LAG-126/126S

LOW DISTORTION AUDIO GENERATOR

SERVICE MANUAL

Leader Instruments Corporation
6484 Commerce Drive
Cypress, CA 90630
Phone 714-527-9300 or 1-800-645-5104
Fax 714-527-7490 or 714-527-9271
Service@LeaderUSA.com

CONTENTS

****

NOTE

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the service manual unless you are qualified to do so.

****

1. SPECIFICATIONS

Frequency range	5 Hz to 500 kHz in 5 ranges
Frequency accuracy	± (3% + 1 Hz)
Output waveform	Sine and square waves selectable by a switch
• Sine wave	
Maximum output voltage	+ 10 dB ± 0.3dB when terminated at 600 ohms, with a dBm-dBV changeover switch.
Distortion factor	At the "Fine Cal" position: Unbalanced output; Less than 0.005% : 20Hz to 20kHz Less than 0.01% : 10Hz to 50kHz Less than 0.1% : 5Hz to 500kHz Balanced output (LAG-126S only); Less than 0.01% : 500Hz to 20kHz Less than 1.5% : 20Hz to 500Hz
Level flatness	Unbalanced output; ± 0.2dB : 5Hz to 20kHz ± 0.5dB : 20kHz to 500kHz Balanced output (LAG-126S only) ± 0.5dB : 20Hz to 20kHz
• Square wave	
Maximum output voltage	Approx. 4Vp-p (when terminated at 600 ohms and the output is dBV)
Rise- time	Less than 200ns
Overshoot	Less than 5% at higher than –30dBV output
Sug	Less than 5%
Attenuator	10dB x 7, 1dB x 9 and 0.1 dB x 9, with a fine adjuster (for the sine wave only) and an output turn-off function
Output impedance	600ohms ± 3% (Unbalanced) 600ohms ± 10% (Balanced)
Power supply	AC 100V ± 10%, 50/60Hz – approx. 13VA (changeable to 120V, 200V, 220V and 240V by selecting taps of the internal transformer)
Size and weight	200(W) x 150(H) x 250(D) mm Approx. 3.2kg (LAG-126) Approx. 3.5kg (LAG-126S)
Accessory	BNC cord with plugs and clips 1

2. TEST EQUIPMENT REQUIRED

The following test equipment is required for calibration and servicing of the Model LAG-126/126S. The suggested specifications are the minimum necessary for proper calibration of this instrument.

Test Equipment	Minimum Spec.
- Multimeter	Accuracy < 1%
- Oscilloscope	5mV sensitivity 10MHz band width Low capacitance probe
- Frequency Counter	5Hz - 500kHz
- AC Millivoltmeter	1mV - 10V Accuracy < 1%
- Resistor	600Ω < 1% 1/2W (-126S)

3. CALIBRATION PROCEDURE

- Calibration should be performed after a 30 minute warm-up period. It should also be confirmed that the unit is connected to the rated power line voltage.

- All adjustment should be completed in the given order, because some adjustments interact with others.

- During the adjustment procedure, remove the case only when necessary and replace immediately after making an adjustment. This will maintain all circuit at constant operating temperature.

3.1 Initial Control Settings

The initial control settings to be used for each check and adjustment are listed below. Any variations from these settings are stated in the applicable procedure.

Frequency dial	10
FREQUENCY RANGE	x100
OUTPUT	
⊓⊔-∿	∿
dBV-dBm	dBV
BALANCED-UNBALANCED	UNBALANCED (-126S)
ON-OFF	ON
600Ω LOAD	IN
FINE	CAL
OUTPUT LEVEL	+10dB

3.2 Power Supply

- Connect the DC voltmeter to TP1.

- Adjust VR1 for a voltage reading of +24V.

- Check all supplies according to Table 3-1.

Table 3-1

Test point	Voltage	Tolerance	Adjustment
TP1	+24V	+23.9V to +24.1V	VR1
TP2	-24V	-23.5V to -24.5V	-
TP3	+15V	+14.4V to +15.6V	-
TP4	-15V	-14.4V to -15.6V	-

3.3 Offset Voltage Adjustment

- Set: Frequency dial 10
  FREQUENCY RANGE x100

- Connect the DC voltmeter to TP5.

- Check that the DC voltage reading of 0V within 20mV. If the voltage exceeds 20mV, adjust VR6 for reading of 0V.

3.4 Photo-coupler Bias Adjustment

- Set: Frequency dial 5
  FREQUENCY RANGE x10

- Connect the oscilloscope, with low capacitance probe, to TP7. Use DC coupled input mode.

- Adjust VR7 for a voltage reading of +4V DC.

3.5 Frequency Adjustment

(1) Frequency dial Zero Settings

* Check the frequency dial zero settings by following procedure, however, it may not always be necessary except a change of potentiometer.

- Connect the oscilloscope to OUTPUT connector.

- The stable oscillation can be obtained when position the 5 of the frequency dial to the indicator.

- Rotate the frequency dial clockwise slowly. The oscillation should be stopped when the dot is just pass through the indicator.

- If not, reset the frequency dial by using two set screws on the flexible coupler to satisfy the above conditions.

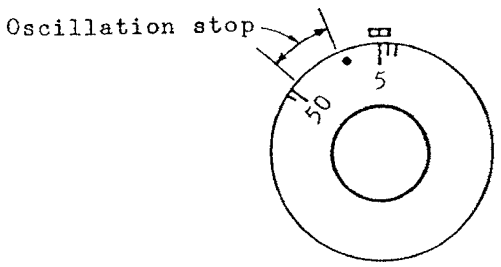


Figure 3-1

(2) Frequency accuracy check

- Connect the frequency counter to OUTPUT connector.

- Check that the frequency accuracy is within 3% +1Hz over entire range. If the accuracy exceeds 3% +1Hz, proceed as follows.

- Connect the oscilloscope, with low capacitance probe, to TP7. Use DC coupled input mode.

(3) 500Hz/50Hz Adjsutment of x10 RANGE

- Set: Frequency dial 50
  FREQUENCY RANGE x10

- Adjust VR2 and VR3 slowly for a frequency reading of 500Hz, voltage reading of +4V DC. (Rotate the VRs same direction alternately)

- Set: Frequency dial 5

- Adjust VR4 and VR5 slowly for a frequency reading of 50Hz within 1Hz, voltage reading of +4V DC. (Rotate the VRs same direction alternately)

- Repeat above adjustment if necessary.

(4) 50kHz Adjustment

- Set: Frequency dial 5
  FREQUENCY RANGE x10K

- Adjust VC1 and VC2 slowly for a frequency reading of 50kHz, voltage reading of +4V DC.

(5) Check the following items over entire range.

- The frequency accuracy should be within 3% +1Hz.

- The voltage at TP7 should be +4V DC within 2V.

- The offset voltage at TP5 should be 0V DC within 20mV.

3.6 Output Voltage Adjustment

(1) Set:

Frequency dial	10
FREQUENCY RANGE	x100
dBV-dBm	dBV
BALANCED-UNBALANCED	UNBALANCED (-126S)
600Ω LOAD	IN
FINE	CAL
OUTPUT LEVEL	+10dB

(2) Unbalanced Output

- Connect the AC millivoltmeter to OUTPUT connector.

- Adjust VR10 for an output voltage of +10dBV(3.162V).

(3) Balanced Output (-126S)

- Set: BALANCED-UNBALANCED BALANCED

- Terminate the BAL OUTPUT terminal with the 600Ω resistor.

- Connect the AC millivoltmeter to the BAL OUTPUT terminal.

- Adjust VR1(T-3305) for an output voltage of +10dBV(3.162V).

3.7 500kHz Distortion Adjustment

- Set: Frequency dial 50
  FREQUENCY RANGE x10k
  FINE Fully counterclockwise

- Connect the oscilloscope to OUTPUT connector and set the vertical position control to fully counterclockwise, TIME/DIV switch to 1mS. Then, adjust vertical sensitivity controls to display the top of the waveform to upper graticule area.

- Adjust VR8 for a stable oscillation.

Correct Incorrect

Figure 3-2

3.8 Square Wave Adjustment

- Set: Frequency dial 10
  FREQUENCY RANGE x100

- Connect the oscilloscope to OUTPUT connector.

- Adjust VR9 for symmetrical square wave.

4. TROUBLESHOOTING PROCEDURE

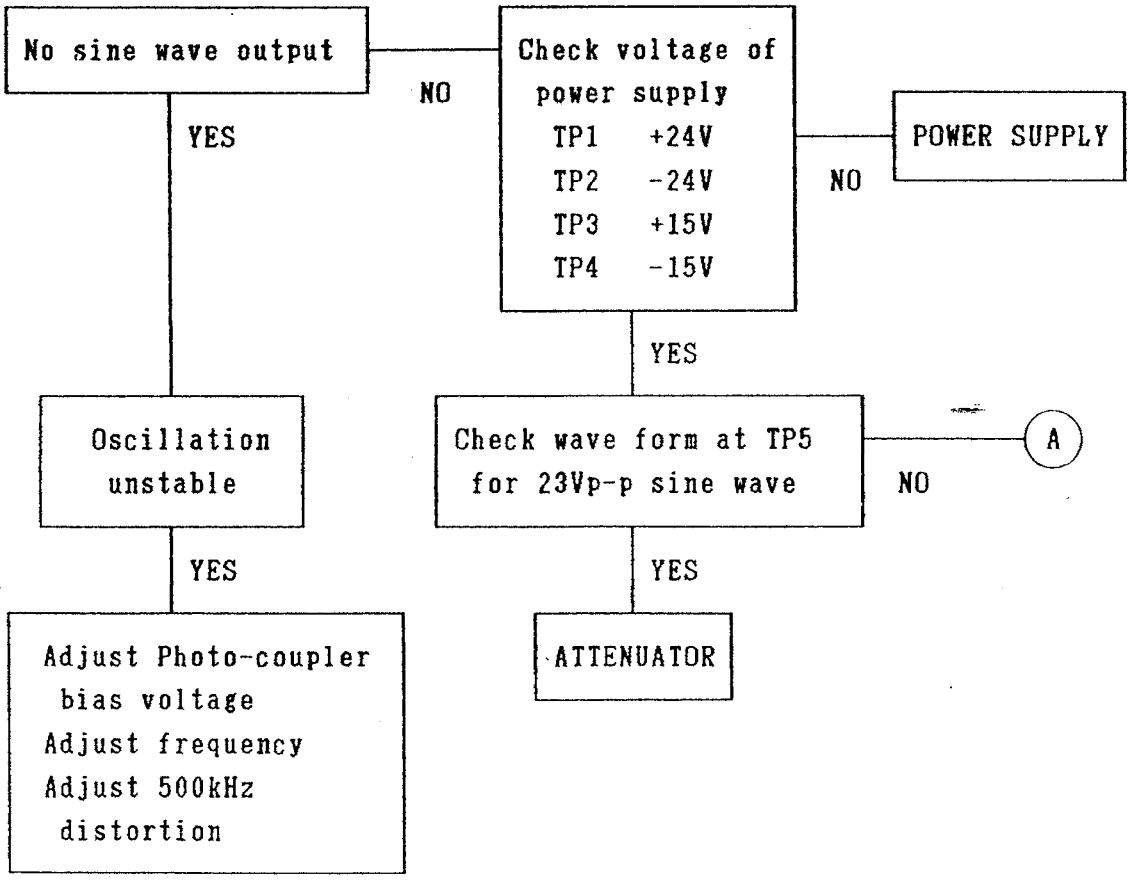
- Check all control settings, because an incorrect setting can make a good unit appear defective.

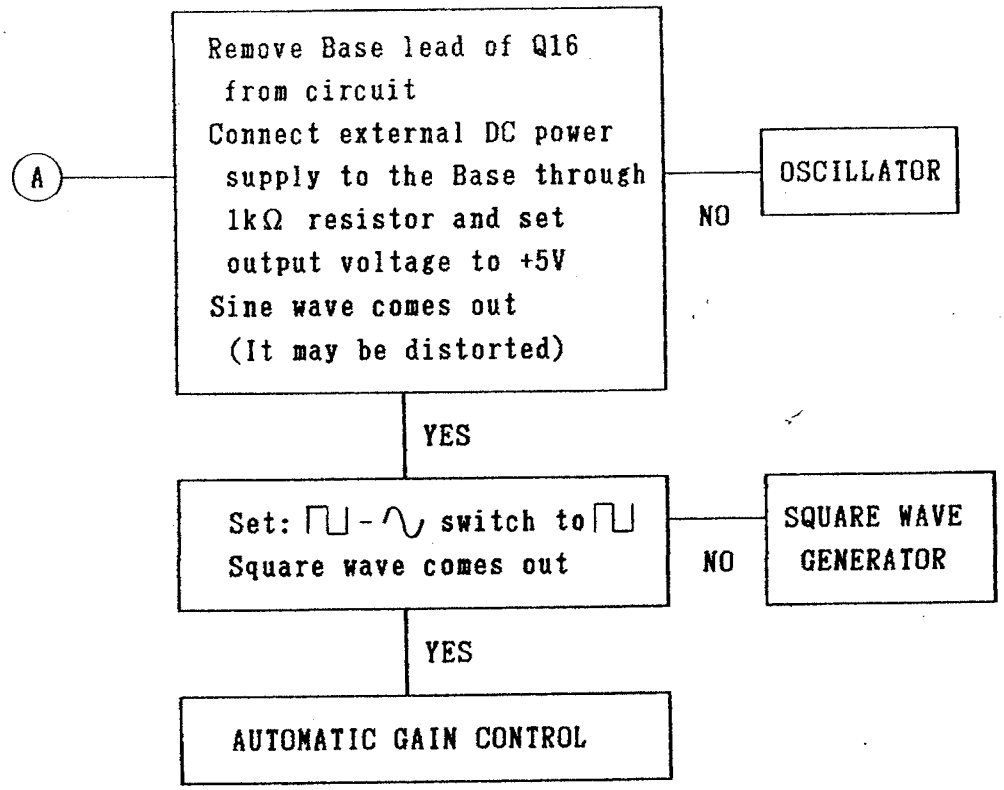
- Some trouble can be solved with proper adjustment.

- Check DC voltage and waveform as shown in the schematic diagram to locate the defective circuit. Start with the power supply.

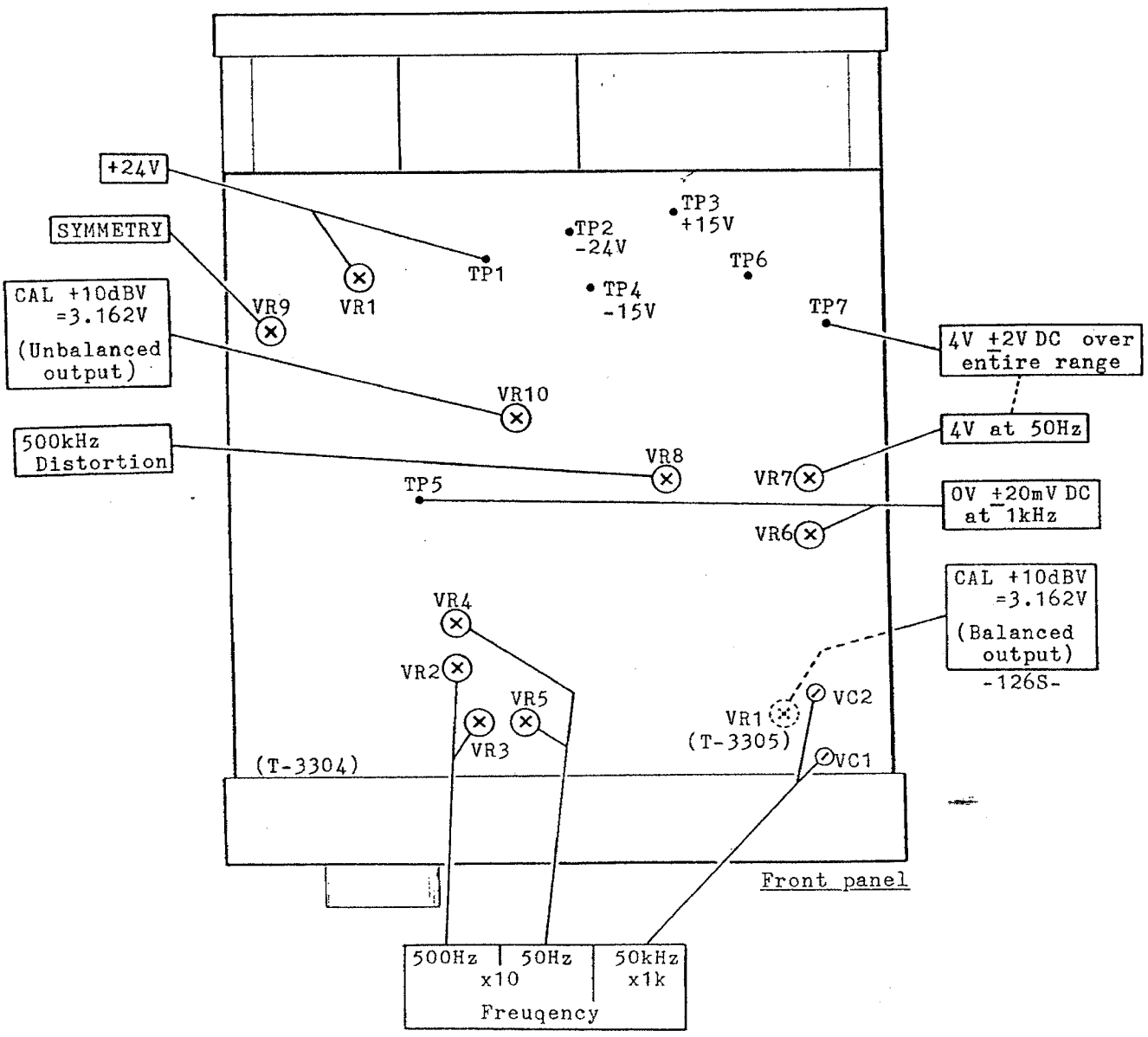
- Check all circuit for visual defects such as broken components, loose connections and poor soldering which could be a cause of trouble.

4.1 Troubleshooting Chart

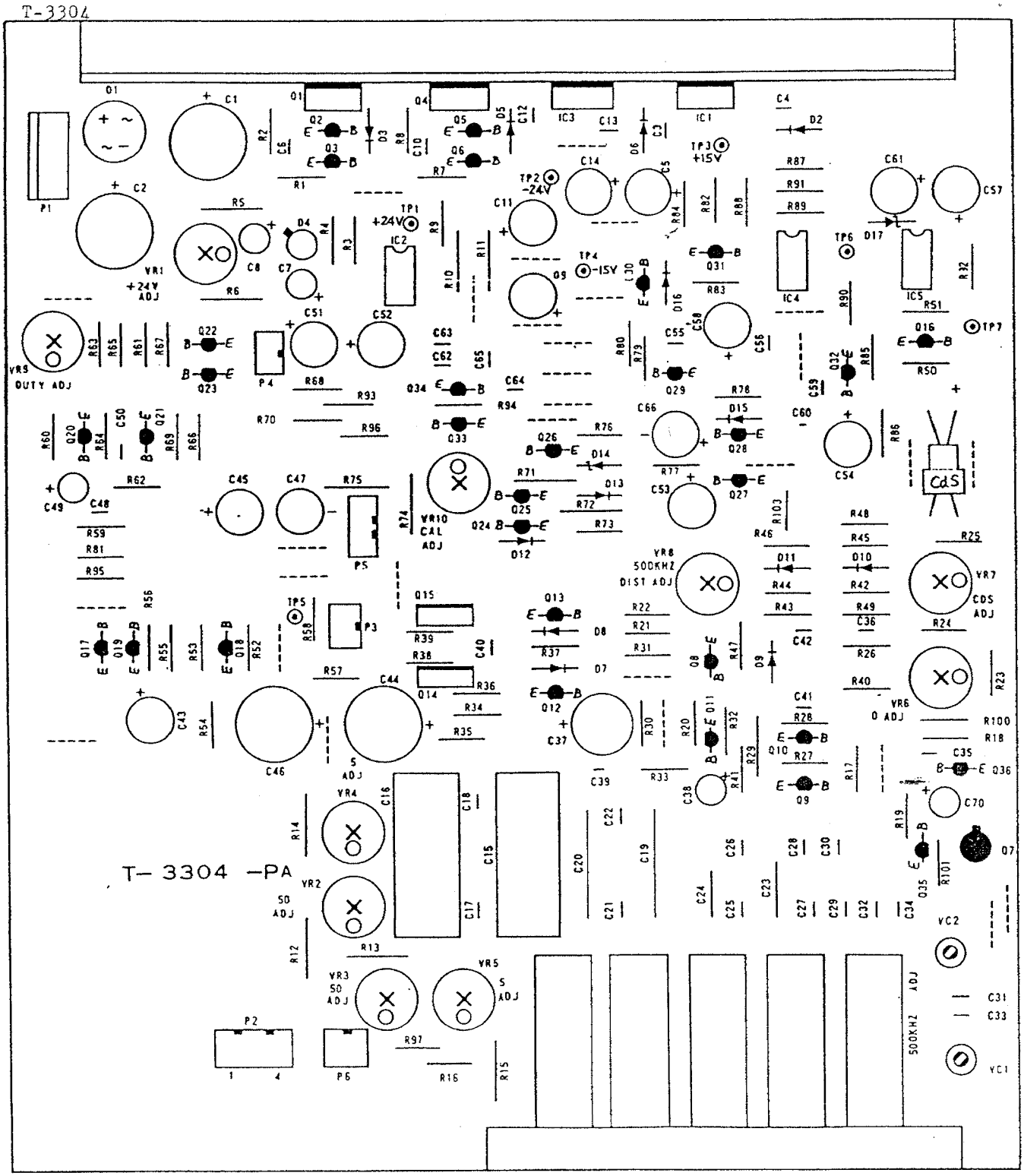



A
Remove Base lead of Q16 from circuit
Connect external DC power supply to the Base through 1kΩ resistor and set output voltage to +5V
Sine wave comes out (It may be distorted)
OSCILLATOR
NO
YES
Set: ⊓⊔ - ∿ switch to ⊓⊔
Square wave comes out
SQUARE WAVE GENERATOR
NO
YES
AUTOMATIC GAIN CONTROL

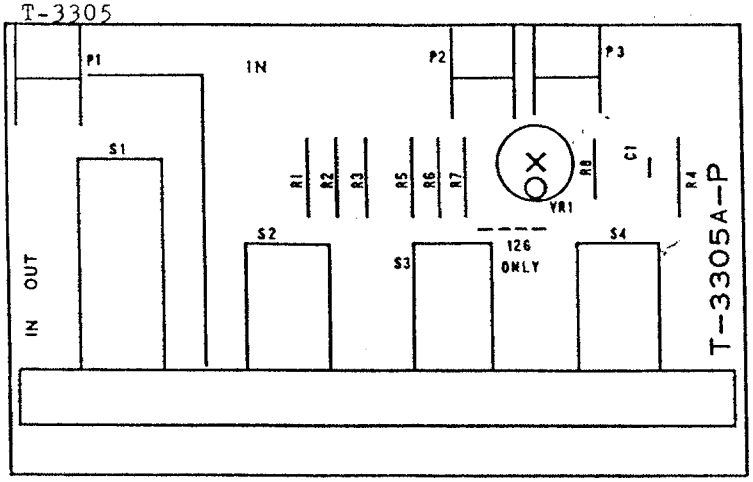
5. ADJUSTMENT LOCATIONS



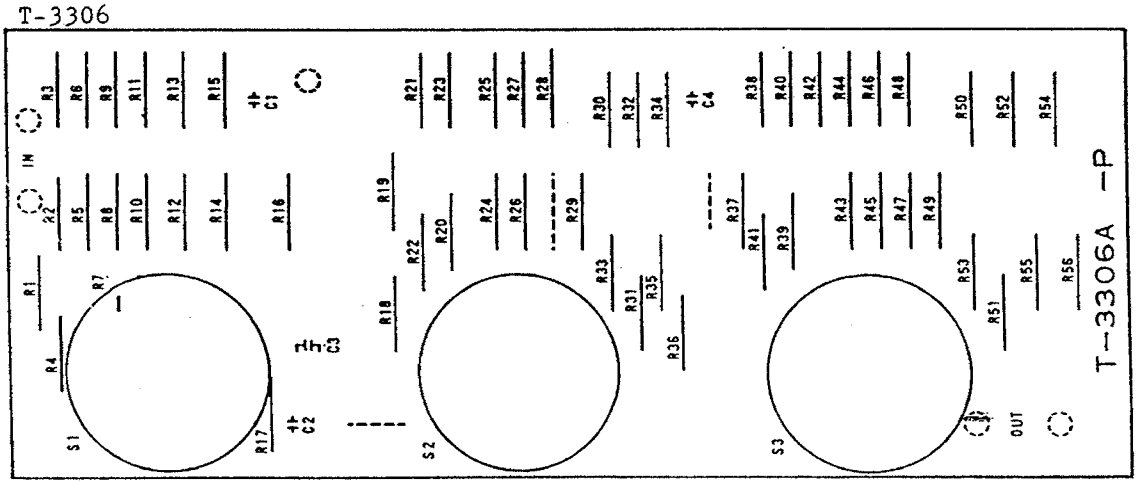
6. PRINTED CIRCUIT BOARD



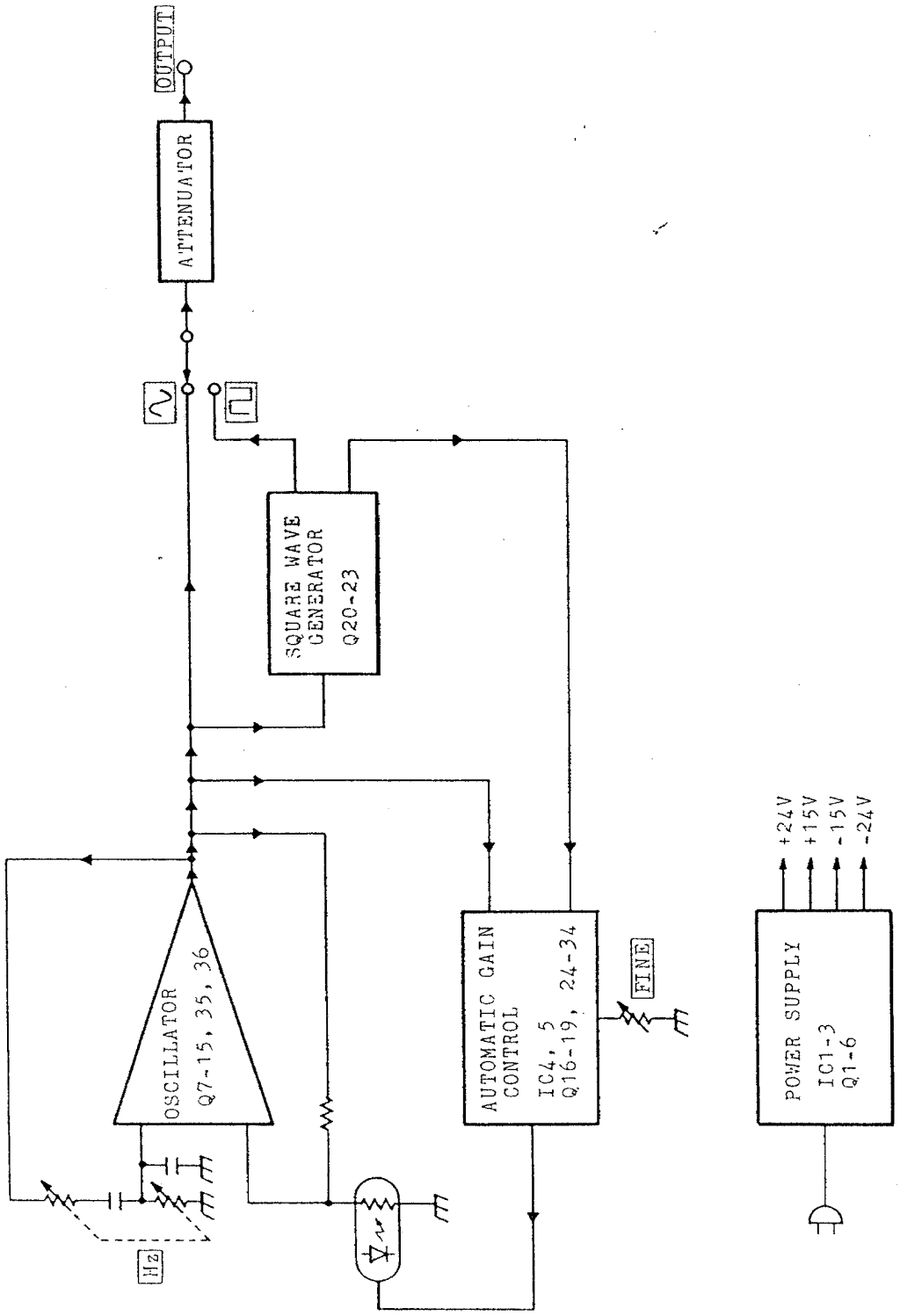
T-3305

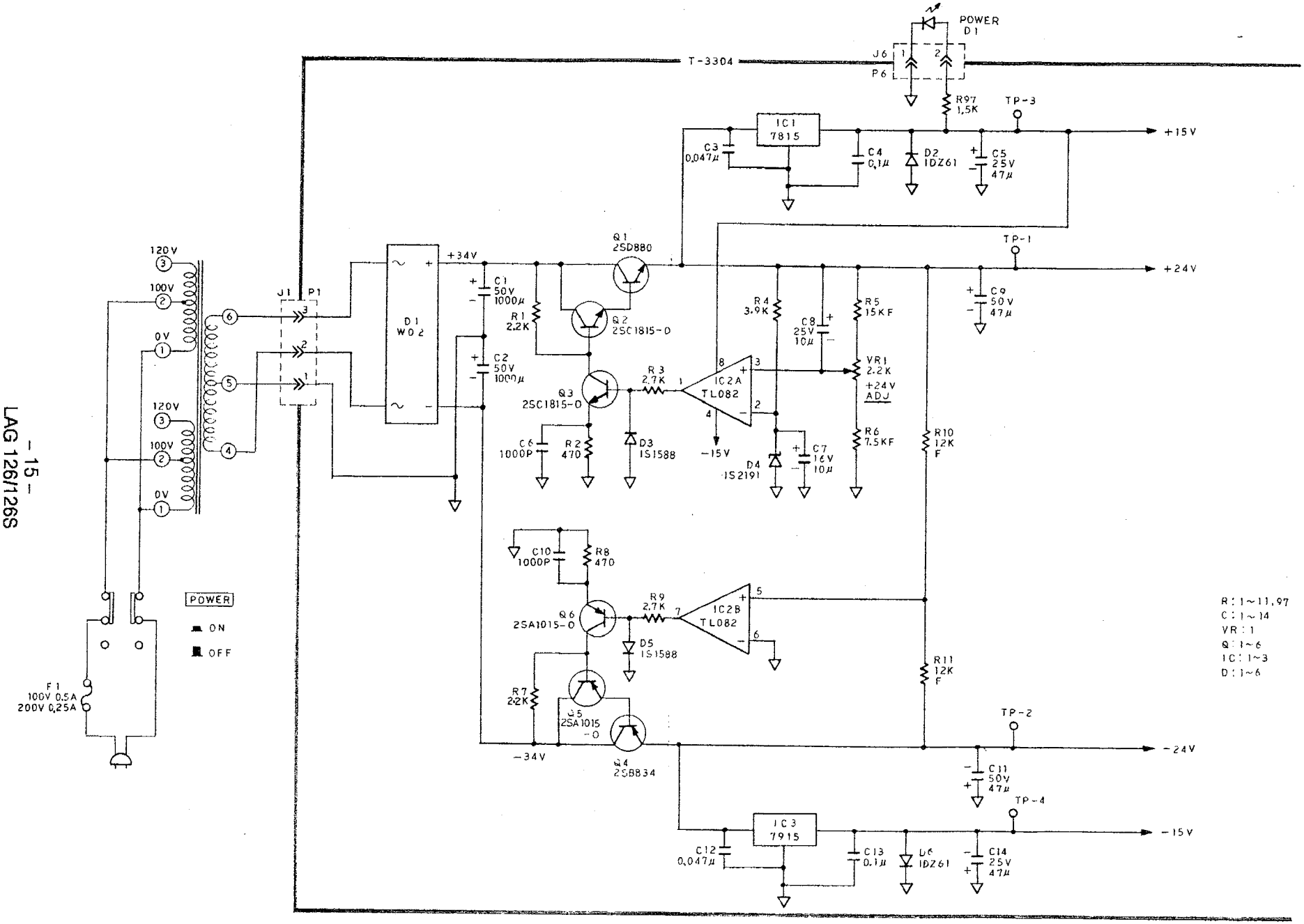

P1
IN
P2
P3
S1
R1
R2
R3
R5
R6
R7
R8
C1
R4
VR1
S2
S3
126
ONLY
S4
IN
OUT
T-3305A-P

T-3306

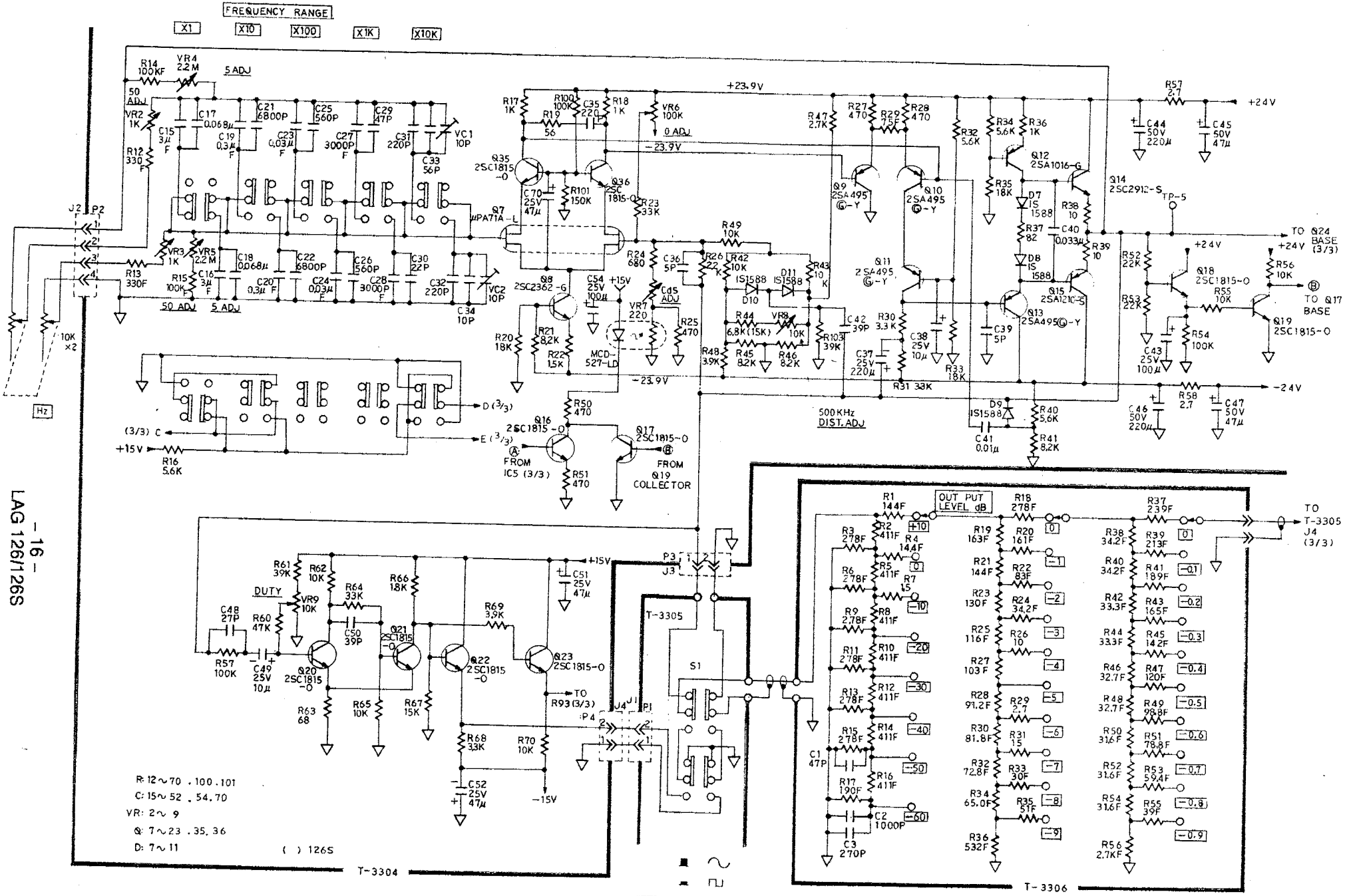

R3
R6
R9
R11
R13
R15
C1
R21
R23
R25
R27
R28
R30
R32
R34
C4
R38
R40
R42
R44
R46
R48
R50
R52
R54
IN
R2
R5
R8
R10
R12
R14
R16
R19
R24
R26
R29
R37
R41
R39
R43
R45
R47
R49
R53
R55
R56
R1
R7
R4
R18
R22
R20
R33
R31
R35
R36
R51
C3
C2
R17
S1
S2
S3
OUT
T-3306A -P

7. BLOCK DIAGRAM

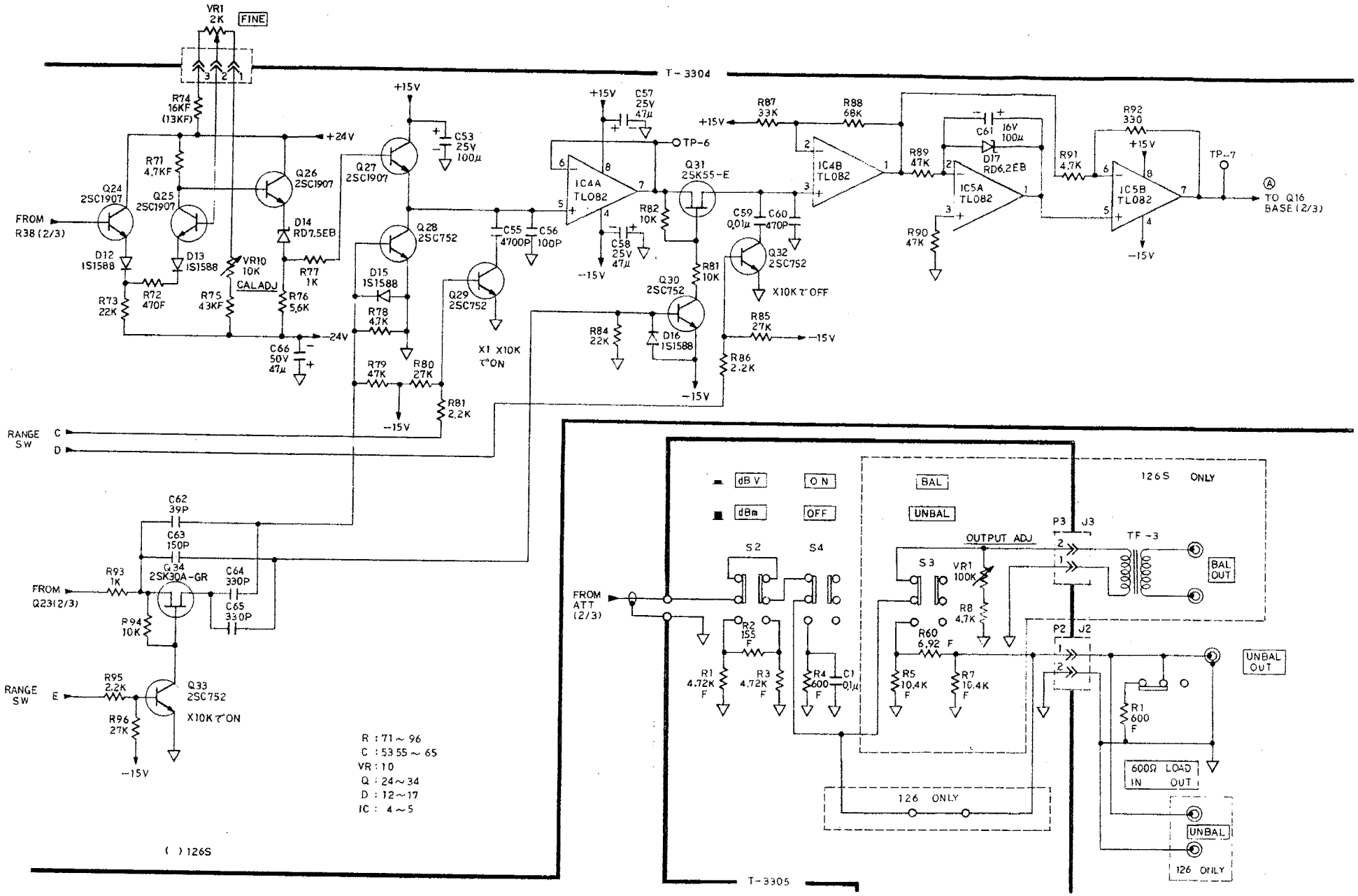




SCHEMATIC	MODEL LAG-126/126S	0-1764 (1/3)
	POWER SUPPLY	LEADER ELECTRONICS CORP.



SCHEMATIC	MODEL LSG-126/126S	O-1764 (2/3)
	OSC, ATT	LEADER ELECTRONICS CORP.



SCHEMATIC	Model LAG-126 / 126S	O - 1764 (3/3)
	AMPLITUDE CONT.,OUTPUT	LEADER ELECTRONICS CORP.

9. PARTS LIST

*: For LAG-126S

MAIN BOARD (T-3304)

< RESISTORS >

No.	LDR PT No.	DESCRIPTION			
R1	1010222004	Carbon film	1/6W	2.2kΩ	5%
R2	1010471005	Carbon film	1/6W	470Ω	5%
R3	1010272009	Carbon film	1/6W	2.7kΩ	5%
R4	1010392009	Carbon film	1/6W	3.9kΩ	5%
R5	1311502000	Metal film	1/4W	15kΩ	1%
R6	1317501004	Metal film	1/4W	7.5kΩ	1%
R7	1010222004	Carbon film	1/6W	2.2kΩ	5%
R8	1010471005	Carbon film	1/6W	470Ω	5%
R9	1010272009	Carbon film	1/6W	2.7kΩ	5%
R10	1311202008	Metal film	1/4W	12kΩ	1%
R11	1311202008	Metal film	1/4W	12kΩ	1%
R12	1313300000	Metal film	1/4W	330Ω	1%
R13	1313300000	Metal film	1/4W	330Ω	1%
R14	1311003002	Metal film	1/4W	100kΩ	1%
R15	1311003002	Metal film	1/4W	100kΩ	1%
R16	1010562008	Carbon film	1/6W	5.6kΩ	5%
R17	1010102004	Carbon film	1/6W	1kΩ	5%
R18	1010102004	Carbon film	1/6W	1kΩ	5%
R19	1010560004	Carbon film	1/6W	56Ω	5%
R20	1010183000	Carbon film	1/6W	18kΩ	5%
R21	1010822008	Carbon film	1/6W	8.2kΩ	5%
R22	1010152009	Carbon film	1/6W	1.5kΩ	5%
R23	1010333003	Carbon film	1/6W	33kΩ	5%
R24	1010681006	Carbon film	1/6W	680Ω	5%
R25	1010471005	Carbon film	1/6W	470Ω	5%
R26	1010222004	Carbon film	1/6W	2.2kΩ	5%
R27	1010471005	Carbon film	1/6W	470Ω	5%
R28	1010471005	Carbon film	1/6W	470Ω	5%
R29	1317509000	Metal film	1/4W	75Ω	1%
R30	1010332001	Carbon film	1/6W	3.3kΩ	5%
R31	1010332001	Carbon film	1/6W	3.3kΩ	5%
R32	1010562008	Carbon film	1/6W	5.6kΩ	5%
R33	1010183000	Carbon film	1/6W	18kΩ	5%
R34	1010562008	Carbon film	1/6W	5.6kΩ	5%
R35	1010183000	Carbon film	1/6W	18kΩ	5%
R36	1010102004	Carbon film	1/6W	1kΩ	5%
R37	1010820004	Carbon film	1/6W	82Ω	5%
R38	1010100000	Carbon film	1/6W	10Ω	5%
R39	1010100000	Carbon film	1/6W	10Ω	5%
R40	1010562008	Carbon film	1/6W	5.6kΩ	5%
R41	1010822008	Carbon film	1/6W	8.2kΩ	5%
R42	1010103006	Carbon film	1/6W	10kΩ	5%
R43	1010103006	Carbon film	1/6W	10kΩ	5%
R44	1010682008	Carbon film	1/6W	6.8kΩ	5%
*	1010153001	Carbon film	1/6W	15kΩ	5%
R45	1010822008	Carbon film	1/6W	8.2KΩ	5%
R46	1010822008	Carbon film	1/6W	8.2kΩ	5%
R47	1010272009	Carbon film	1/6W	2.7kΩ	5%
R48	1010392009	Carbon film	1/6W	3.9kΩ	5%
R49	1010103006	Carbon film	1/6W	10kΩ	5%
R50	1010471005	Carbon film	1/6W	470Ω	5%
R51	1010471005	Carbon film	1/6W	470Ω	5%
R52	1010223006	Carbon film	1/6W	22kΩ	5%
R53	1010223006	Carbon film	1/6W	22kΩ	5%
R54	1010104008	Carbon film	1/6W	100kΩ	5%
R55	1010103006	Carbon film	1/6W	10kΩ	5%
R56	1010103006	Carbon film	1/6W	10kΩ	5%
R57	1010279003	Carbon film	1/6W	2.7Ω	5%
R58	1010279003	Carbon film	1/6W	2.7Ω	5%
R59	1010104008	Carbon film	1/6W	100kΩ	5%
R60	1010473009	Carbon film	1/6W	47kΩ	5%
R61	1010393001	Carbon film	1/6W	39kΩ	5%
R62	1010103006	Carbon film	1/6W	10kΩ	5%
R63	1010680004	Carbon film	1/6W	68Ω	5%
R64	1010333003	Carbon film	1/6W	33kΩ	5%
R65	1010103006	Carbon film	1/6W	10kΩ	5%
R66	1010182008	Carbon film	1/6W	1.8kΩ	5%
R67	1010153001	Carbon film	1/6W	15kΩ	5%
R68	1010332001	Carbon film	1/6W	3.3kΩ	5%
R69	1010392009	Carbon film	1/6W	3.9kΩ	5%
R70	1010103006	Carbon film	1/6W	10kΩ	5%
R71	1314701004	Metal film	1/4W	4.7kΩ	1%
R72	1314700002	Metal film	1/4W	470Ω	1%
R73	1010223006	Carbon film	1/6W	22kΩ	5%
R74	1311602004	Metal film	1/4W	16kΩ	1%
*	1311302002	Metal film	1/4W	13kΩ	1%
R75	1314302000	Metal film	1/4W	43kΩ	1%
R76	1010562008	Carbon film	1/6W	5.6kΩ	5%
R77	1010102004	Carbon film	1/6W	1kΩ	5%
R78	1010472007	Carbon film	1/6W	4.7kΩ	5%
R79	1010473009	Carbon film	1/6W	47kΩ	5%
R80	1010273001	Carbon film	1/6W	27kΩ	5%
R81	1010222004	Carbon film	1/6W	2.2kΩ	5%
R82	1010103006	Carbon film	1/6W	10kΩ	5%
R83	1010103006	Carbon film	1/6W	10kΩ	5%
R84	1010223006	Carbon film	1/6W	22kΩ	5%
R85	1010273001	Carbon film	1/6W	27kΩ	5%
R86	1010222004	Carbon film	1/6W	2.2kΩ	5%
R87	1010333003	Carbon film	1/6W	33kΩ	5%
R88	1010683000	Carbon film	1/6W	68kΩ	5%
R89	1010473009	Carbon film	1/6W	47kΩ	5%
R90	1010473009	Carbon film	1/6W	47kΩ	5%
R91	1010472007	Carbon film	1/6W	4.7kΩ	5%
R92	1010331009	Carbon film	1/6W	330Ω	5%
R93	1010102004	Carbon film	1/6W	1kΩ	5%
R94	1010103006	Carbon film	1/6W	10kΩ	5%
R95	1010222004	Carbon film	1/6W	2.2kΩ	5%
R96	1010273001	Carbon film	1/6W	27kΩ	5%
R97	1010152009	Carbon film	1/6W	1.5kΩ	5%
R98		---			
R99		---			
R100	1010104008	Carbon film	1/6W	100kΩ	5%
R101	1010154003	Carbon film	1/6W	150kΩ	5%
R102		---			
R103	1010393001	Carbon film	1/6W	39kΩ	5%

< VARIABLE RESISTORS >

VR1	1712007008	Carbon film	1/2W	2.2kΩ
VR2	1712006006	Carbon film	1/2W	1kΩ
VR3	1712006006	Carbon film	1/2W	1kΩ
VR4	1712019005	Carbon film	1/2W	2.2MΩ

No.	LDR PT No.	DESCRIPTION			
VR5	1712019005	Carbon film	1/2W	2.2MΩ	
VR6	1712014005	Carbon film	1/2W	100kΩ	
VR7	1712003000	Carbon film	1/2W	220Ω	
VR8	1712010007	Carbon film	1/2W	10kΩ	
VR9	1712010007	Carbon film	1/2W	10kΩ	
VR10	1712010007	Carbon film	1/2W	10kΩ	
< CAPACITORS >					
C1	2250102007	Electrolytic	50V	1000uF	20%
C2	2250102007	Electrolytic	50V	1000uF	20%
C3	2010473008	Ceramic	50V	0.047uF	10%
C4	2010104007	Ceramic	50V	0.1uF	10%
C5	2240470009	Electrolytic	25V	47uF	20%
C6	2010102003	Ceramic	50V	1000pF	10%
C7	2230100009	Electrolytic	16V	10uF	20%
C8	2240100006	Electrolytic	25V	10uF	20%
C9	2250470006	Electrolytic	50V	47uF	20%
C10	2010102003	Ceramic	50V	1000pF	10%
C11	2250470006	Electrolytic	50V	47uF	20%
C12	2010473008	Ceramic	50V	0.047uF	10%
C13	2010104007	Ceramic	50V	0.1uF	10%
C14	2240470009	Electrolytic	25V	47uF	20%
C15	2194020009	Plastic film	100V	3uF	1%
C16	2194020009	Plastic film	100V	3uF	1%
C17	2140683017	Plastic film	50V	0.068pF	10%
C18	2140683017	Plastic film	50V	0.068pF	10%
C19	2194019004	Plastic film	100V	0.3uF	1%
C20	2194019004	Plastic film	100V	0.3uF	1%
C21	2140682015	Plastic film	50V	6800pF	10%
C22	2140682015	Plastic film	50V	6800pF	10%
C23	2194018002	Plastic film	100V	0.03uF	1%
C24	2194018002	Plastic film	100V	0.03uF	1%
C25	2130561007	Plastic film	50V	560pF	10%
C26	2130561007	Plastic film	50V	560pF	10%
C27	2194021001	Plastic film	100V	3000pF	1%
C28	2194021001	Plastic film	100V	3000pF	1%
C29	2120470016	Mica	500V	47pF	10%
C30	2120220004	Mica	500V	22pF	10%
C31	2110221009	Mica	50V	220pF	10%
C32	2110221009	Mica	50V	220pF	10%
C33	2120560008	Mica	500V	56pF	10%
C34	2120100004	Mica	500V	10pF	10%
C35	2110221009	Mica	50V	220pF	10%
C36	2120050005	Mica	500V	5pF	10%
C37	2240221008	Electrolytic	25V	220uF	20%
C38	2240100006	Electrolytic	25V	10uF	20%
C39	2120050005	Mica	500V	5pF	10%
C40	2140333010	Plastic film	50V	0.033uF	10%
C41	2140103013	Plastic film	50V	0.01uF	10%
C42	2120390009	Mica	500V	39pF	10%
C43	2240101008	Electrolytic	25V	100uF	20%
C44	2250221005	Electrolytic	50V	220uF	20%
C45	2250470006	Electrolytic	50V	47uF	20%
C46	2250221005	Electrolytic	50V	220uF	20%
C47	2250470006	Electrolytic	50V	47uF	20%
C48	2120270009	Mica	500V	27pF	10%
C49	2240100006	Electrolytic	25V	10uF	20%

No.	LDR PT No.	DESCRIPTION			
C50	2120390009	Mica	500V	39pF	10%
C51	2240470009	Electrolytic	25V	47uF	20%
C52	2240470009	Electrolytic	25V	47uF	20%
C53	2250470006	Electrolytic	50V	47uF	20%
C54	2250470006	Electrolytic	50V	47uF	20%
C55	2140472014	Plastic film	50V	4700pF	10%
C56	2130331000	Mica	50V	100pF	10%
C57	2240470009	Electrolytic	25V	47uF	20%
C58	2240470009	Electrolytic	25V	47uF	20%
C59	2140562015	Plastic film	50V	5600pF	10%
C60	2130471006	Plastic film	50V	470pF	10%
C61	2230101001	Electrolytic	16V	100uF	20%
C62	2120390009	Mica	500V	39pF	10%
C63	2110151004	Mica	50V	150pF	10%
C64	2130331000	Plastic film	50V	330pF	10%
C65	2130331000	Plastic film	50V	330pF	10%
C66	2250470006	Electrolytic	50V	47uF	20%
C67		---			
C68		---			
C69		---			
C70	2240470009	Electrolytic	25V	47uF	20%
< VARIABLE CAPACITORS >					
VC1	2910016002	Ceramic	10pF		
VC2	2910016002	Ceramic	10pF		
< TRANSISTORS >					
Q1	3040880001	NPN	2SD880-O		
Q2	3031815009	NPN	2SC1815-O or Y		
Q3	3031815009	NPN	2SC1815-O or Y		
Q4	3020834000	PNP	2SB834-O		
Q5	3011015003	PNP	2SA1015-O or Y		
Q6	3011015003	PNP	2SA1015-O or Y		
Q7	3090026008	FET	UPA71A-L		
Q8	3032362004	NPN	2SC2362-G		
Q9	3010495016	PNP	2SA495(G)TM-Y		
Q10	3010495016	PNP	2SA495(G)TM-Y		
Q11	3010495016	PNP	2SA495(G)TM-Y		
Q12	3011016005	PNP	2SA1016-G		
Q13	3010495016	PNP	2SA495(G)TM-Y		
Q14	3032912003	NPN	2SC2912-S		
Q15	3011210001	PNP	2SA1210 S		
Q16	3031815009	NPN	2SC1815-O or Y		
Q17	3031815009	NPN	2SC1815-O or Y		
Q18	3031815009	NPN	2SC1815-O or Y		
Q19	3031815009	NPN	2SC1815-O or Y		
Q20	3031815009	NPN	2SC1815-O or Y		
Q21	3031815009	NPN	2SC1815-O or Y		
Q22	3031815009	NPN	2SC1815-O or Y		
Q23	3031815009	NPN	2SC1815-O or Y		
Q24	3031907004	NPN	2SC1907		
Q25	3031907004	NPN	2SC1907		
Q26	3031907004	NPN	2SC1907		
Q27	3031907004	NPN	2SC1907		
Q28	3030752005	NPN	2SC752(G)TM-O		
Q29	3030752005	NPN	2SC752(G)TM-O		

No.	LDR PT No.	DESCRIPTION	
Q30	3030752005	NPN	2SC752(G)TM-O
Q31	3050055007	FET	2SK55E
Q32	3030752005	NPN	2SC752(G)TM-O
Q33	3030752005	NPN	2SC752(G)TM-O
Q34	3050030001	FET	2SK30A-GR
Q35	3031815009	NPN	2SC1815-O or Y
Q36	3031815009	NPN	2SC1815-O or Y

< DIODES >

D1	3110042008	Rectifier	W-02
D2	3110019003	Det	1DZ61
D3	3110006004	Det	1S1588
D4	3110033007	Det	1S2191
D5	3110006004	Det	1S1588
D6	3110019003	Det	1DZ61
D7	3110006004	Det	1S1588
D8	3110006004	Det	1S1588
D9	3110006004	Det	1S1588
D10	3110006004	Det	1S1588
D11	3110006004	Det	1S1588
D12	3110006004	Det	1S1588
D13	3110006004	Det	1S1588
D14	3120027009	Zener	RD7.5EB
D15	3110006004	Det	1S1588
D16	3110006004	Det	1S1588
D17	3120025005	Zener	RD6.2EB
D18	3560023001	Photo coupler	MCD-527-LD

< ICs >

IC1	3217815997	Regulator	7815P
IC2	3220038002	Op amp	TL082
IC3	3217915991	Regulator	7915P
IC4	3220038002	Op amp	TL082
IC5	3220038002	Op amp	TL082

< SWITCH >

S1	4020180008	S-5-39	"FREQUENCY RANGE"

< PC BOARD >

5903304005 T-3304

OUTPUT BOARD (T-3305)

< RESISTORS >

R1	1324721007	Metal film	1/2W	4.72kΩ	1%
R2	1321550008	Metal film	1/2W	155Ω	1%
R3	1324721007	Metal film	1/2W	4.72kΩ	1%
R4	1326000003	Metal film	1/2W	600Ω	1%
R5	* 1321042009	Metal film	1/2W	10.4kΩ	1%
R6	* 1326929003	Metal film	1/2W	69.2Ω	1%
R7	* 1321042009	Metal film	1/2W	10.4kΩ	1%
R8	* 1010472007	Carbon film	1/6W	4.7kΩ	5%

No.	LDR PT No.	DESCRIPTION			
< VARIABLE RESISTOR >					
VR1	1712014005	Carbon film	1/2W	100kΩ	
< CAPACITOR >					
C1	2010104007	Ceramic	50V	0.1uF	10%
< SWITCHES >					
S1,2,4	4020182002	S-4-40	"OUTPUT"		
S1-4	* 4020181001	S-4-39	"OUTPUT"		
< PC BOARD >					
	5903305016	T-3305			

ATTENUATOR BOARD (T-3306)

< RESISTORS >

R1	1321440001	Metal film	1/2W	144Ω	1%
R2	1324110008	Metal film	1/2W	411Ω	1%
R3	1322780001	Metal film	1/2W	278Ω	1%
R4	1321449009	Metal film	1/2W	14.4Ω	1%
R5	1324110008	Metal film	1/2W	411Ω	1%
R6	1322780001	Metal film	1/2W	278Ω	1%
R7	1000109001	Carbon film	1/6W	1Ω	5%
R8	1324110008	Metal film	1/2W	411Ω	1%
R9	1322780001	Metal film	1/2W	278Ω	1%
R10	1324110008	Metal film	1/2W	411Ω	1%
R11	1322780001	Metal film	1/2W	278Ω	1%
R12	1324110008	Metal film	1/2W	411Ω	1%
R13	1322780001	Metal film	1/2W	278Ω	1%
R14	1324110008	Metal film	1/2W	411Ω	1%
R15	1322780001	Metal film	1/2W	278Ω	1%
R16	1324110008	Metal film	1/2W	411Ω	1%
R17	1321900009	Metal film	1/2W	190Ω	1%
R18	1322780001	Metal film	1/2W	278Ω	1%
R19	1321630002	Metal film	1/2W	163Ω	1%
R20	1321610000	Metal film	1/2W	161Ω	1%
R21	1321440001	Metal film	1/2W	144Ω	1%
R22	1328309005	Metal film	1/2W	83.0Ω	1%
R23	1321300005	Metal film	1/2W	130Ω	1%
R24	1323429005	Metal film	1/2W	34.2Ω	1%
R25	1321160005	Metal film	1/2W	116Ω	1%
R26	1010100000	Carbon film	1/6W	10Ω	5%
R27	1321030002	Metal film	1/2W	103Ω	1%
R28	1329129009	Metal film	1/2W	91.2Ω	1%
R29	1010279003	Carbon film	1/6W	2.7Ω	5%
R30	1328189001	Metal film	1/2W	81.8Ω	1%
R31	1010150005	Carbon film	1/6W	15Ω	5%
R32	1327289009	Metal film	1/2W	72.8Ω	1%
R33	1313009006	Metal film	1/4W	30Ω	1%
R34	1326509001	Metal film	1/2W	65.0Ω	1%
R35	1315109002	Metal film	1/4W	51Ω	1%
R36	1325320005	Metal film	1/2W	532Ω	1%
R37	1322390008	Metal film	1/2W	239Ω	1%

No.	LDR PT No.	DESCRIPTION			
R38	1323429005	Metal film	1/2W	34.2Ω	1%
R39	1322130002	Metal film	1/2W	213Ω	1%
R40	1323429005	Metal film	1/2W	34.2Ω	1%
R41	1321900009	Metal film	1/2W	190Ω	1%
R42	1323339004	Metal film	1/2W	33.3Ω	1%
R43	1321650002	Metal film	1/2W	165Ω	1%
R44	1323339004	Metal film	1/2W	33.3Ω	1%
R45	1321420005	Metal film	1/2W	142Ω	1%
R46	1323279002	Metal film	1/2W	32.7Ω	1%
R47	1311200004	Metal film	1/4W	120Ω	1%
R48	1323279002	Metal film	1/2W	32.7Ω	1%
R49	1329889005	Metal film	1/2W	98.8Ω	1%
R50	1323169005	Metal film	1/2W	31.6Ω	1%
R51	1327889003	Metal film	1/2W	78.8Ω	1%
R52	1323169005	Metal film	1/2W	31.6Ω	1%
R53	1325949003	Metal film	1/2W	59.4Ω	1%
R54	1323169005	Metal film	1/2W	31.6Ω	1%
R55	1313909002	Metal film	1/4W	39Ω	1%
R56	1312701002	Metal film	1/4W	2.7kΩ	1%

< CAPACITORS >

C1		---			
C2	2140102002	Plastic film	50V	1000pF	5%
C3	2130271008	Plastic film	50V	270pF	10%
C4	2120470016	Mica	500V	47pF	10%

< SWITCHES >

S1	4010054006	SRM1018120	"OUTPUT LEVEL"
S2	4010043001	SRM101A L=20	"OUTPUT LEVEL"
S3	4010043001	SRM101A L=20	"OUTPUT LEVEL"

< PC BOARD >

	5903306018	T-3306

MAIN FRAME

< RESISTOR >

R1	1326000003	Metal film	1/2W	600Ω	1%

< VARIABLE RESISTORS >

VR1	1815015003	VB16L4N(7x6.5)N20RB 2kΩ	"FINE"
VR2	1940036000	EWS-4AA 020 535 10kΩ	"FREQUENCY DIAL"

< DIODE >

D1	3130063000	LED	TLG164	"POWER"

< TRANSFORMER >

T1	3800512008	J-512	Power transformer
T2	* 3810031009	TF-3	Matching transformer

No.	LDR PT No.	DESCRIPTION			
< SWITCHES >					
S1	4020138009	SDDG A3P L=18M		"POWER"	
*S2	4030075008	SLWK-22-09C		"600Ω LOAD"	
< FUSE >					
F1	4361701008	Time lag	ST-4	0.5A	(100-120V)
	4361711001	Time lag	ST-4	0.25A	(200-240V)

10. TOP/BOTTOM COVER REMOVAL