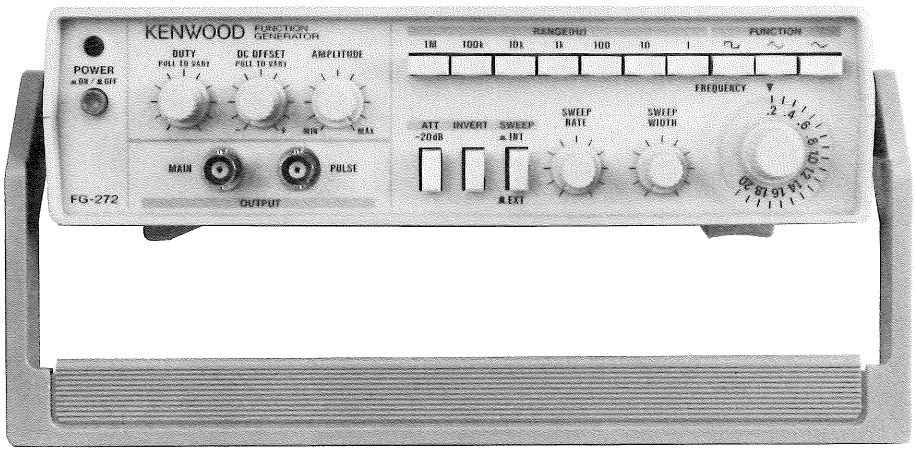
KENWOOD

FUNCTION GENERATOR

FG-272

SERVICE MANUAL

KENWOOD CORPORATION



WARNING

The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.

CONTENTS

SPECIFICATIONS

Frequency Characteristics	
Outputs	Sine, square, triangle, pulse, ramp, TTL square wave
Frequency range	0.2 Hz to 2 MHz in 7 ranges (1/10/100/1k/10k/100k/1M)
Accuracy	±5% of full scale
External frequency control (VCF)	
Input voltage	0 to +10V DC. Frequency decreases with positive voltage.
Variable frequency range	Greater than 100:1
Variable symmetry	Variable over 1:1 to 5:1 range
DC offset	Continuously variable; maximum of ±10 V open circuit, ±5 V into 50 ohms.
Polarity	Inverted or non-inverted
Sine Wave	
Distortion	Less than 1%, 10 Hz to 100 kHz
Amplitude flatness	Within ±1.0 dB to 100 kHz at maximum output amplitude
Output	Variable amplitude
Square Wave	
Symmetry	Less than ±3% at 100 Hz
Rise and fall time	Less than 100 ns at maximum output
Output	Variable amplitude
Triangle Wave	
Linearity	Less than 1% at 100 Hz
Output	Variable amplitude
TTL Output	
Rise and fall time	Less than 25 ns
Output	TTL level
Sweep Characteristics	
Internal	Linear or logarithm
Sweep rate	0.5 Hz (2 s) to 50 Hz (20 ms), continuously variable
Sweep width	Variable from 10:1 to 1000:1
External sweep	Rear panel VCF jack. Input impedance is 13 kΩ.

SPECIFICATIONS

Output	
Amplitude	20 Vp-p open circuit, 10 Vp-p into 50 ohms.
Attenuator	Step of −20 dB, continuously variable
Impedance	50 ohms, ±10%
Power Requirements	
Input voltage	AC 100 V/120 V/220 V/240 V ±10%
Frequency	50 Hz/60 Hz
Power consumption	Approx. 20 VA
Environmental Conditions	
Storage	−20°C to 60°C, Less than 70% humidity
Operating	0°C to 40°C, Less than 80% humidity
Specification	23°C ±5°C, Less than 70% humidity
Dimensions and Weight	
Dimensions	240 (W)×64 (H)×190 (D) mm
Weight	1.8 kg
Accessories	
Instruction manual	1
AC cord	1
Fuse	0.3 A (slow-blow type)×1 0.2 A (fast-blow type)×1

*** Circuit and rating are subject to change without notice due to developments in technology.**

SAFETY

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. The specified voltage is shown near of the AC inlet. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using ac-power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the instrument at earth ground. Do not attempt to defeat the ground wire connection or float the instrument; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.

The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located on the rear panel and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This instrument may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Replace fuse FS1 with a fuse of appropriate value, 0.3 A slow-blow type for 100 VAC to 120 VAC operation, 0.2 A fast-blow for 220 VAC to 240 VAC operation.
2. Reinsert it for appropriate voltage range.
3. When performing the reinsertion of fuse holder for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

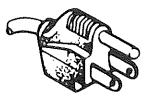
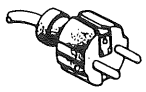
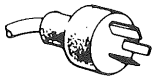
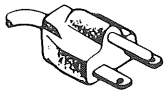
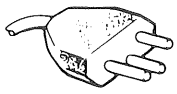
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord and plate
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.3 A, 250 V Slow blow 6×30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	0.2 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	0.2 A, 250 V Fast blow 6×30 mm	0.8 A Type C	—
	Australian 240 volt/50 Hz Rated 10 amp	0.2 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.2 A, 250 V Fast blow 6×30 mm	None	—
	Switzerland 240 volt/50 Hz Rated 10 amp	0.2 A, 250 V Fast blow 6×30 mm	None	—

Fig. 1 Power Input Voltage Configuration

ADJUSTMENT

CASE DISASSEMBLY AND ASSEMBLY

1. To open the case, turn the unit upside down with the rubber feet facing up. (See Fig. 2)
2. Remove the four screws from the bottom case.
3. Carefully separate the two halves of the case and recalibrate the unit following the prescribed procedure.

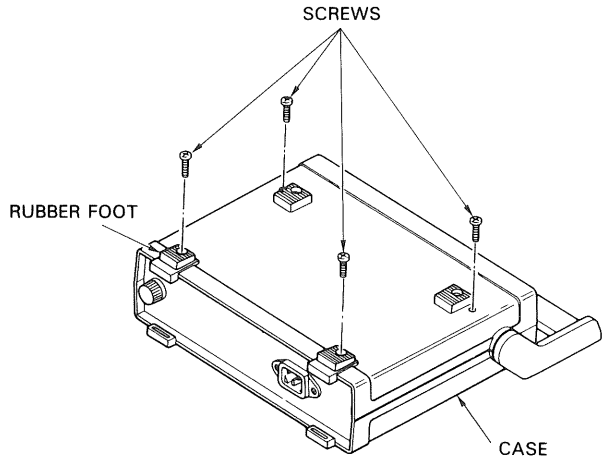


Fig. 2

4. To close the case, lower the bottom case and guide the front and rear panels into thier slots. Position the rubber feet as illustrated and screw the two halves of the case together.
   Do not overtighten screws.

100/120/220/240 VOLT CONVERSION

This instrument operates from a 100 V, 120 V, 220 V or 240 V AC, 50 to 60 Hz line-voltage source. The applied voltage is indicated on the rear panel. To convert from the specified voltage to other line voltages, replace the voltage plug position on PC Board, referring to the figure below and change the rear panel applied voltage indication. Also, be sure to replace the fuse to correspond to the line voltage 0.3 A slow-blow fuse for 100 V to 120 V operation and 0.2 A fast-blow fuse for 220 V to 240 V operation. If it is not wired to your local line voltage, set the power transformer wiring as shown below. (See Fig. 3.)

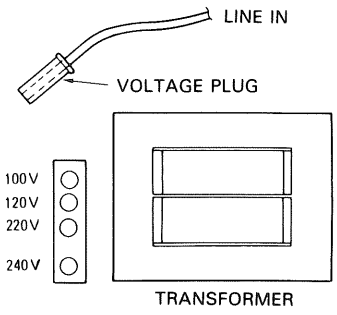


Fig. 3

TEST EQUIPMENT REQUIRED

- Digital Multimeter: KENWOOD DL-707 or equivalent
- Osilloscope: KENWOOD CS-1022 or equivalent
- Frequency Counter: KENWOOD FC-756 or equivalent
- Distortion Analyzer: Y.H.P 334A or equivalent
- DC Power Supply: KENWOOD PD18-10 or equivalent

AMPLIFIER INTERNAL DC OFFSET AND TRIANGLE WAVE AMPLITUDE ADJUSTMENT

1. Push function switch to OFF position, load 50 ohms.
2. Push range switch to OFF position, ATT switch OFF.
3. Amplitude to minimum.
4. Adjust R82 to get −5 mV at the main out BNC jack.
5. Push function switch to "TRIANGLE WAVE", setting amplitude VR at maximum.
6. Push range switch to 100 kHz.
7. Tuning the frequency dial to 1.0 position approximately.
8. Adjust the resistor R86 to get 10.4±0.1 Vp-p main output level and make sure the wave form are not clipping.
9. Check all range except MHz that triangle wave output amplitude more than 10.25 Vp-p.
10. Re-adjust resistor R86 to obtain 10.25 Vp-p output at any critical frequency point.
11. Repeat step 1 to 4 to maintain −5 mV DC voltage at main output BNC.

TRIANGLE WAVE FREQUENCY RESPONSE ADJUSTMENT

1. Push function switch to "TRIANGLE WAVE".
2. Push range switch to 1 MHz, amplitude VR MAX.
3. Tuning the frequency dial to 2.0 position approximately.
4. Load 50 ohms and ATT switch OFF.
5. Adjust the C16 to get 10.4±0.1 V main output level and make sure the wave form are not clipping.

SQUARE WAVE RISE & FALL TIME ADJUSTMENT

1. Push function switch to "SQUARE WAVE", amplitude VR MAX.
2. Push range switch to 100 kHz.
3. Tuning frequency dial to 2.0 position.
4. Load 50 ohms, ATT switch OFF.
5. In maximum output amplitude condition, adjust C31 to reduce over shoot phenomenon.
6. Push range switch to 1 MHz, check rise/fall time for less than 100 ns.
7. Repeat step 5, 6 to minimize over shoot and maintain rise/fall time.

SQUARE WAVE AMPLITUDE ADJUSTMENT

1. Push function switch to "SQUARE WAVE".
2. Push range switch to 1 MHz, amplitude VR MAX.
3. Tuning frequency dial to 2.0 position.
4. Load 50 ohms, ATT switch OFF.
5. Adjust R56 (square wave output amplitude) to get 10.4±0.1 Vp-p main output level.

ADJUSTMENT

SINE WAVE AMPLITUDE ADJUSTMENT

1. Push function switch to ''SINE WAVE''.
2. Push range switch to 100 kHz, dial scale setting at 1.0 position.
3. Load 50 ohms, ATT switch OFF, amplitude VR MAX.
4. Adjust R74 (sine wave output amplitude) to get 10.4±0.1 Vp-p level from main output and make sure the waveform do not clip on the top and bottom.

SINE WAVE, FREQUENCY RESPONSE ADJUSTMENT

1. Push function switch to ''SINE WAVE''.
2. Push range switch to 1 M, amplitude VR MAX.
3. Turn the frequency dial to 2.0 position approximately.
4. Load 50 ohms, ATT switch OFF.
5. Adjust C26 (sine wave response) to get 10.4±0.1 Vp-p level from main output and make sure the signal are not clipping.

SINE WAVE DISTORTION ADJUSTMENT

Set sweep width VR, rate VR, duty VR, offset VR to minimum situation. Offset VR press in to internal offset position.

1. Push function switch to ''SINE WAVE''.
2. Push range switch to 100 kHz.
3. Tuning frequency dial to 0.2 position.
4. Adjust R33 make potential equal (within ±10 mV) between Q5 gate and pin 10 of U5.
5. Adjust R10, R18 make DC voltage equal between pin 2 and pin 3 of both U1 and U2.
6. Push range switch to 100 Hz, adjust R43 CW to MAX.
7. Adjust R46 to reduce 20 Hz distortion.
8. Readjust R43 to reduce 20 Hz distortion.
9. Repeat step 7 and 8 to minimize 20 Hz distortion for less than 0.8%.
10. Push range switch to 100 kHz, setting frequency dial to 1.0 position.
11. Check distortion of 100 kHz for less than 0.8%.
12. Repeat step 7 to 11 for maintain distortion less than 0.8%.

FREQUENCY ACCURACY ADJUSTMENT

1. Push function switch to triangle wave.
2. Push range switch to 100 kHz, amplitude VR MAX.
3. Tuning frequency VR to 2.0 position.
4. Adjust R6 for a counter display reading 200 kHz.
5. Check all ranges accuracy and function are in full scale ±4.5%.
6. Repeat steps 4 and 5.
7. Tuning frequency VR to 0.2 position.
8. Check all function and frequency except MHz range frequency accuracy are in full scale ±4.5%.
9. Repeat steps 3 to 7 to complete step 8.

1 M RANGE FREQUENCY ADJUSTMENT

1. Push function switch to triangle wave.
2. Push range switch to 1 MHz, amplitude VR MAX.
3. Tuning frequency VR to 2.0 position.
4. Adjust C8 for a counter display reading 2 MHz.
5. Tuning frequency VR to 0.2 position.
6. Check all function frequency accuracy is in full scale ±4.5%.
7. Repeat steps 3 to 5 to complete step 6.

PARTS LIST

MISCELLANEOUS

REF.NO	PARTS NO	NAME & DESCRIPTION
	A02-0522-08	TOP CASE
	A02-0523-08	BOTTOM CASE
	A21-1131-08	DECORATEVE PANEL
	A22-0868-08	SUB PANEL
	A23-1685-08	REAR PANEL
	B41-0800-08	CAUTION LABEL
	B50-7659-00	INSTRUCTION MANUAL(JAPANESE)
	B50-7663-00	INSTRUCTION MANUAL(ENGLISH)
	E04-0251-05	BNC RECEPTACLE
	E18-0351-05	AC INLET 3 P
	E22-0482-08	CONNECTOR 4P(SELECT VOLTAGE)
	E30-1644-15	BS POWER CORD
	E30-1818-05	JIS POWER CORD
	E30-1819-05	CEE POWER CORD
	E30-1821-05	SAA POWER CORD
	E31-2930-08	WIRE ASS'Y 1P (FUSE TO PIN)
	E31-2935-08	WIRE ASS'Y 4P (J2)
	E31-2936-08	WIRE ASS'Y 4P
	E31-2937-08	WIRE ASS'Y 3P (J3)
	E31-2938-08	WIRE ASS'Y 3P
	E31-2939-08	WIRE ASS'Y 2P
	E31-2940-08	SHIELD CABLE 110MM
	E31-2943-08	SHIELD CABLE 170MM
	E40-7028-08	PIN CONNECTOR 4 P
	E40-7029-08	PIN CONNECTOR 3 P
	E40-7030-08	PIN CONNECTOR 2 P
	F02-0517-08	HEAT SINK 19X19X10H
	F02-0518-08	HEAT SINK H=15MM
	F05-2012-05	FUSE 0.2A(FAST BLOW)
	F05-3017-05	FUSE 0.3A(SLOW BLOW)
	F09-0515-04	SHEET(COVERED ON CAUTION LABEL
	F20-0670-08	INSULATED FIBER
	G02-0612-08	COIL SPRING
	G13-0724-08	SPONGE 20X40
	G16-0615-08	SHIELD PAPER
	G53-0602-08	LED HOLDER
	H01-5884-08	CARTON BOX
	H12-0571-08	FOAMED PAD
	H20-1728-08	VIYNL COVER 320X340X0.06
	J02-0520-08	RUBBER FOOT(FRONT)
	J02-0521-08	RUBBER FOOT(REAR)
	J13-0507-08	FUSE HOLDER
	J21-4609-08	VR BRACKET(FIX FREQUENCY'S VR)
	J25-5244-08	PCB (UNMOUNTED) 220X169
	J25-5245-08	PCB (UNMOUNTED) 61X36
	J30-0622-08	TRANSISTOR HOLDER
	J32-0802-08	HEX STUD L=44.2
	K01-0527-08	HANDLE
	K23-0810-08	KNOB
	K27-0541-08	PUSH BUTTON(POWER SWITCH)
	K27-0542-08	PUSH BUTTON,WHITE
	K29-0812-08	KNOB ASS'Y (FREQUENCY)
	L01-9726-08	POWER TRANSFORMER
	N09-0758-08	TAPPING SCREW(FRONT FOOT)3.5X8
	S40-1523-08	PUSH SWITCH(POWER) TV-3
	S42-0504-08	PUSH SWITCH(RANGE,FUNCTION)
	S42-3512-08	PUSH SWITCH(ATT,INVERT,SWEEP)
	W02-0452-08	MAIN UNIT(MOUNTED)
	W02-0453-08	SWITCH UNIT(MOUNTED)

SEMICONDUCTOR

REF.NO	PARTS NO	NAME & DESCRIPTION
D001	1N4148	DIODE
⌇		
D030	1N4148	DIODE
D031	RD5.6E(B2)	DIODE, ZENER 5.6V
D032	1N4148	DIODE
⌇		
D049	1N4148	DIODE
D050	NO USE	
D051	B30-0959-08	LED,RED
D052	1N4001	DIODE
D053	1N4001	DIODE
D054	1N4001	DIODE
D055	1N4001	DIODE
D056	1N4148	DIODE
D057	1N4001	DIODE

REF.NO	PARTS NO	NAME & DESCRIPTION
Q001	2SC1815(GR)	TR. SI. NPN
Q002	2SA1015(GR)	TR. SI. PNP
Q003	2SA1015(GR)	TR. SI. PNP
Q004	2SC1815(GR)	TR. SI. NPN
Q005	2N5485	FET. N-CHANNEL
Q006	2SA1015(GR)	TR. SI. PNP
Q007	2SA1015(GR)	TR. SI. PNP
Q008	2SC1815(GR)	TR. SI. NPN
Q009	2SC1674(K)	TR. SI. NPN
Q010	2SC1674(K)	TR. SI. NPN
Q011	2N3906	TR. SI. PNP
Q012	2SC1674(K)	TR. SI. NPN
Q013	2N2219A	TR. SI. NPN
Q014	2N2905A	TR. SI. PNP
Q015	LM7815	IC, 3-TERMINAL POSI. REGULATOR
Q016	TIP32B	TR. SI. PNP
Q017	2N3906	TR. SI. PNP
U001	UA741	IC, OP AMP.
U002	UA741	IC, OP AMP.
U003	UA308	IC, OP AMP.
U004	UA308	IC, OP AMP.
U005	CA3086	IC, NPN TRANSISTOR ARRAY
U006	SN7420	IC, DUAL 4-INPUT NAND GATE
U007	CA3030	IC, OP AMP.
U008	UA741	IC, OP AMP.
U009	LM358	IC, DUAL OP AMP.
U010	UA741	IC, OP AMP.

RESISTOR

REF.NO	PARTS NO	NAME & DESCRIPTION			
R001	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R002	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R003	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R004	R01-2521-08	V.R.	5KB		
R005	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R006	R12-3040-05	RES. SEMI FIXED	22K B		
R007	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R008	NO USE				
R009	RN14BK2C3322F	RES. METAL FILM	33.2K	1%	1/6W
R010	R12-3041-05	RES. SEMI FIXED	10KB		
R011	RN14BK2C3011F	RES. METAL FILM	3.01K	1%	1/6W
R012	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R013	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R014	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R015	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R016	RN14BK2C1003F	RES. METAL FILM	100K	1%	1/6W
R017	RN14BK2C4992F	RES. METAL FILM	49.9K	1%	1/6W
R018	R12-3041-05	RES. SEMI FIXED	10KB		
R019	RN14BK2C3011F	RES. METAL FILM	3.01K	1%	1/6W
R020	R01-3520-08	V.R. WITH SW	10KB		
R021	RN14BK2C4991F	RES. METAL FILM	4.99K	1%	1/6W
R022	RN14BK2C7151F	RES. METAL FILM	7.15K	1%	1/6W
R023	RN14BK2C3480F	RES. METAL FILM	348	1%	1/6W
R024	RN14BK2C7502F	RES. METAL FILM	75K	1%	1/6W
R025	RN14BK2C7503F	RES. METAL FILM	750K	1%	1/6W
R026	RN14BK2C4991F	RES. METAL FILM	4.99K	1%	1/6W
R027	RN14BK2C7151F	RES. METAL FILM	7.15K	1%	1/6W
R028	RN14BK2C3480F	RES. METAL FILM	348	1%	1/6W
R029	RN14BK2C7502F	RES. METAL FILM	75K	1%	1/6W
R030	RN14BK2C7503F	RES. METAL FILM	750K	1%	1/6W
R031	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R032	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R033	R12-1028-05	RES. SEMI FIXED	4.7KB		
R034	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R035	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R036	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R037	RN14BK2C4021F	RES. METAL FILM	4.02K	1%	1/6W
R038	RN14BK2C4021F	RES. METAL FILM	4.02K	1%	1/6W
R039	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R040	RN14BK2C3012F	RES. METAL FILM	30.1K	1%	1/6W
R041	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R042	RN14BK2C4990F	RES. METAL FILM	499	1%	1/6W
R043	R12-1033-05	RES. SEMI FIXED	2.2K B		
R044	RN14BK2C1302F	RES. METAL FILM	13K	1%	1/6W
R045	RN14BK2C1302F	RES. METAL FILM	13K	1%	1/6W
R046	R12-1033-05	RES. SEMI FIXED	2.2K B		

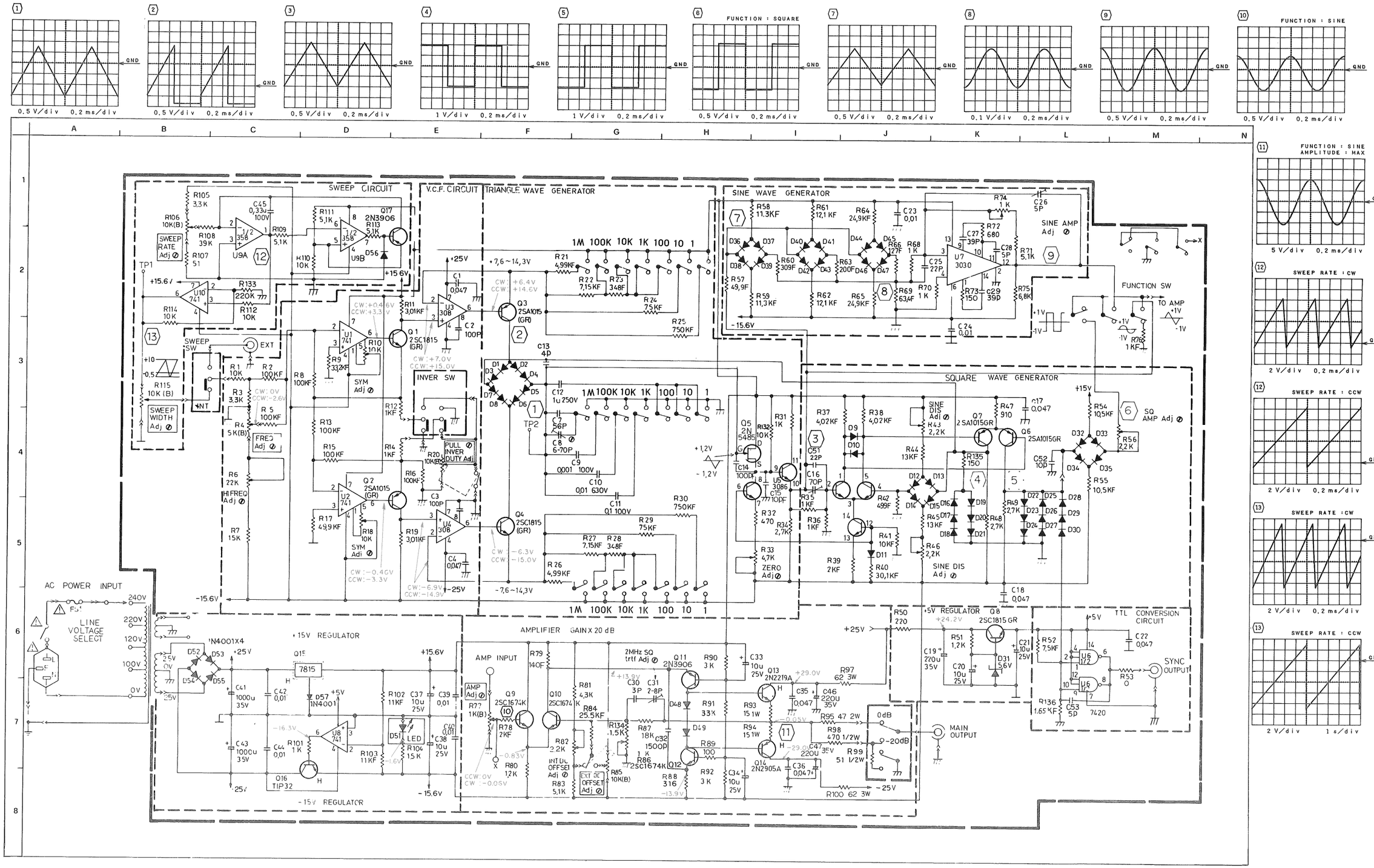
PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R047	RD14BB2C911J	RES. CARBON	910	5%	1/6W
R048	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R049	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R050	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R051	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R052	RN14BK2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R053	R92-1061-05	JUMPING RES.	ZERO OHM		
R054	RN14BK2C1052F	RES. METAL FILM	10.5K	1%	1/6W
R055	RN14BK2C1052F	RES. METAL FILM	10.5K	1%	1/6W
R056	R12-1033-05	RES. SEMI FIXED	2.2K B		
R057	RN14BK2C49R9F	RES. METAL FILM	49.9	1%	1/6W
R058	RN14BK2C1132F	RES. METAL FILM	11.3K	1%	1/6W
R059	RN14BK2C1132F	RES. METAL FILM	11.3K	1%	1/6W
R060	RN14BK2C3090F	RES. METAL FILM	309	1%	1/6W
R061	RN14BK2C1212F	RES. METAL FILM	12.1K	1%	1/6W
R062	RN14BK2C1212F	RES. METAL FILM	12.1K	1%	1/6W
R063	RN14BK2C2000F	RES. METAL FILM	200	1%	1/6W
R064	RN14BK2C2492F	RES. METAL FILM	24.9K	1%	1/6W
R065	RN14BK2C2492F	RES. METAL FILM	24.9K	1%	1/6W
R066	RN14BK2C1270F	RES. METAL FILM	127	1%	1/6W
R067	NO USE				
R068	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R069	RN14BK2C63R4F	RES. METAL FILM	63.4	1%	1/6W
R070	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R071	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R072	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R073	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R074	R12-1029-05	RES. SEMI FIXED	1K B		
R075	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R076	RN14BK2C1001F	RES. METAL FILM	1K	1%	1/6W
R077	R01-1516-08	V.R.	1KB		
R078	RN14BK2C2001F	RES. METAL FILM	2K	1%	1/6W
R079	RN14BK2C1400F	RES. METAL FILM	140	1%	1/6W
R080	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R081	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R082	R12-1033-05	RES. SEMI FIXED	2.2K B		
R083	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R084	RN14BK2C2552F	RES. METAL FILM	25.5K	1%	1/6W
R085	R01-3520-08	V.R. WITH SW	10KB		
R086	R12-1029-05	RES. SEMI FIXED	1K B		
R087	RD14BB2C183J	RES. CARBON	18K	5%	1/6W
R088	RN14BK2C3160F	RES. METAL FILM	316	1%	1/6W
R089	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R090	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R091	RD14BB2C333J	RES. CARBON	33K	5%	1/6W
R092	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R093	RS14AB3A150J	RES. METAL FILM	15	5%	1W
R094	RS14AB3A150J	RES. METAL FILM	15	5%	1W
R095	RS14AB3D470J	RES. METAL FILM	47	5%	2W
R096	NO USE				
R097	RS14AB3F620J	RES. METAL FILM	62	5%	3W
R098	RD14DB2H471J	RES. CARBON	470	5%	1/2W
R099	RD14DB2H510J	RES. CARBON	51	5%	1/2W
R100	RS14AB3F620J	RES. METAL FILM	62	5%	3W
R101	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R102	RN14BK2C1102F	RES. METAL FILM	11K	1%	1/6W
R103	RN14BK2C1102F	RES. METAL FILM	11K	1%	1/6W
R104	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R105	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R106	R01-3519-08	V.R.	10KB		
R107	RD14BB2C510J	RES. CARBON	51	5%	1/6W
R108	RD14BB2C393J	RES. CARBON	39K	5%	1/6W
R109	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R110	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R111	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R112	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R113	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R114	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R115	R01-3519-08	V.R.	10KB		
R132	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R133	RD14BB2C224J	RES. CARBON	220K	5%	1/6W
R134	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R135	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R136	RN14BK2C1651F	RES. METAL FILM	1.65K	1%	1/6W

CAPACITOR

REF.NO	PARTS NO	NAME & DESCRIPTION			
C001	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C002	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C003	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C004	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C007	CC45CH1H560J	CAP. CERAMIC	56P	5%	50V
C008	C05-0451-08	CAP. TRIMMER	70PF		
C009	C91-1259-08	CAP. POLYE FILM	0.001	2%	100V
C010	C91-1258-08	CAP. METAL FILM	0.01	2%	630V
C011	C91-1257-08	CAP. METAL FILM	0.1	2%	100V
C012	C91-1262-08	CAP. METAL FILM	1	2%	250V
C013	CC45CH1H040C	CAP. CERAMIC	4P	0.25P	50V
C014	CC45CH1H101J	CAP. CERAMIC	100P	5%	50V
C015	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C016	C05-0466-08	CAP. TRIMMER	70PF		
C017	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C018	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C019	CE04EW1V221M	CAP. ELECTRO	220	20%	35V
C020	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C021	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C022	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C023	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C024	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C025	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C026	C05-0465-08	CAP. TRIMMER	5PF		
C027	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C028	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C029	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C030	CC45CH1H030C	CAP. CERAMIC	3P	0.25P	50V
C031	C05-0450-08	CAP. TRIMMER	8PF		
C032	CK45B1H152K	CAP. CERAMIC	1500P	10%	50V
C033	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C034	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C035	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C036	CK45F1H473Z	CAP. CERAMIC	0.047		50V
C037	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C038	CE04EW1V100M	CAP. ELECTRO	10	20%	35V
C039	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C040	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C041	CE04EW1V102M	CAP. ELECTRO	1000	20%	35V
C042	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C043	CE04EW1V102M	CAP. ELECTRO	1000	20%	35V
C044	CK45F1H103Z	CAP. CERAMIC	0.01		50V
C045	C91-1260-08	CAP. METAL FILM	0.33	10%	100V
C046	CE04EW1V221M	CAP. ELECTRO	220	20%	35V
C047	CE04EW1V221M	CAP. ELECTRO	220	20%	35V
C051	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C052	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C053	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V

SCHEMATIC DIAGRAM



1 0.5 V/div 0.2 ms/div

2 0.5 V/div 0.2 ms/div

3 0.5 V/div 0.2 ms/div

4 1 V/div 0.2 ms/div

5 1 V/div 0.2 ms/div

6 FUNCTION : SQUARE
0.5 V/div 0.2 ms/div

7 0.5 V/div 0.2 ms/div

8 0.1 V/div 0.2 ms/div

9 0.5 V/div 0.2 ms/div

10 FUNCTION : SINE
0.5 V/div 0.2 ms/div

11 FUNCTION : SINE
AMPLITUDE : MAX
5 V/div 0.2 ms/div

12 SWEEP RATE : CW
2 V/div 0.2 ms/div

12 SWEEP RATE : CCW
2 V/div 0.2 ms/div

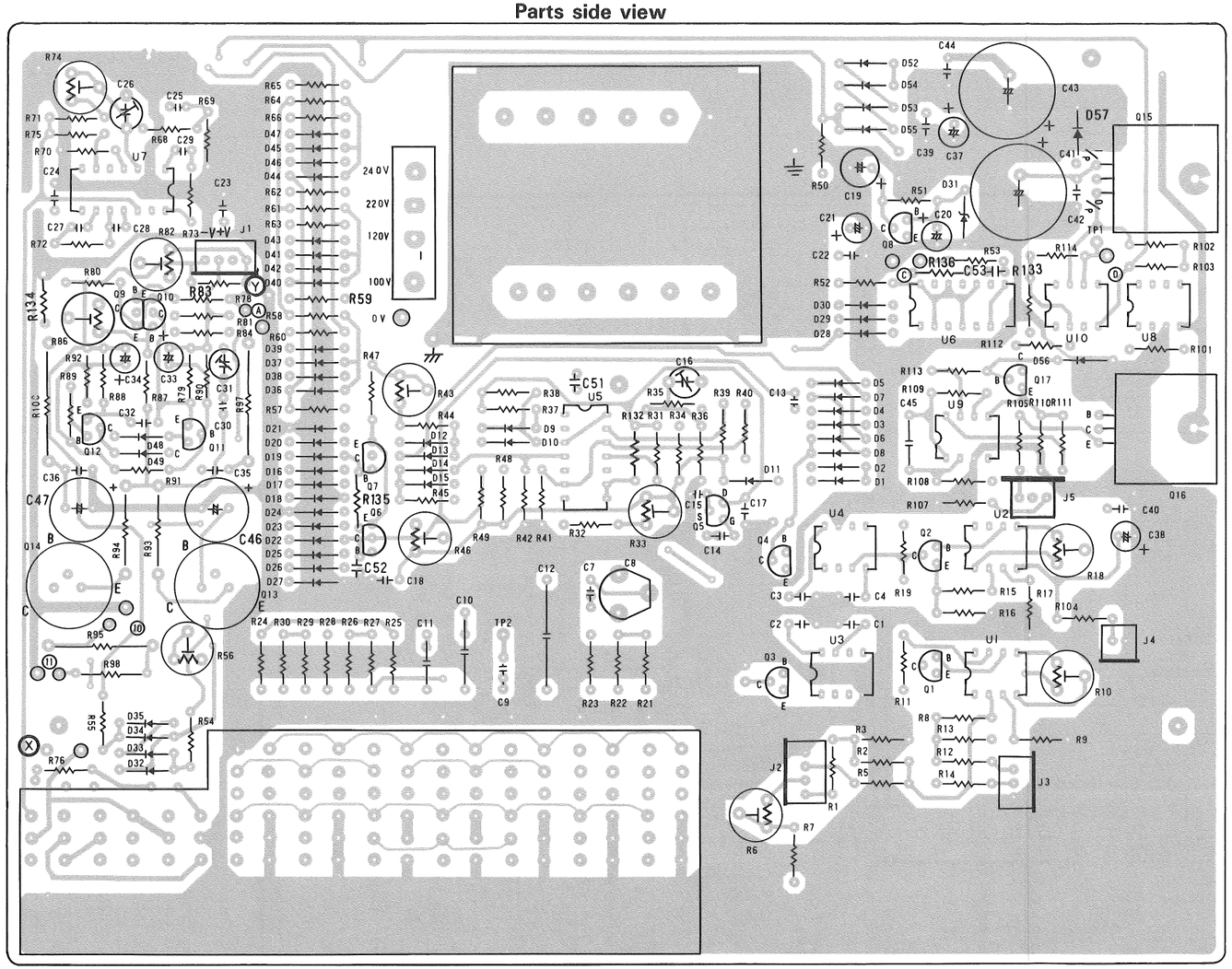
13 SWEEP RATE : CW
2 V/div 0.2 ms/div

13 SWEEP RATE : CCW
2 V/div 1 s/div

P.C. BOARD

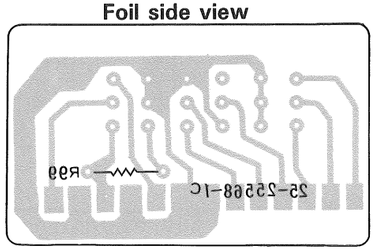
MAIN UNIT (W02-0452-08)

Parts side view



SWITCH UNIT (W02-0453-08)

Foil side view



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