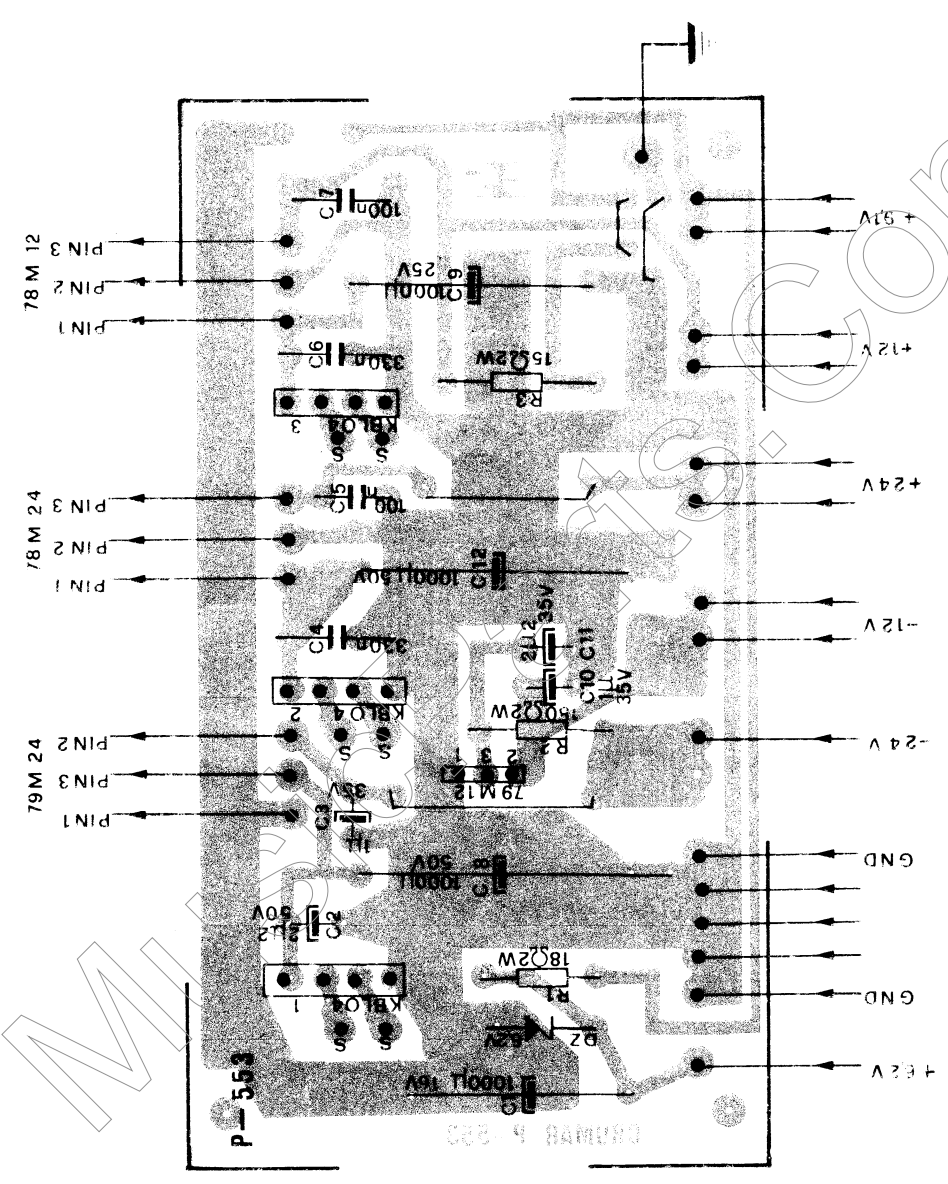
MODULATING OSCILLATOR AND DELAY

MODEL	PERFORMER	REVISION	
DATE	DRAWN BY	DESIGNED BY	
	Borden C. Rison		

P-553



MODEL PERFORMER		REVISION	
DATE	DRAWN BY	DESIGNED BY	DATE
	Bondhu. 6.	R. Prasad	



REVISION		DATE	
MODEL PERFORMER		DESIGNED BY	
DATE	DRAWN BY	DATE	DESIGNED BY

PART LIST

P 555 - (MASTER OSCILLATOR)

IC 1	7 4 L S 2 2 1
IC 2	5 0 2 4 0
IC 3	7 2 3
IC 4	7 4 1
TR 1	B C 2 8 6
TR 2	B C 1 7 3

P 554 - (WAVEFORMS GENERATION)

da IC 1 a IC 12	T D A 1 0 0 8
IC 13	1 4 5 8
IC 14	7 4 1

P. 557 - (BRASS FILTER)

da TR 1 a TR 13	B C 2 0 9 C
TR 14	B C 2 0 4
TR 15 e TR 16	B C 2 0 9

P 559 - (STRING FILTER)

da IC 1 a IC 4	1 4 5 8
IC 5	7 4 1
IC 6	3 0 8 0
TR 1 e TR 2	B C 2 0 9
TR 3 e TR 4	B C 2 0 4

P 550 - (LFO FOR ANALOG DELAY LINES)

TR 8 e TR 15	B C 2 0 9 C
TR 6 e TR 7	B C 2 0 9
da TR 9 a TR 14	B C 2 0 9
da TR 16 a TR 22	B C 2 0 9

P 551 - (ANALOG DELAY LINES)

da TR 1 a TR 3	B C 2 0 4
TR 4 e TR 5	B C 2 0 9 C

P 556 - (MODULATION)

IC 1	4 0 1 1
IC 2	7 4 1
IC 3	3 0 8 0
IC 4 e IC 5	1 4 5 8
da TR 1 a TR 3	B C 2 0 9
TR 4 e TR 6	B C 2 0 4
TR 5	B C 2 0 9

CROSS REFERENCE GUIDE

TRANSISTOR

- 1) BC 286 è
BC 286 FAIRCHILD -SGS
BD 371 NATIONAL SEMICONDUCTOR
- 2) BC 209 B/C è
BC 173 B/C I T T
BC 239 B/C NATIONAL SEMICONDUCTOR
BC 239 B S/C S MISTRAL
BC 549 B/C PHILIPS
- 3) BC 204 B/C è
BC 308 B/C MISTRAL - TELEFUNKEN
BC 204 V I MISTRAL - TELEFUNKEN (solo tipo B)
BC 205 B/C NATIONAL SEMICONDUCTOR

INTEGRATED CIRCUIT

- 1) 74LS221 è
SN74LS221 TEXAS INSTRUMENT
74LS221 FAIRCHILD
- 2) 50240 è
MK50240 MOSTEK
- 3) 723 è
uA723 FAIRCHILD
LM723 NATIONAL SEMICONDUCTOR
- 4) 741 è
uA741 FAIRCHILD
LM741 NATIONAL SEMICONDUCTOR
SN72741 TEXAS INSTRUMENT
MC741 MOTOROLA
- 5) TDA 1008 PHILIPS
- 6) 1458 è
uA1458 FAIRCHILD
LM1458 NATIONAL SEMICONDUCTOR
MC1458 MOTOROLA
- 7) 3080 è
LM3080 NATIONAL SEMICONDUCTOR
CA3080 R C A
- 8) 4011 è
4011 FAIRCHILD
CD4011 NATIONAL SEMICONDUCTOR - MOTOROLA - R C A

- All components mentioned in this enclosed « PART LIST » are on stock at CRUMAR'S.

PERFORMERS

Testing Standards

POWER SUPPLY (P553)

The output voltages of the transformer secondaries are:

- a) 26 VAC
- b) 26 VAC
- c) 16 VAC

The input voltages of the various regulators are:

- a) 79 M24 -32 VDC
- b) 78 M24 +32 VDC
- c) 79 M12 -15 VDC
- d) 78 M12 +18, 5VDC

The output voltages and current consumptions:

- a) -24V (+0,5v) 80 mA
- b) +24v (+0,5v) 170 mA
- c) -12V (+0,5v) 50mA
- d) +12V (+0,5v) 120mA
- e) +6,2V (+0,5v) 150mA
- f) There is also a point where you can read the +9,IV, but the regulator for this voltage is found on P.C. Board 554 and therefore, in testing P553, it is necessary to externally connect a Zener, at 9,IV with parallel condensor at 2200 UF 16V in order to assure the exact functioning currents at Zener of 6,2V.

Master Oscillator (P555)

This P.C. Borad contains the master oscillator at 2.00024 MHz and from there the 12 frequencies which drive the TDA 1008 which are found on P.C. Board .

- a) Set the control for PITCH at center and set.... the calibration at 2.00024 MHz making the trimmer at 1KR RVI and having the probe forthe frequency meter at pin 12 of 74L5221. The emitter of TR1 should be around 3.4V
- b) At pin 2 of 50240 the 2.00024 MHz should have an amplitude that varies from one volt to at least 10 volts.
- c) The UA 723 applies and regulates the +5V to 74LS221.

Reproduction and (P554-P558) Frequency Division

This P.C. Board contains the TDA 1008. The inputs are the 49 controls that come from the keyboard, the 12 frequencies that come from P555 and one wire for regulating the sustain. The outputs are the audio signals (BRASS: STRING 16' and 8'; EXTERNAL OUT).

Regarding the 49 controls that come from the keyboard, they receive signals from the main rod (buss Bar) depending on the keys depressed.

- a) If atleast one string is inserted (without BRASS) the common rod at rest is at +2V, at work (this is with a least one key pressed) the voltage of the common rod goes to +6,2V (the amplitude is stabilized by the setting of the CRESCENDO control.
- b) If the BRASS is inserted (with or without the STRING) the common rod is always at 6.2V.
On the circuit stamped of the P.C.Board (P558) is where the function OR, 49 inputs at whose exit is available the GATE at rest is at 0V (GND), when at least one key is pressed it goes to +5, 4V.

The TDA 1008 is an integrated circuit that functions as electronic counter for, potentially 5 keys of the same name.

This means that a TDA 1008 can do only all the DO, or only all the RE, etc, For this reason, there are 12 notes if you use 12TDA 1008. In the PERFORMER of 5 potential inputs, only 5 are used for the DO, while for all the other notes only 4 are used leaving the fifth one free.

Each TDA 1008 functions correctly when the pins of each one has the following characteristics:

Pins TDA 1008	Description:
1	+12V
13	+6V
15	input clock (output frequency of 50240 from P555).
16	GND
7	SUSTAIN - This pedal with the BRASS inserted (with or without STRING) is always at a fixed voltage of +2, 3V to which corresponds a sustain length equal to zero. This pedal, with at least one STRING inserted (without BRASS) is at a voltage, variable with the setting of the sustain, that goes from +2, 3V approx. (sustain = zero to +0,8V approx. (sustain = maximum length.)

8-9-10-11-12

INPUTS TDA 1008 - Pressing a key the pertinent pins go from +IV to +5V. The ascent is immediate when the BRASS (with or without STRING) is inserted.

The rate of ascent (from +1 to +5V) is regulated with the setting of the CRESCENDO when at least one STRING (without BRASS) is inserted.

6-5-4-3-2

OUTPUTS TDA 1008 at rest (without Keys pressed) all these pins are found at $\approx 9V$. Pressing a key, relative to TDA 1008 under inspection, one should observe in each one of these pins, symmetrical to $+9V$, a wave with amplitude of one volt except for pin 6 on which the amplitude of the wave is $0,5V$ ppK.

The final elements of this P.C. Board are the operational amplifiers at the outputs of which you should see the following signals:

1458 pin 1 STRING 8'	with 1 key pressed	2V ppK
	" 2 keys pressed	3,8V ppK
1458 pin 7 STRING 16	" 1 key pressed	2V ppK
	" 2 keys pressed	3,8V ppK
741 pin 6 BRASS	" 1 key pressed	0,8V ppK
	" 2 keys pressed	1,4V ppK

All these signals should be symmetrical with GND.

This P.C. Board also contains the Zener of $9,IV$ for feeding the outputs of the TDA 1008 and it is this Zener to which we refer when talking of the P.553

At the edge of this P.C. Board it is necessary to talk of the effect sustain for which it is good to specify (see P559 keys on BRASS ON 16' ON 8") that this acts only on the STRING or only on the BRASS and therefore does not work for selections that use BRASS and STRING simultaneously.

Point SOF corresponds to SUSTAIN at minimum.

Point SON corresponds to SUSTAIN regulated by the setting of the SUSTAIN LENGTH CONTROL.

BRASS P(557)

This P.C. Board contains the VCF and everything that is used to obtain the sound of BRASS.

a) Rest voltage no key pressed
 ATTACK = 0; DECAY = 0; RANGE = 0; RESONANCE = 0.

Collector	TR1-TR6	+10,20V
"	TR2-TR7	+7,50V
"	TR3-TR8	+6,00V
"	TR4-TR9	+4,40V
"	TR5-TR10	+2,80V
Base	TR5-TR10	+1,80V
Emittor	TR5-TR10	+1,30V
Collector	TR11	+8,4V
Base	TR11	+4,5V
Emittor	TR11	+3,9V
Collector	TR12	+10,2V
Base	TR12	+4,5V
Emittor	TR12	+3,9V

signals Only 1 key pressed

ATTACK = 0; DECAY = Max; RANGE = Max; RESONANCE = 0

Regular the trimmer RV 1 so that +2V is at center, regulate trimmer RV 2 to the center of its Rotation.

BASE	TR 10	40 mVppK
COLLECTOR	TR7	10 mVppK
COLLECTOR	TR2	15 mVppK

Equal signals at these last two are found on all the collectors of the same (wire) row and all the signals are symmetrical with respect to the rest voltages of the various transistors.

Collector	TR11	800mVpp
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b) Calibration of Brass Filter

ATTACH = 0; DECAY = Max; RANGE = Max; RESONANCE = 0

Rest tension for TR 13 and TR 14 - No key pressed.

Collector	TR 13	+1,1V
Base	TR 13	+0,6V
Base	TR 14	+0,08V
Collector	TR 14	-11,8V

If we now activate even one key the signal GATE (as we have seen previously goes from 0V (rest) to +5,4v (work).

Collector	TR 16	from +10V goes to 0V
Collector	TR 15	from 0V goes to +12V with slow rise in amplitude from the condensor C19.

Node D1-D2-C18-R-26

In this mode you can see a positive rise with amplitude held to between +8V and +10V. The return rate to zero is regulated with the DECAY CONTROL with PL at maximum the amplitude is +10V, with PL at minimum the amplitude pot is +8V. In this mode the P5 ATTACK has no effect on the filtering.

CENTRAL P5

The same filtering preceding the minor amplitude (+0,8V) and with the attack rate regulated by P2 with P2 at maximum the amplitude reduces to +0,2V peak.

On the base of TR 13 you see again the filtering of 0,6V at rest with amplitude of 40 - 60 Mv.

c) Regulating the Trimmers

RV 1 (Regulates the opening of the VCF and therefore the excursion of the pot P2RANGE). ATTACK = 0; DECAY = Max; RANGE = Max; RESONANCE = 0.

This trimmer has already been positioned (see point A) so that at its center there is a voltage of +2V. A more accurate regulation is made internally in the +2V so that, repeatedly playing a note in the middle of the keyboard, at the output of the filter (collector TR11) you see, with an oscilloscope, the initial saw tooth not filtered for a short period. An erratic regulation of RV1 can cause the VCF to not filter because it is too open or the VCF is too closed.

RV 2 (Regulates the anti oscillation of the VCF and therefore the excursion of the pot P3 RESONANCE).

ATTACK = 0; DECAY = Max; RANGE = Max; RESONANCE = Max.

With a note pressed at the middle of the keyboard you should see a sine wave (anti oscillation of the VCF) signal, that should have a maximum amplitude at the beginning of the ramp 10+ the saw tooth and amplitude 0 at the end of the same ramp.

An erratic regulation of RV 2 can cause annoying whistles or, on the other hand, inefficiency of the pot P3 RESONANCE.

STRING (P559)

This P.C.Board contains the pre-amplification circuits for the signal for the delay lines, a 3 band EQ control (high, medium, bass) a modulating circuit of amplitude for the CRESCENDO effect of the STRING. When the BRASS is inserted and the stage of final pre-amplification for the output MAIN.

a) CRESCENDO (Control of the circuit of CRESCENDO)

The CRESCENDO acts only on the STRING and observing BR 3 and BR 2 of the key on BRASS you can see how this effect is obtainable from the voltage of the common rod (BRASS OFF) or from a 3080 connected as modulator of amplitude (BRASS ON).
The CRESCENDO is triggered from the GATE,

Insert the BRASS effect with volume at zero.

Collector TR1	+11V (rest)	0V (work)
Base TR3	+6,2V	
Collector TR3	0V (rest)	+6,5V (work)

the ascent rate from 0 to +6,5 is regulated with the control P4 CRESCENDO LENGTH

Condensator C14 Like collector TR 3

Pin 7 1758 l.c.4 At rest regulate RV 1 in order to have +2V; at work the rise from +2V to arrive at +6,2V always with the rate of ascent regulated by the control P4.

The change in the CRESCENDO so obtained goes to 1458 l.c. 3:11 pin 1 from this 0V at rest through the trimmer RV 2. At work, starting from 0V going to -4V, opens the modulator with the 3080.

Playing instead only one STRING (without BRASS) the excursion of CRESCENDO goes to the common rod and the modulator is excluded from via BR 3 of the key ON BRASS.

b) Audio Signals

Insert the BRASS effect with volume at zero.

Enter STRING 16' with 1 key pressed 2vppK.
 Enter STRING 8' with k key pressed 2vppK.
 Insert the STRING effects 16' and 8'
 Pin 7 1458 i.c. 2 with 1 key pressed 2vppK.
 Arrange the controls P1-P2-P3 to the centers.
 Pin 6 741 with 1 key pressed 2vppK.

INPUT ANALOG DELAY LINES with one key pressed IVppK
 OUT ANALOG DELAY LINES with one key pressed 280 mvppK.
 PIN 6 3080 with one key pressed 800 mvppK.
 symmetrical with respect to GND. The
 symmetry to GNP is regulated with the trimmer
 RV3.
 PIN 7 1458 I.C. 3 with one key pressed 100 mvppK.
 OVIT MAIN 1 with one key pressed + BRASS with filter
 open 180 mvppK
 JACK BRASS with one key pressed 200 mvppK.

MODULATION P (556)

This P. C. Board contains an oscillator of low frequency for the modulation and a modulator of amplitude to obtain the DELAY. The modulator of amplitude 3080 is always functioning and is controlled by the GATE.

GATE	OV (rest)	+5,4(work)	
Collector TR2	+11V (rest)	OV (work)	
Pin 104011	+12v (rest)	at work it has a negative impulse (from +12V to OV) of duration 6 to 7 msec.	
Pin 11 4011	OV (rest)	at work it has a positive impulse (from OV b + 12v) of duration 6 to 7 Msec.	
Condensor	C3 + 9V (rest)	GATE hardly arrives when the con- densor C3 goes immediately to OV to initial, after 6-7 msec, to rise to +9V with a rate of ascent regulated by control P1 LENGTH DELAY.	
Pin 6 741	10V (rest)	GATE barely arrives and this pin goes immediately to OV to initial, after 6-7 msec, to rise to -10V with descent tempo regulated always by the control P1 LENGTH DELAY.	
Pin 7 1458 IC4		You see the frequency of the modula- tion (triangle) with amplitude IVppK symmetrical to GND.	
Pin 7 1458 IC5		You see the same frequency of Pin 7 of I.C. 4 modulated by pin 6 of 741 and with maximum amplitude at 6VppK symmetrical to GND. This symmetry is obtained from trimmer RV 1.	

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