INSTRUCTION MANUAL

YO-301

YAESU MUSEN CO., LTD.

TOKYO JAPAN

YO-301 MONITORSCOPE

OPERATION MANUAL

GENERAL

The model YO-301 Monitorscope is a measuring instrument [redacted] "on the air" signal and an oscilloscope. A two tone signal generator is built in for single sideband transmitter adjustment. The main function of the monitorscope is to monitor the transmitted signal on the scope. It can also be used to observe the signal received with an optional receiver adapter kit. The cabinet and front panel design of the YO-301 matches that of the FT-301 series of amateur SSB equipment.

SPECIFICATIONS

VERTICAL AMPLIFIER

Input Impedance	-	1M ohm 50 PF
Input Attenuator	-	X1, X10, X100 and Ground
Sensitivity	-	20 mV/Div (P-P)
Frequency Response	-	2 Hz to 4 MHz -3 dB 9 MHz to 10.7 MHz
Maximum Input Voltage	-	600V DC + AC Peak

HORIZONTAL AMPLIFIER

Input Impedance	-	100K ohm 100 PF
Sensitivity	-	300 mV/Div (P-P)
Sensitivity Adjustment	-	Variable
Frequency Response	-	10 Hz to 250 kHz -3 dB

TONE GENERATOR

Frequency	-	1500 Hz and 1900 Hz app.
Output Voltage	-	20 mV (P-P) nominal 115 mV (P-P) maximum

TRANSMITTER MONITOR

Frequency Coverage	-	1.8 MHz to 54 MHz
Input Impedance	-	50 to 75 ohms
Signal Power Limit	-	10 watts to 500 watts
Input Attenuator	-	5 steps
Insertion Loss	-	less than 0.5 dB

Picture Tube	-	C312P1
Picture Tube Anode Voltage	-	1.3 KV
Power Requirement	-	100/110/117/200/220 or 234 Volts AC

Weight	-	6 Kg app.

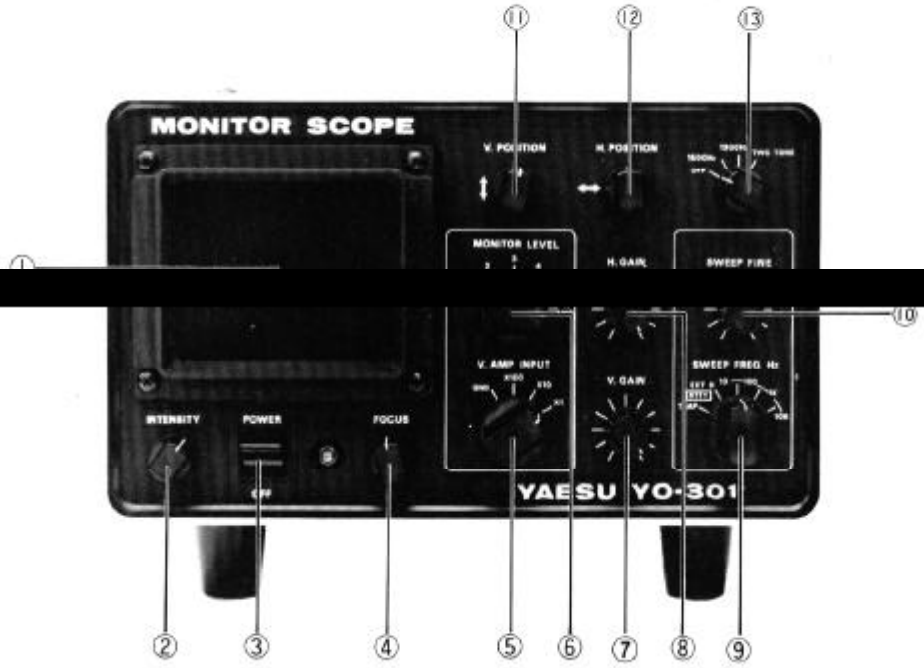
SEMICONDUCTORS

FET :	2SK30A. ..... 5 pcs
SILICON Transistor :	2SA733P ..... 2 pcs
	2SC372O ..... 8 pcs
	2SC373 ..... 1 pce
	2SC1514..... 4 pcs
DIODE :	1N60 ..... 3 pcs
	1S1588.....3 pcs
	1S1830 .....1 pce
	1DZ61 .....2 pcs
	SIR150.....4 pcs
ZENER DIODE:	RD6AM .....2 pcs
	RD8.2FA.....1 pce
	RD15FA .....1 pce

ACCESSORIES

Coax Cable (1)	- 5D2V both ends with coax plug ..... 2 pcs
Coax Cable (2)	- RG-58A/U with one end coax
Shielded Wire (2)	- RCA plug and 4P mike plug .....1 pce
RCA Plug	.....2 pcs
Fuse 0.5A	.....3 pcs

Prior to using the monitorscope, it is recommended that you study and thoroughly understand the function of each control and switch described below:



FRONT PANEL

(1) PICTURE TUBE - Displays pattern on this surface. A 6 mm division scale is provided.

(2) INTENSITY - This control varies the brightness of the pattern on the scope screen. Excessive brightness may burn the phosphor on the face of the CRT (Cathode Ray Tube).

(3) POWER - Apply AC power at ON position.

(4) FOCUS - This control is used to adjust the clear and sharp surface. There may be some interaction between this control and the INTENSITY control. Adjust this control for the clearest trace.

(5) V. AMP INPUT - This switch has two functions. It is an attenuator and also selects the input level to the vertical amplifier. At G position, the vertical input is grounded.

(6) MONITOR LEVEL - This is a six position switch. Positions 1 through 5 are used as an attenuator for the transmit signal monitor. This switch should be set to V. AMP position for receiver monitor or oscilloscope use.

(7) V. GAIN - This control is used to vary the gain of the vertical amplifier. When the monitorscope is used as a transmitter monitor, the pattern height cannot be varied by this control. The transmitted signal pattern can be varied by the monitor level control.

(8) H. GAIN - This control is used to vary the gain

[redacted]

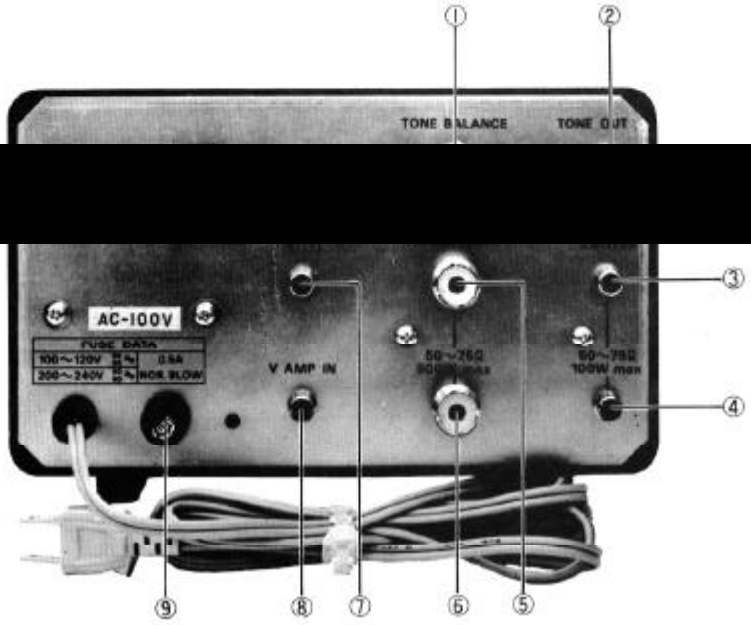
is also used for RTTY cross pattern observation. The TRAP position is used for trapezoid pattern monitoring.

(10) SWEEP FINE - This control is used for a fine tuning of the sweep frequency set by the SWEEP FREQ switch.

(11) V. POSITION - This control determines the vertical position of the displayed pattern.

(12) H. POSITION - This control determines the horizontal position of the displayed pattern.

(13) TONE SELECTOR - This switch is used for internal two tone signal generation and selects either 1500 Hz, 1900 Hz or both of them.



REAR PANEL

(1) TONE BALANCE - This control is used to balance the output level of the two tone signal.

(2) TONE OUT - This control is the output terminal of the internal two tone signal.

[redacted]

pattern monitoring.

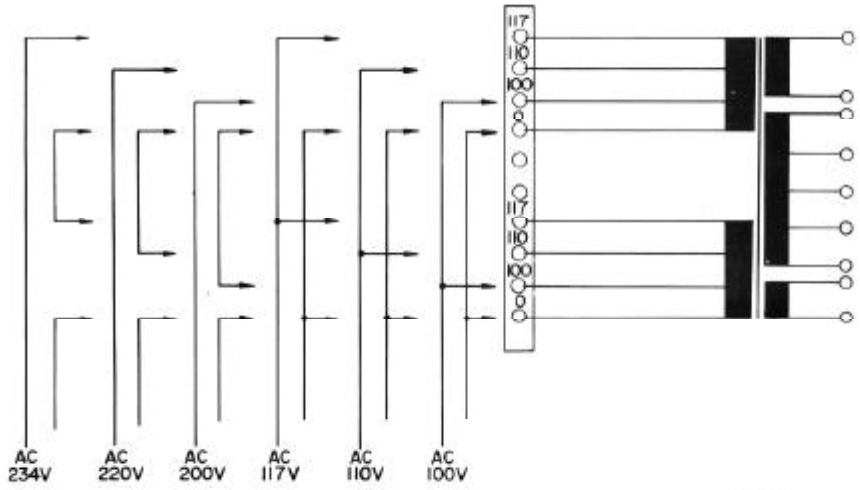
(5)(6) ANT. - Two coax connectors for transmitter signal monitoring.

(7) EXT. H IN - Input terminal for the horizontal amplifier.

[redacted]

(8) V AMP IN - Input terminal for the vertical amplifier.

(9) FUSE - Fuse holder.



YO-301

Figure 1

monitorscope is designed to be used in many areas of the world using the power line supply voltage that may differ from the operator's local supply voltage. Therefore, before connecting the AC cord to the power outlet, be sure that the voltage marked on the rear of the monitorscope agrees with the local AC supply voltage.

CAUTION

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE MONITORSCOPE.

INITIAL SETTING OF THE CONTROLS

The following set-up procedure is required prior to operating the monitorscope.

POWER	-	OFF
INTEN	-	12 o'clock position
FOCUS	-	12 " "
V. POSITION	-	12 " "
H. POSITION	-	12 " "
V. GAIN	-	12 " "
H. GAIN	-	12 " "
SWEEP FINE	-	12 " "
V. AMP. INPUT	-	X100
SWEEP FREQ	-	10 Hz - 100 Hz
MONITOR LEVEL	-	V. AMP.
TONE SELECTOR	-	OFF

proper brightness. Excessive brightness for prolonged period of time may burn the phosphor on the CRT screen.

Adjust the FOCUS control for a clear and sharp trace. There is an interaction between this control and the INTEN control. Therefore, adjust them for the best focus at the desired brightness.

Adjust the H. POSITION and V. POSITION to bring the spot to the center of the screen. Rotate the H. GAIN control and observe that the spot produces a horizontal line in the center of the screen.

TRANSMITTER MONITORING

The following instructions are for the transmitter which has a 50 - 75 ohm coaxial output.

(1) [redacted]

Connect the dummy load or antenna to the other coaxial connector marked ANTENNA. Refer to Figure 2.

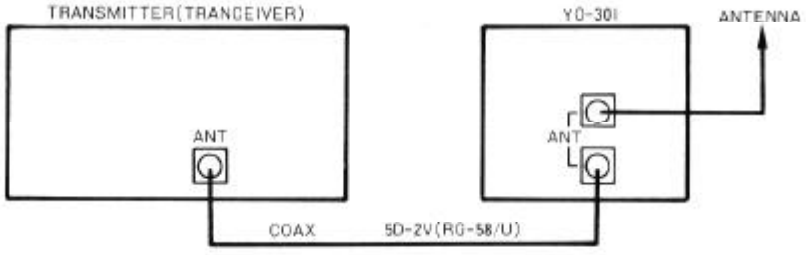


Figure 2

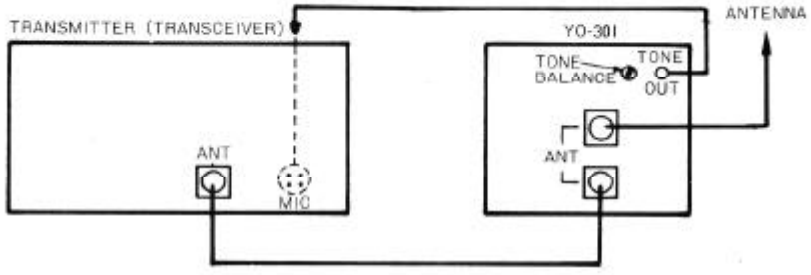


Figure 3

(2) Set the MONITOR LEVEL switch to proper setting as shown in Table 1.

OUTPUT	MONITOR LEVEL	HEIGHT
5W	5	5 DIV.
15W	4	6D IV.
100W	3	6 DIV.
100W	2	5 DIV.
500W	1	6 DIV.

Table 1 (Measured With 50ohm Dummy Road)

(3) Push the POWER switch of the monitorscope and adjust the controls as described in the initial adjustment procedure.

(4) Turn on the transmitter and adjust the H. GAIN, SWEEP FREQ and SWEEP FINE controls for the desired pattern display.

(5) Internal tone generator signal may be used for SSB or AM transmitter with the shielded cable. Use either 1500 kHz or 1900 kHz for signal tone test. In SSB transmission, set the TONE SELECTOR switch to TWO TONE position. Refer to Figure 3

(6) Refer to the patterns on Page10for the evaluation of the transmitted signal.

NOTE: For a two tone test, the amplitude of each tone signal should be set to the same value.

[redacted]

VERT GAIN until the display reaches two scales.

Then, set the TONE switch to 1900 Hz and adjust TONE BALANCE on rear panel until same height is obtained as the 1500 kHz signal.

The following are typical transmitted signal patterns displayed on the monitorscope screen when it is connected as in Figure 1.

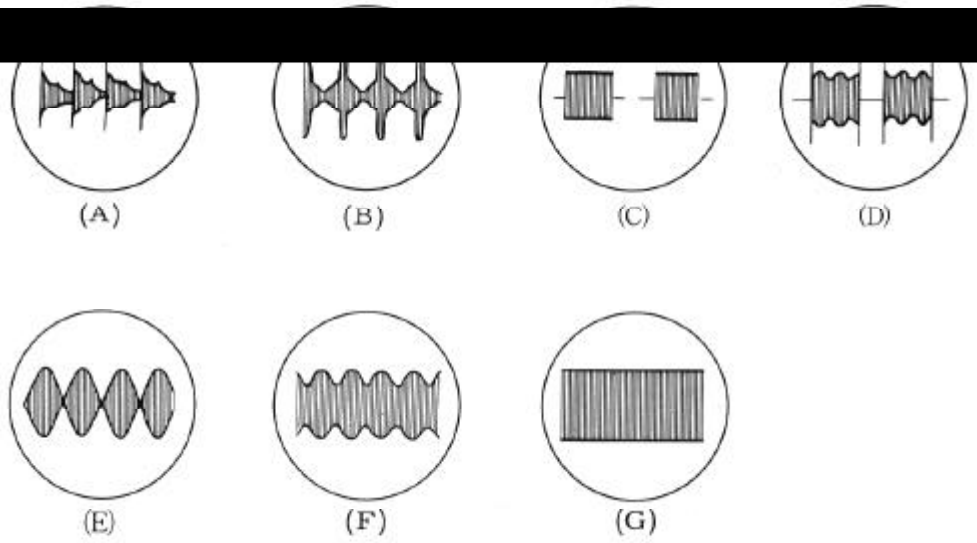


Figure 4

(A) SSB signal voice modulated. Correctly adjusted.

(B) SSB signal voice modulated. Excessive mic gain or insufficient

(C) Pure CW signal.

(D) CW signal with hum and key click.

(E) SSB signal two tone modulated. Correctly adjusted.

(F) SSB signal two tone modulated. Carrier leaking.

(G) SSB signal single tone modulated. Correctly adjusted.

RF TRAPEZOID TEST

Set up the monitorscope and the transmitting equipment as illustrated in Figure 5 for linearity test of the RF amplifier. The patterns from this test are called trapezoid patterns. Press down the TRAP switch on the front panel.

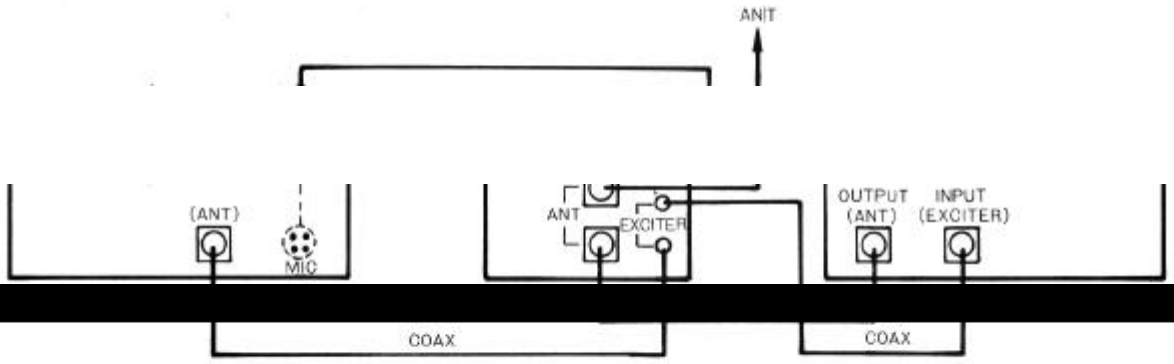


Figure 5

[redacted]

linear amplifier to one of the ANTENNA connectors on the monitorscope. Connect the dummy load or antenna to the other ANTENNA connector of the monitorscope.

(3) Connect a shielded cable from the TONE OUT of the [redacted]

(4) Turn ON the POWER switch of the monitorscope and adjust the controls as described in the initial adjustment procedure.

(5) Set the SWEEP FREQ switch to TRAP position and the tone signal switch to the TWO TONE position.

(6) Turn on the exciter and linear amplifier and adjust the switch and H. GAIN control of the monitorscope for the desired linearity of the linear amplifier under test.

NOTE: To avoid the burn-out of the screen phosphor when there is no output from the transmitter, the INTENSITY control should be set as low as possible.

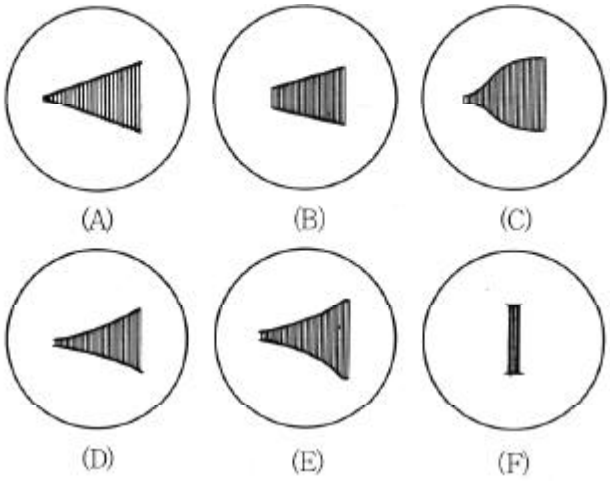


Figure 6

(A) Good linearity.

(B) Modulation less than 100% and good linearity.

(C) Non-linear pattern indicating overdrive, insufficient antenna loading, grid current curvature or regeneration.

(D) Non-linear pattern indicating regeneration or excessive grid bias.

(E) Non-Linear and parasitic oscillation on modulation peak.

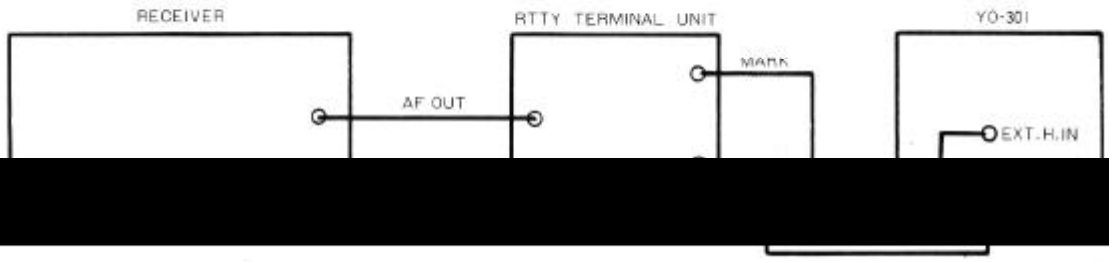


Figure 7

RTTY CROSS TEST

(1) Connect a shielded cable from the mark terminal of the RTTY terminal unit to the HORIZ input and the other cable from the space terminal to the V. AMP. INPUT of the monitorscope, as illustrated in Figure 7.

(2) Set the front panel controls as described in the initial adjustment procedures. Then set the V. AMP. INPUT to V. AMP. and the SWEEP FREQ to EXT. H (RTTY) position. Make sure that the [redacted] screen when no signal is applied to the monitorscope.

(3) The mark and space output of the terminal unit should be adjusted for an equal output when the receiver is properly tuned in. To check the equal output, insert the mark and space signal alternately into the vertical input of the scope and adjust the balance potentiometer of the terminal unit until equal height is obtained.

(4) After setting the balance potentiometer for equal output as described above, adjust the V. GAIN AND H. GAIN controls for a cross pattern of equal length of horizontal and vertical trace. Once the desired pattern has been set, the gain controls on the monitorscope should not be changed.

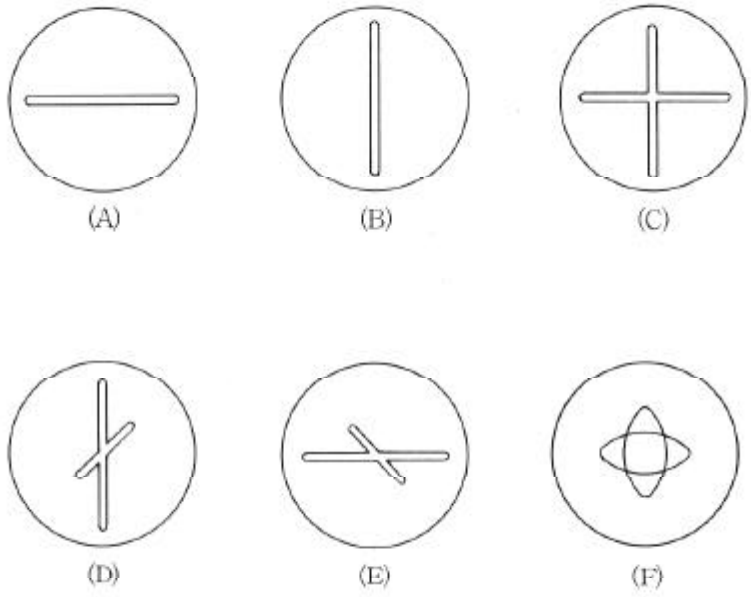


Figure 8

RECEIVER MONITORING

[redacted]

signal is applied to the V. AMP IN terminal and MONITOR LEVEL is set to V. AMP position.

FOR FT-301:

The IF output is provided with Pin 4 of the accessory socket. Pin 6 is connected to ground.

FOR FT-221:

As the IF output is not provided, the following modification is necessary.

(1) Remove SSB IF unit from its socket.

(2) Solder the 5 PF ceramic capacitor and a 47 cm length of the coax cable as illustrated in Fig. 9.

(3) Install coax cable as illustrated in Fig. 10 and 11.

(4) Disconnect wire from ALC connector and use the terminal for IF output.

[redacted]

100K ohm 1/4W resistor between ALC terminal and ground.

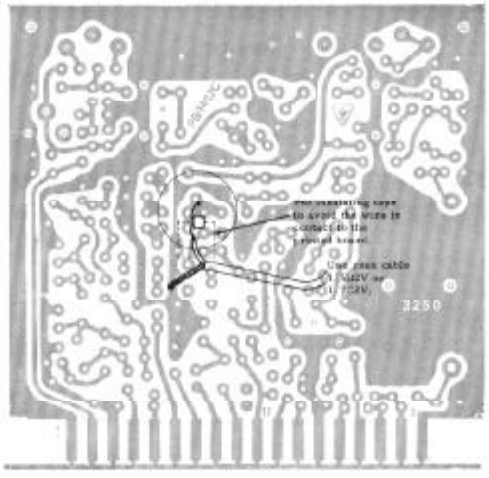
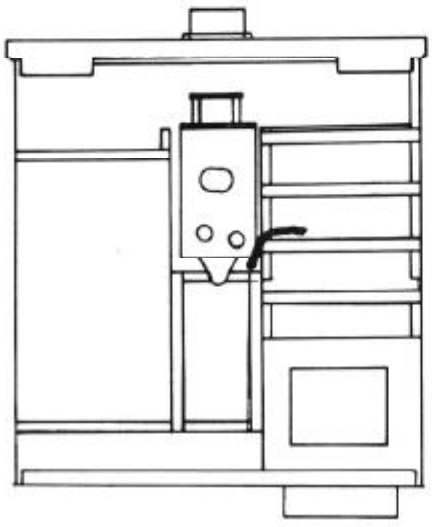
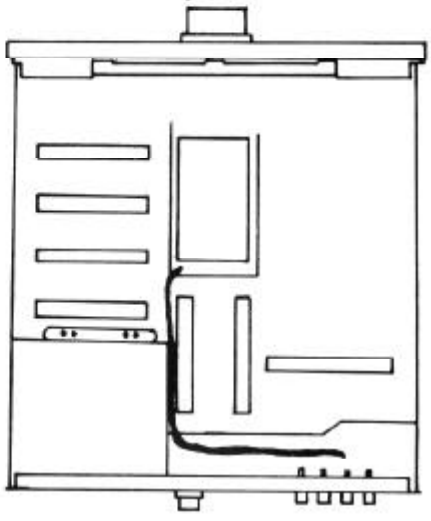


Figure 9



TOPVIEW Figure 10



BOTTOM VIEW Figure 11

An IF out connector is provided with this model, however, the IF output from this connector is not sufficient for YO-301, therefore, requiring the following modification.

(1) Remove PB-1183 from its socket.

(2) Solder the 5 PF capacitor and coax cable as illustrated in Fig 12.

(3) Reinsert the PB-1183 to its socket.

(4) Disconnect the coax cable from the IF out connector and solder the other end of the coax cable installed in Step (2). Solder the outer conductor of the coax cable to ground.

(5) Solder the 100K ohm 1/4W resistor between the inner and outer conductors of the cable at the connector.

(6) Peak T109 after above modification.

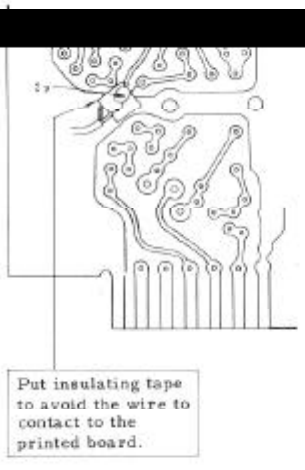


Figure 12

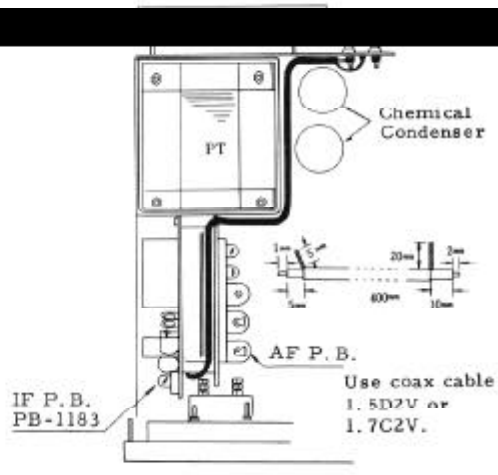


Figure 13

FOR FR-101:

(1) Locate the IF printed board, PB-1251, and solder the 5 PF capacitor and coax cable as illustrated in Fig 14

(2) Install the coax cable as illustrated and solder the other end of the coax cable to AUX connector on rear panel.

(3) Solder the 100K ohm 1/4W resistor between the inner and outer conductors of the coax cable at the AUX connector.

(4) Peak T119 after the above modification.

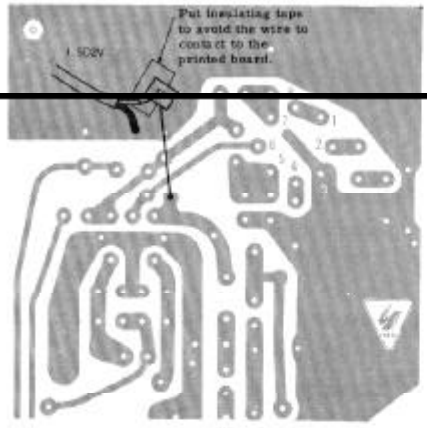


Figure 14

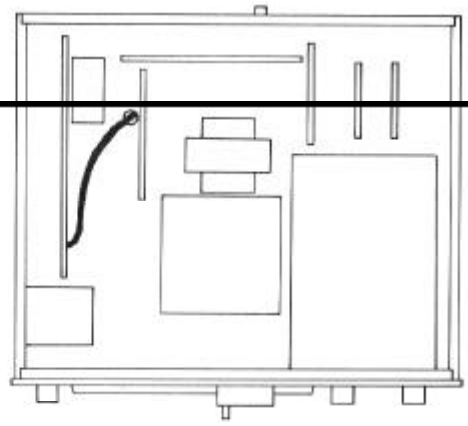


Figure 15

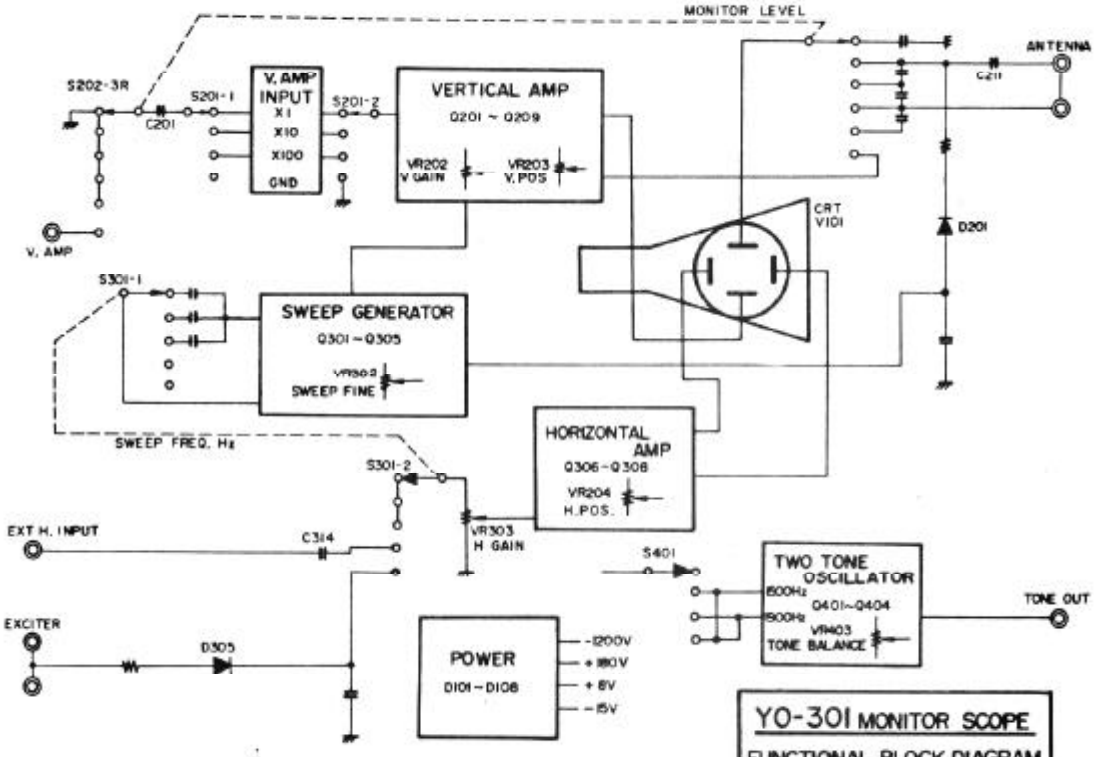


Figure 16

CIRCUIT DESCRIPTION

The block diagram may be helpful in order to understand the performance of the monitorscope.

VERTICAL AMPLIFIER CIRCUIT

The signal applied to V. AMP. IN J201 is coupled through an attenuator S201 and V. GAIN potentiometer to the high input impedance amplifier, Q202, SSK30AY from which the signal is delivered to the following stage at low impedance. Q201 and Q203, 2SC372 O, work as a protecting circuit for large input voltage by clipping the signal peaks.

The output from Q202 is then applied to a differential amplifier consisting of Q204 and Q205, 2SC1215 which converts the input signal to balance output to be delivered to the following push-pull buffer amplifiers, Q206 and Q207, 2SC372 O. The signal is further amplified by a vertical amplifier Q208 and Q209, 2SC1514 and then fed to vertical deflection electrodes, Y+ and Y-.

HORIZONTAL AMPLIFIER CIRCUIT

The horizontal signal selected by the SWEEP FREQ switch S301 is applied through H. GAIN potentiometer, VR303 to amplifier Q306, 2SK30AY which converts the high input impedance to low output impedance. The output is amplified by a horizontal amplifier Q307 and Q308, 2SC1514 and then fed to the horizontal deflection electrodes X+ and X-.

SWEEP CIRCUIT

[redacted]

through SWEEP FREQ switch S301 to the horizontal amplifier.

The sweep frequency covers 100 Hz to 10 kHz continuously by

[redacted]

the sweep frequency.

TWO TONE GENERATOR CIRCUIT

[redacted]

The signal is fed to a buffer amplifier Q405, 2SC373 and the signal level is set by TWO TONE LEVEL control VR404.

TRANSMITTER MONITOR CIRCUIT

A portion of the transmitter power is sampled through C211 from the feed line when the transmitter's antenna feed line is connected to the ANTENNA connectors of the monitorscope. The sampled RF voltage is applied through a MONITOR LEVEL switch S202 to the vertical deflection plate in order to obtain proper height on the display screen. Since the input circuit is untuned, the monitorscope can be used up to 100 MHz, however, some distortion of the pattern may be observed when used on 144 MHz band.

The RF voltage is detected by an envelope detector, D201, 1N60 and used to synchronize the sweep generator for a stable display of the signal.

When the exciter output is fed through the EXCITER terminals to a linear amplifier and the output of the linear amplifier is fed through the ANTENNA connectors to the antenna, a portion of the exciter signal is detected by the envelope detector D305, 1N60 and fed through

linear amplifier.

POWER SUPPLY

The power transformer has two primary windings for the selection of various AC supply voltage. Unless otherwise specified, the power transformer is wired for 100 Volts AC operation. The secondary of the transformer has three windings to deliver four different DC voltages and AC heater voltage for the cathode ray tube.

wave rectifier circuit consisting of D105 and D108, 1S1830 for the vertical and horizontal amplifier.

The D106 and D107, 1DZ61 provide 30 Volts DC for the transistors.

The 30 Volts DC is regulated by a zener diode, D109, RD15FA and D110, RD82FA providing +8 Volts and -15 Volts.

usage, should only require the usual attention given to any electronic equipment. Service, or replacement of major components, may require substantial realignment, however, under no circumstances

monitorscope is fully understood and the malfunction has been fully analyzed and traced to misalignment. Service work should only be performed by experienced personnel using proper equipment.

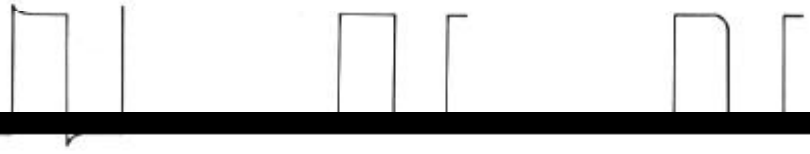
WARNING

DANGEROUS HIGH VOLTAGES OF MORE THAN 1200 VOLTS ARE PRESENT, THEREFORE, EXTREME CAUTION SHOULD BE TAKEN WHENEVER MAKING ANY ADJUSTMENT INSIDE THE CABINET. BEFORE REMOVING THE CABINET, UNPLUG THE POWER PLUG

AN INSULATED SCREWDRIVER.

1. Frequency Response Compensation of Vertical Attenuator (TC201, TC202).

   Apply a pure square wave (50 Hz - 5 kHz), to the vertical input and observe the display on CRT. Adjust TC201 for X10 position and TC202 for X100 position until the same wave form as in the X1 position is obtained.



Over Compensation CORRECT Less Compensation

Figure 17

2. Vertical Amplifier Balance (VR201).

   Wait for 30 minutes after the switch is turned on. Check the position of display when the vertical gain control is widely rotated. If the display moves up or down, then adjustment of the balance is required.

Set V. AMP INPUT switch to GND and V. GAIN control to a fully CCW position. Adjust V. POSITION control to set the display (horizontal line) in the center of the CRT screen.

[redacted]

at the center of the screen regardless of the V. GAIN control position.

[redacted]

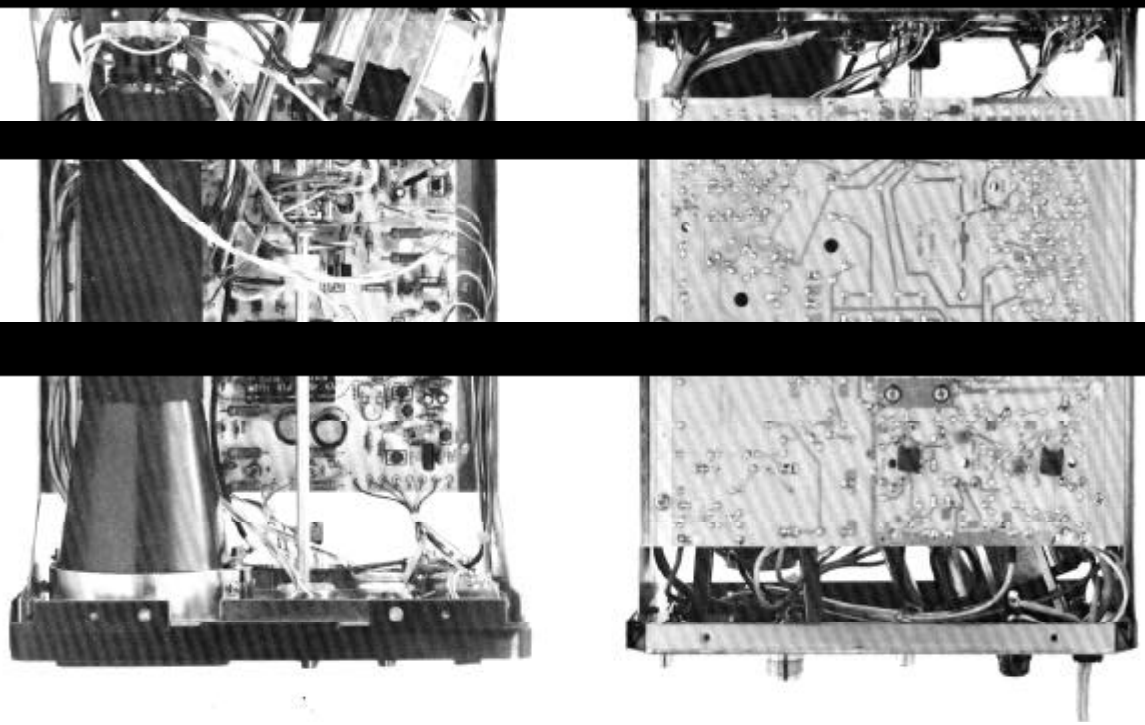
Adjust VR401 and VR402 until a pure, stable sine wave of 1500 Hz and 1900 Hz is available.

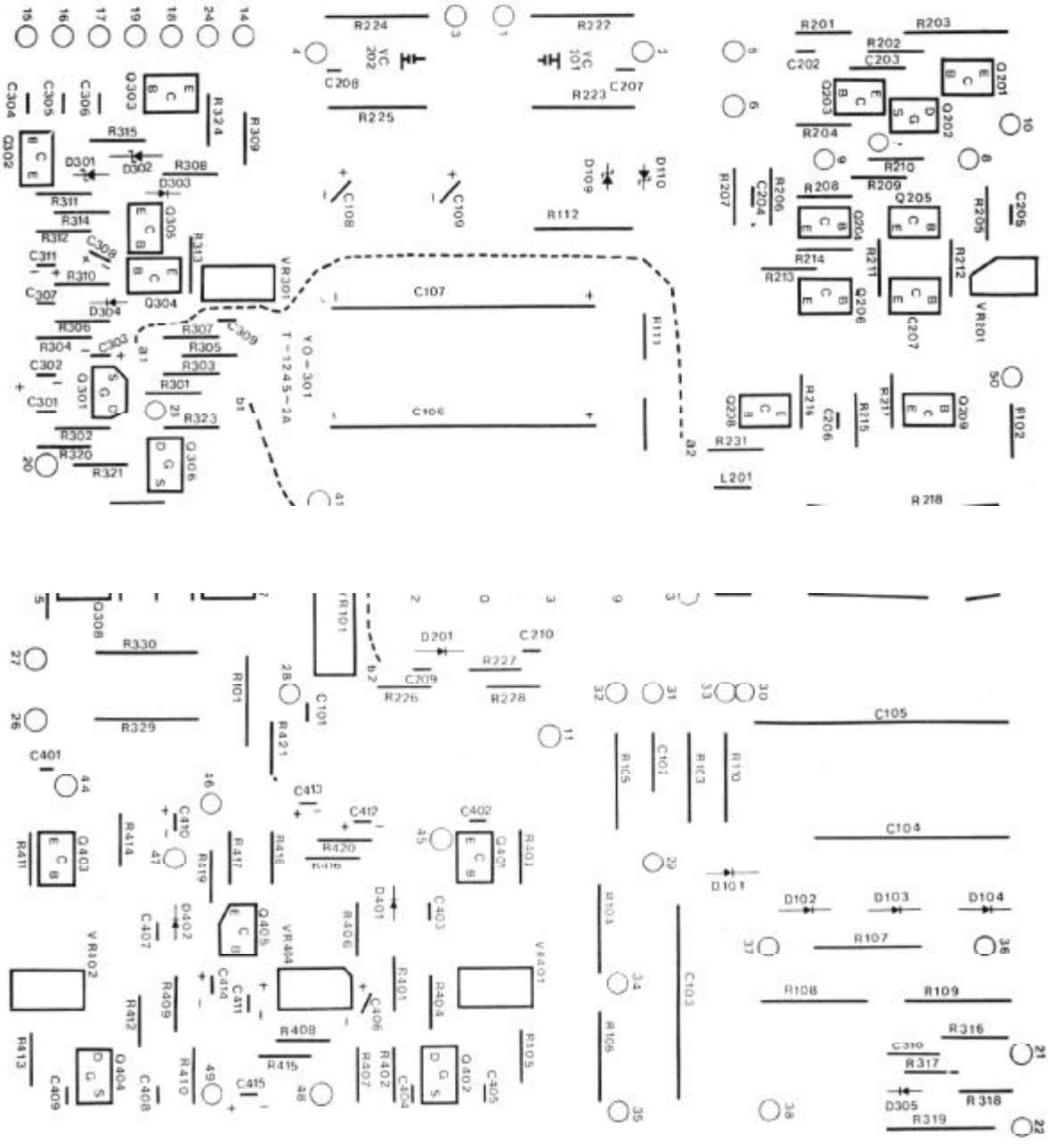
The 1900 Hz output voltage is adjusted by VR404 and balanced with the 1500 Hz output voltage by a TONE BALANCE control VR403 on rear panel.

4. Astigmatism (VR101).

This adjustment is only necessary when the CRT is replaced. Set the FOCUS control to 12 o'clock position. Adjust VR101 for sharp focusing.

[redacted]




R224
R222
R225
R223
C208
C207
C108
C109
D109
D110
R112
C107
C106
R111
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R202
R203
C202
C203
Q201
Q202
Q203
R204
R210
R209
R208
Q205
R207
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R206
C205
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R214
R213
R211
R212
Q204
Q206
Q207
VR201
R231
L201
R218
R102
R215
R217
R216
C206
Q208
Q209
R315
R324
R309
Q303
Q302
D301
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C401
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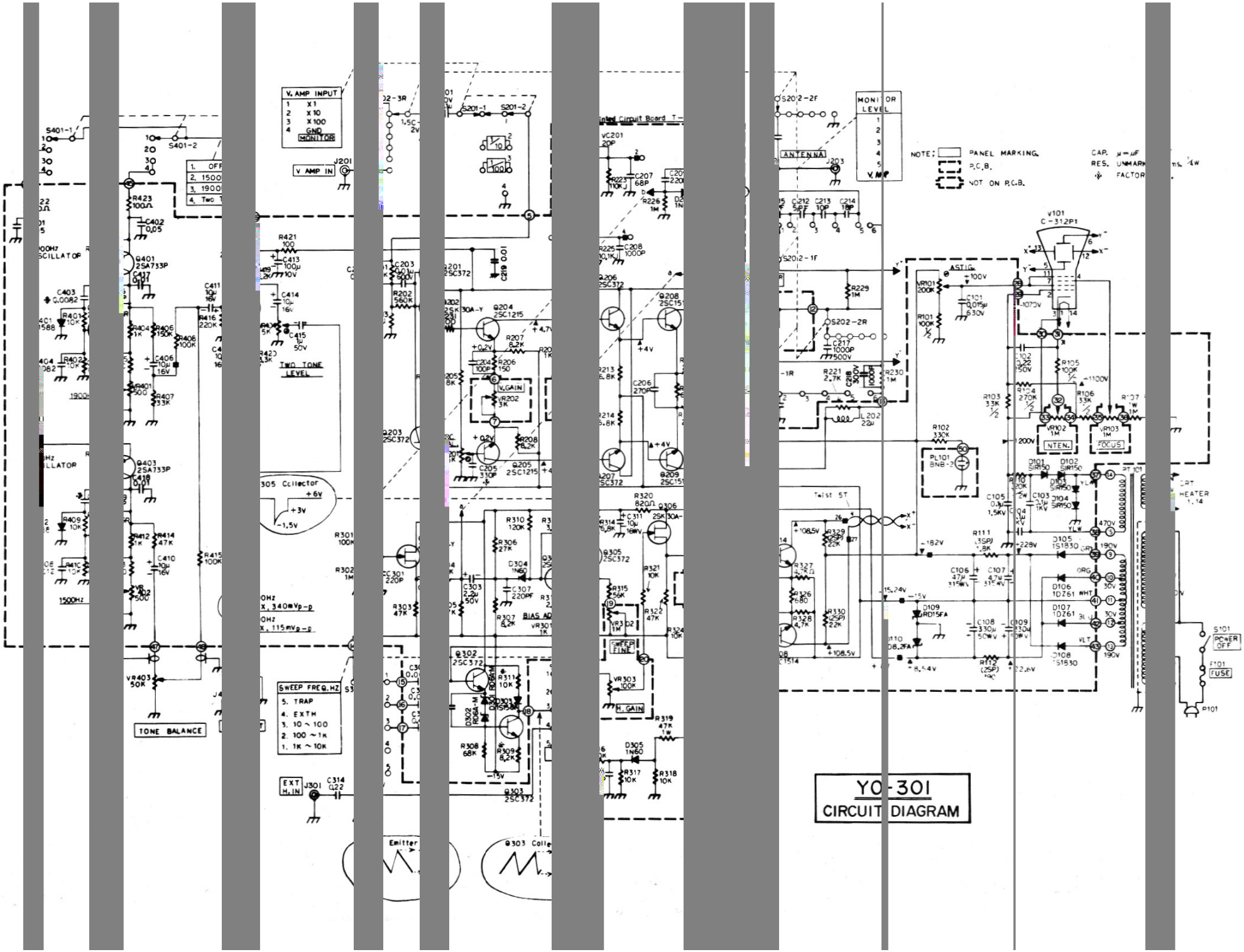
C210
R227
C209
R226
R228
C105
C104
D101
D102
D103
D104
R107
R108
R109
R316
C319
R317
D305
R318
R319
C103
R104
R105
R106
R103
R110
C102
C413
C412
C402
R420
R419
R401
Q401
R411
Q403
R414
R417
R418
C410
R419
D401
C403
C407
D402
Q405
R406
VR404
VR401
VR402
R409
C411
C410
R404
R401
R412
R408
R415
R407
C406
C404
C405
R405
R413
C409
Q404
Q402
R410
C415
C408
Q308

Figure 18


V. AMP INPUT
1 X1
2 X10
3 X100
4 GND
MONITOR
V AMP IN
J201
S401-1
S401-2
S201-1
S201-2
MONITOR LEVEL
ANTENNA
J203
NOTE;
PANEL MARKING.
P.C.B.
NOT ON P.C.B.
CAP. μ=μF
RES. UNMARK
FACTOR
TWO TONE LEVEL
V.GAIN
H.GAIN
SWEEP FINE
BIAS ADJ
SWEEP FREQ.HZ
5. TRAP
4. EXTH
3. 10 ~ 100
2. 100 ~1k
1. 1k ~ 10K
TONE BALANCE
EXT H.IN
J301
ASTIG.
NTEN.
FOCUS
Twist 5T
CRT HEATER
S101
POWER OFF
F101
FUSE
P101
Emitter
Collector
+6v
+3v
-1,5v
+0.2v
+4v
-15v
+108.5v
-182v
-228v
-15.24v
+8.54v
+22.6v
470v
190v
30v
Y0-301
CIRCUIT DIAGRAM

PARTS LIST

PB PRINTED CIRCUIT BOARD		
T-1245		
V CATHODE RAY TUBE		
101	C312P1	
Q FET & TRANSISTOR		
402,404	FET	2SK19GR
202,301,306	FET	2SK19Y
401,403	Tr	2SA733P
302～305		
405	Tr	2SC373
204,205	Tr	2SC1215
208,209,307,308	Tr	2SC1514
D DIODE		
201,304,305	Ge	1N60
106,107	Si	1DZ61
303,401,402	Si	1S1588
105,108	Si	1S1830
101～104	Si	SIR150
301,302	Zener	RD6A-M
110	Zener	RD8.2FA
109	Zener	RD15FA

211,212	¼W	220Ω
405,413	¼W	270Ω
418	¼W	560Ω
215,326	¼W	680Ω
320	¼W	820Ω
201,209,210 403,404,411,412	¼W	1KΩ
216,217,323,419	¼W	2.2KΩ
313	¼W	2.7KΩ
220,221,420	¼W	3.3KΩ
312	¼W	3.9KΩ
327,328	¼W	4.7KΩ
311,317,318,321,324 401,402,409,410	¼W	10KΩ
315	¼W	56KΩ
231,308	¼W	68KΩ
228,301,316,408,415	¼W	100KΩ
310	¼W	120KΩ
406	¼W	150KΩ
416,417	¼W	220KΩ
102	¼W	330KΩ
202	¼W	560KΩ
226,227,302	¼W	1MΩ
103,106	½W PSJ	33KΩ
101,105	½W PSJ	100KΩ
110	½W PSJ	220KΩ
223	½W PYJ	110KΩ

222	½W PYJ	900KΩ
224	½W PYJ	990KΩ
203	½W PYJ	1MΩ
317	1 W PSJ	47KΩ
107	1 W PSJ	1MΩ
109	1 W PSJ	1.2MΩ
METALIC FILM		
329,330	2 W	22KΩ
111	3 W	1.8KΩ
218,219	4 W	8.2KΩ
VR POTENTIOMETER		
401,402	V10K8-2-2	500Ω
301	V10K8-2-2	1KΩ
201 404	V10K8-2-2	5KΩ
403	V16L4N10SB	50KΩ
101	V18K3-2B	200KΩ
203	V24L5N20KC-B	2KΩ
202	V24L5N20KC-C	3KΩ
304	V24L5N20KC-B	10KΩ
303	V24L5N20KC-B	100KΩ
302	V24L5N20KC-B	1MΩ

206	50WV	270PF
205	50WV	330PF
215	500WV	2PF
212	500WV	5PF
213	500WV	10PF
214	500WV	18PF
309	500WV	22PF
211	500WV	39PF
207,210	500WV	68PF
204,416,419	500WV	100PF
CERAMIC DISC		
216,217,218	500WV	0.001μF
※403,404	50WV	0.0082μF
202	50WV	0.01μF
407,408	50WV	0.012μF
305	50WV	0.047μF
STYROL		
310	50WV	470PF
312	50WV	680PF
※313	50WV	820PF
METALIZED FILM		
306	100WV	0.47μF
102,314	250WV	0.22μF
ELECTROLYTIC		

413	10WV	100μF	
311, 406, 410～412, 414	16WV	10μF	
415	50WV	1μF	
302, 303, 308	50WV	2.2μF	
108, 109	50WV	330μF	
106, 107	315WV	47μF	
	OIL PAPER		
103, 104	1KV DC	0.1μF	
105	1.5KV DC	0.1μF	
VC TRIMMER CAPACITOR			
201, 202	ECV-1ZW	20×32	20PF
L INDUCTOR			
201, 202	RFC		22μH
PT POWER TRANSFORMER			
101	L-247A		
S SWITCH			
101	Power	8H1011	
202	Monitor Level	S22-3-6-6	
201	V.Amp Input	SRM34SK0020	
401	Two Tone	SRM34SK0020	
J RECEPTACLE			
202, 203		V-6A	
201, 301～303, 401		CN-7017	
VS CRT SOCKET			
101		#1231-1	
PL PILOT LAMP			
101		BNB-2	
F FUSE			
101	0.5A(100～120V)	0.3A(200V～240V)	
101	FH-003		

YAESU