

**INSTRUCTION  
MANUAL  
YO-901**

**YAESU MUSEN CO , LTD.**

TOKYO JAPAN.

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# YO-901 MULTISCOPE



The YO-901 is a high-performance monitoring instrument, designed for use with the FT-901DM series of amateur equipment. Built around a high-performance oscilloscope, useful for countless station measurements, the YO-901 includes a two-tone generator, provision for both RX and TX monitoring, and automatic remote switching of monitoring modes.

An exciting option for the YO-901 is a band scope, which allows instant determination of band conditions and activity.

Interface to the FT-901DM is quick and easy, with no modification required for both narrow and wide band IF monitoring. Connection cables for typical installations are included with your YO-901.

The owner is urged to read this manual in its entirety, so as to become better acquainted with the exciting new YO-901 Multiscope.

# SPECIFICATIONS

## RF Monitor

Frequency range: 1.8–54 MHz  
 Input impedance: 50–75 ohms  
 Power ranges: 10–500 watts (ANTENNA jack)  
                   5–100 watts (EXCITER jack)  
 Input attenuator: 5 positions  
 Insertion loss: 0.5 dB max.

## IF Monitor

Operating frequency: 8987.5 kHz  
 Sensitivity: 2 mV (p-p)/div

## Vertical input

Sensitivity: 20 mV (p-p)/div  
 Input attenuator: X1, X10, X100  
 Frequency range: 2 Hz–4 MHz (–3 dB)  
                       8.5–10.7 MHz  
 Input impedance: 1 M ohm, 80 pf.  
 Maximum voltage: 600 volts (DC + AC peak)

## Horizontal input

Sensitivity: 300 mV (p-p)/div  
 Frequency range: 10 Hz–250 kHz (–3 dB)  
 Input impedance: 100 K ohms, 100 pf.  
 Sweep frequencies: 10 Hz–100 kHz, 4 ranges

## Two-tone generator

Frequency: 1500/1900 Hz  
 Output level: 20 mV (p-p)

## Band Scope (Option)

Operating frequency: 8987.5 kHz  
 Sensitivity: Log 50 $\mu$ V/4 DIV  
                   Lin 500 $\mu$ V/4 DIV  
 Scanning frequency: 10 Hz  
 Input impedance: 50/5 K ohms  
 Power requirements: 100/110/117/200/220/234  
                           volts AC, 50/60 Hz  
 Current consumption: 25 VA  
 Size: 157 (W) x 210 (H) x 323 (D) mm  
 Weight: 6.5 kg

## SEMICONDUCTORS

### Integrated Circuits:

MC7915CP	1	$\mu$ PC14308H	1
$\mu$ PC14312H	1		

### Field-Effect Transistors:

2SK30AGR	2	2SK30AY	3
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### Silicon Transistors:

2SA733P	2	2SC1215	4
2SC752(O)	2	2SC1514	2
2SC1012A	2	2SC1815(O)	8

### Germanium Diodes:

1N60	3		
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### Silicon Diodes:

1DZ61	8	1S1588	18
S1R150	4	1S1830	2

### Zener Diodes:

RD5.6EB	1	RD6.2EB	1
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### BAND SCOPE (Option)

#### Field-Effect Transistors:

2SK30AGR	2	3SK40	1
2SK33F	1		

#### Silicon Transistors:

2SA1015	2	2SC1215	3
2SA1015GR	2	2SC1815O	6
2SA1015O	1		

#### Germanium Diodes:

1N60	2		
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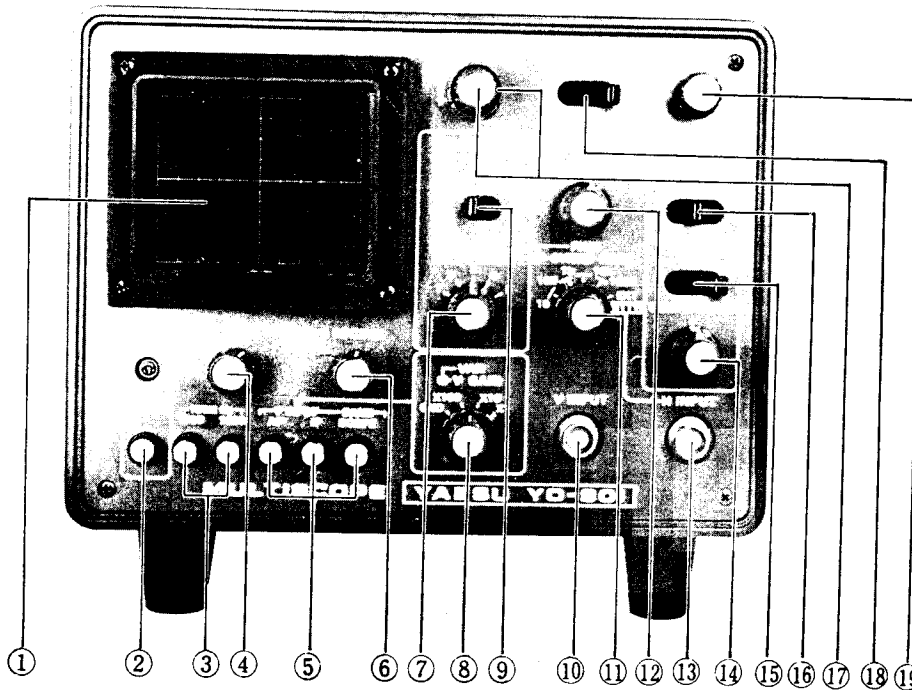
#### Silicon Diodes:

1S1588	21		
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#### Varactor Diodes:

FC-52M	1		
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## FRONT PANEL CONTROLS



### (1) SCOPE

High-resolution cathode-ray tube.

### (2) POWER ( ON OFF)

Push this button to apply AC power.

### (3) TONE ( ON OFF)

For the 1500 and 1900 Hz tone generators, an on/off switch is provided. Pushing both buttons applies both tones.

### (4) INTENSITY

This control varies the brightness of the pattern on the scope screen. Excessive brightness may burn the phosphor on the face of the picture tube, so use the minimum brightness necessary for easy viewing.

### (5) V INPUT, BAND SCOPE

These buttons select between AF, IF/narrow, and IF/wide input to the vertical amplifier.

### (6) FOCUS

This control sets the clarity of the display trace. There may be some interaction between this control and the INTENSITY control.

### (7) INPUT LEVEL

This control sets the level for the transmitter output signal monitor.

### (8) V GAIN, VAR

The V GAIN sets the level for the vertical display. The VAR control allows precise setting of the gain level of the vertical amplifier.

### (9) ENVEL/TRAP

This switch selects between monitoring of the transmitter output envelope and trapezoidal display (for two-tone testing).

### (10) V INPUT

This is the input terminal for the vertical amplifier, for using the YO-901 as an oscilloscope (AF mode).

### (11) SWEEP FREQ/FINE

These controls set the sweep frequency. At the EXT H position of the SWEEP FREQ control, horizontal input is selected, and this position can also be used for RTTY cross pattern observation. The FINE control allows fine tuning of the sweep frequency.

**(12) H GAIN**

This control sets the gain of the horizontal amplifier.

**(13) H INPUT**

This is the input terminal for the horizontal amplifier. This can be used for RTTY cross pattern monitoring, as well as general XY scope tests.

**(14) CENTER FREQ**

When the Band Scope option is installed, this control sets the center frequency of the monitor.

**(15) WIDTH (kHz/DIV)**

This control sets the bandwidth of the optional bandscope.

**(16) LIN/MARK ON/LOG**

This is the function switch for the optional band scope. The switch selects between linear or log display, or the internal marker generator. In the LOG position, the display is set to 3 dB/division. The marker can be used to set the center of the optional band scope.

The following accessories are included with your YO-901:

- (1) CONNECTION CABLES (see below)
  - (2) BNC PLUG (UG-88/U) 2
  - (3) SPARE FUSES 1
- (Note: when replacing fuses, use only a 1 ampere fuse.)

**(17) V POS. B SCOPE**

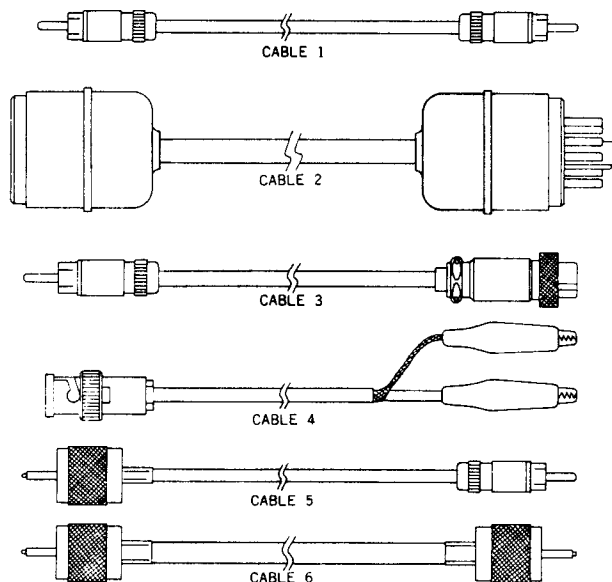
These controls determine the vertical position of the displayed pattern. The B Scope control is used only during Bandscope operation

**(18) MODE**

This switch sets the operating mode of the YO-901. In the AUTO mode, automatic switching is provided between transmit and receive monitoring. When only the transmit monitor or optional band scope is being used, the switch should be set appropriately.

**(19) H POS.**

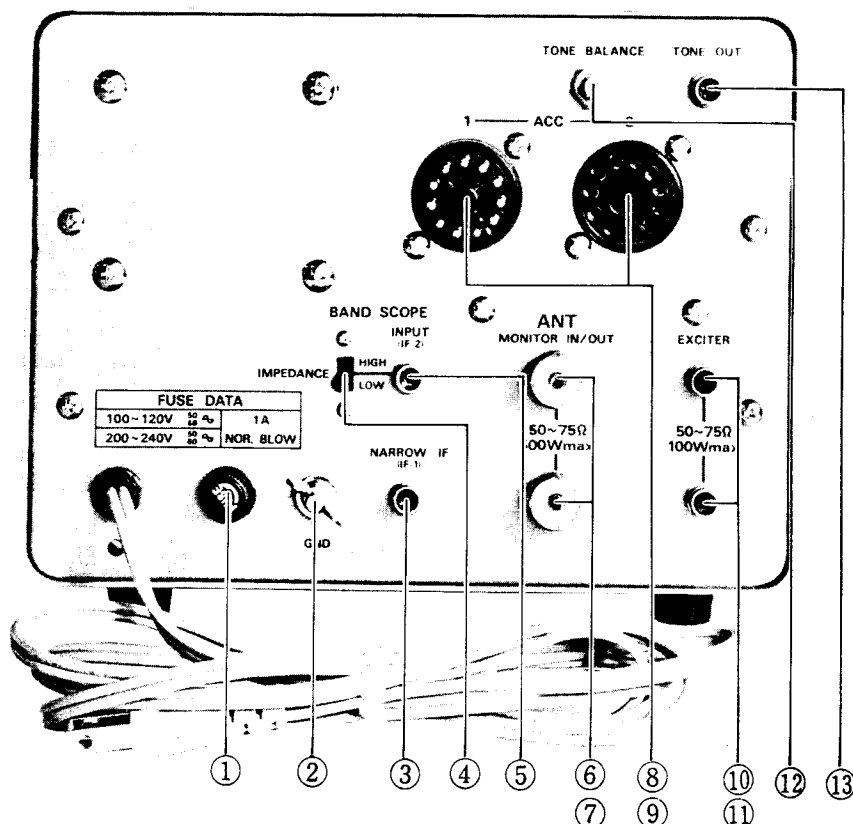
This switch sets the horizontal position of the displayed pattern.



PIN 1.....HEATER	PIN 8.....GND
PIN 2.....HEATER	PIN 9.....TX, GND
PIN 7.....ALC	PIN10.....RX, GND

CABLE 2 CONNECTIONS

## REAR APRON



### (1) FUSE

For all AC voltages, a 1 ampere fuse must be installed here. When replacing fuses, be absolutely certain to use a fuse of the proper rating. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.**

### (2) GND

For proper operation, connect this terminal to a good earth ground. This practice also will help guard against dangerous electrical shock.

### (3) NARROW IF

This jack should be connected to the IF-1 terminal on the rear apron of the FT-901DM, for IF monitoring.

### (4) HI/LOW

For using the optional band scope, this switch selects the input impedance. For use with the FT-901DM use the LOW position.

### (5) BAND SCOPE INPUT

When the optional band scope is installed, this jack should be connected to the IF-2 jack on the rear apron of the FT-901DM.

### (6)(7) ANT

These connectors are in parallel, for sampling of the transmitter output signal. Do not exceed 500 watts PEP at these terminals. **OUT WARRANTY DOES NOT COVER DAMAGE CAUSED BY USE OF A HIGHER-POWER TRANSMITTER WITH THIS EQUIPMENT.**

### (8)(9) ACC

The interconnection cable to the FT-901DM should be connected to the ACC-1 jack. The ACC plug, normally inserted in the rear of the FT-901DM, should be inserted in the ACC-2 socket, to make the proper connections for heater voltage, etc.

### (10)(11) EXCITER

For trapezoidal pattern monitoring, connect the exciter to these terminals. Do not exceed 100 watts at these terminals.

### (12) TONE BALANCE

This control sets the level of the 1500 Hz tone. The 1900 Hz tone is fixed in amplitude.

### (13) TONE OUT

This jack is the output connection for the two-tone generator.

## INSTALLATION NOTES

Details for interconnection will be presented along with the discussion of each test procedure.

### Power connections

The YO-901 Multiscope is designed for use throughout the world, from a variety of supply voltages. Therefore, before connecting the AC power cord to the supply, be absolutely certain that the voltage specification on the back of the Multiscope matches your local supply voltage. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF IMPROPER SUPPLY VOLTAGE.**

As well, the power cable should never be connected to a DC power source. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF DC POWER TO THE POWER JACK.**

Be certain to observe the maximum voltage allowances for the V. INPUT and H. INPUT jacks:

V. INPUT . . . . . 600 volts (DC + AC peak)

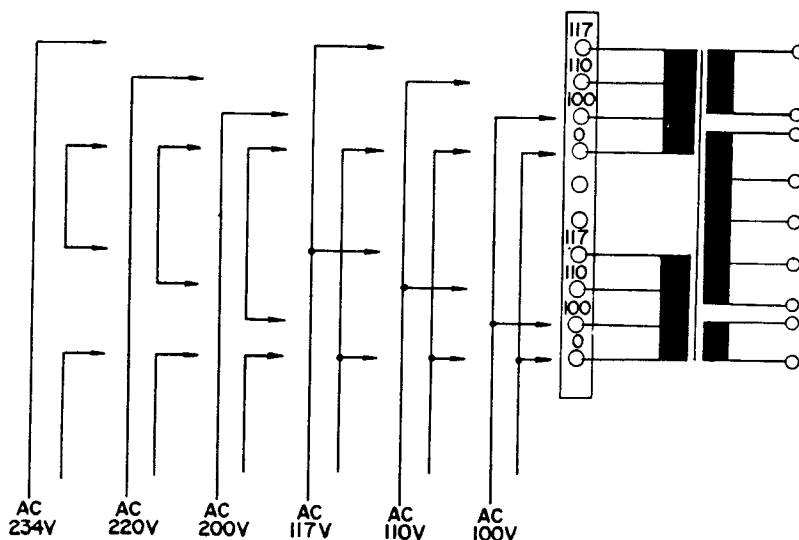
H. INPUT . . . . . 30 volts (DC + AC peak)

Do not exceed 100 watts of RF power at the EXCITER jack, nor 500 watts of RF power at the ANT jack. These limitations apply up to an SWR of 3:1 with respect to the 50–75 ohm range. If the SWR is above this level, these ratings are decreased significantly, because of the high voltages present on the transmission line. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY EXCEEDING THESE POWER LIMITATIONS.**

In order to ensure long life for your cathode-ray tube, a few simple precautions need to be observed. It is possible to burn the phosphor on the screen if an excessively bright display is used for a long time. Do not leave the display locked on a particular display mode (e.g. focus point, standby line, etc.) at maximum brightness.

When making the voltage connections to the FT-901DM ACC jack, the ACC plug supplied with the transceiver should be installed in the ACC-2 position on the rear panel of the Monitorscope, so as to make the proper heater connections for the FT-901DM.

When setting up your station, the following precaution needs to be observed: the YO-901 should not be located immediately adjacent to a strong magnetic field, such as that which might be induced by the power transformer in a linear amplifier. Refer to Figure 1 for a demonstration of correct and incorrect configurations of station equipment.





## OPERATION

Prior to commencing operation, reaffirm that the voltage specification of the YO-901 is correct, and a proper fuse is installed.

Preset the controls and switches as follows:

POWER . . . . . OFF  
INTENSITY . . . . . To the center of its range.  
FOCUS . . . . . To the center of its range.  
V. POS . . . . . To the center of its range.  
H. POS . . . . . To the center of its range.  
VAR . . . . . To the center of its range.  
H. GAIN . . . . . To the center of its range.  
CENTER FREQ. . . . . To the center of its range.  
FINE . . . . . To the center of its range.  
INPUT LEVEL . . . . . 3  
V. GAIN . . . . . X 100  
MODE . . . . . AUTO  
SWEEP FREQ. . . . . 10 Hz – 100 Hz  
TONE . . . . . BOTH OFF  
V. INPUT . . . . . AF or IF

Adjust the FOCUS control for a clear and sharp trace. There may be some interaction between this control and the INTENSITY control, so they both may require some adjustment.

Adjust the H. POS and V. POS controls to bring the trace into the center of the screen. Adjustment of the H. GAIN control will produce a horizontal line on the screen.

### Operating reminder:

When making tests with the YO-901, we recommend the use of a dummy load, instead of an antenna, out of courtesy to other operators. Of course, the YO-901 may be used at all times during normal operation, but extensive tests may cause interference to other amateurs. Spectrum conservation is everyone's responsibility.

Switch the POWER switch ON. The pilot light will turn on, and after a warm-up period of approximately 10 seconds, a bright trace will appear on the screen. Adjust the INTENSITY control for a comfortable, yet not excessively bright, display.

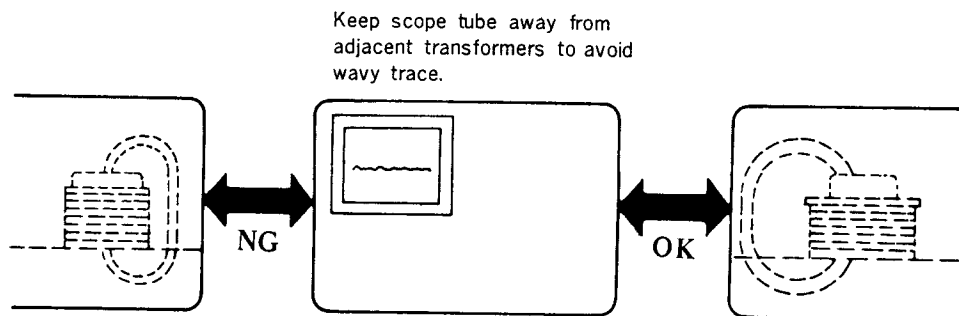


Figure 1.

## TRANSMITTER/RECEIVER MONITORING

Make connections between the YO-901 and the FT-901DM as shown in Figure 2 .

### I. TRANSMITTER MONITORING

- (1) Place the MODE switch in the TX MONITOR position.
- (2) Place the ENVEL/TRAP switch in the ENVEL position.
- (3) Place the INPUT level control to the position indicated in Table 1 , according to the power level being used.
- (4) For the following SSB signal evaluation tests, the SWEEP FREQ and FINE controls will provide the desired display synchronization.
- (5) For two-tone signal testing, push the 1900 and 1500 buttons. While transmitting, the correct levels for the MIC GAIN, RF PROCESSOR, and other controls can be made by referring to Figure 3 .
- (6) To set the level correctly between the two internally-generated tones, first press the 1900 Hz tone button. While transmitting, adjust the V. GAIN control until the display reaches the second division on the scale. Now turn the 1900 Hz button off, and turn on the 1500 Hz button. Rotate the TONE BALANCE control, located on the rear apron of the transceiver, until the display amplitude is the same as that observed for the 1900 Hz tone previously.

The following are typical signal waveforms observed from the transmitter when it is connected as shown in Figure 2 .

- (A) SSB signal, voice modulated, with proper adjustment. The display will become somewhat more "full" when the RF processor in the FT-901DM is activated.
- (B) SSB signal, voice modulated, with excessive mic gain or insufficient loading. Flat-topping on the waveform can be observed.
- (C) Pure, clean CW signal.
- (D) CW signal, with hum and key clicks.
- (E) SSB signal, two-tone test conditions, correctly adjusted.
- (F) SSB signal, two-tone test conditions, with carrier leakage.
- (G) SSB signal, single-tone test conditions, correctly adjusted.

OUTPUT	INPUT LEVEL	HEIGHT
5W	5	5 DIV.
15W	4	6 DIV.
100W	3	6 DIV.
100W	2	5 DIV.
500W	1	6 DIV.

Table 1 (Measured With 50 ohm Dummy Load)

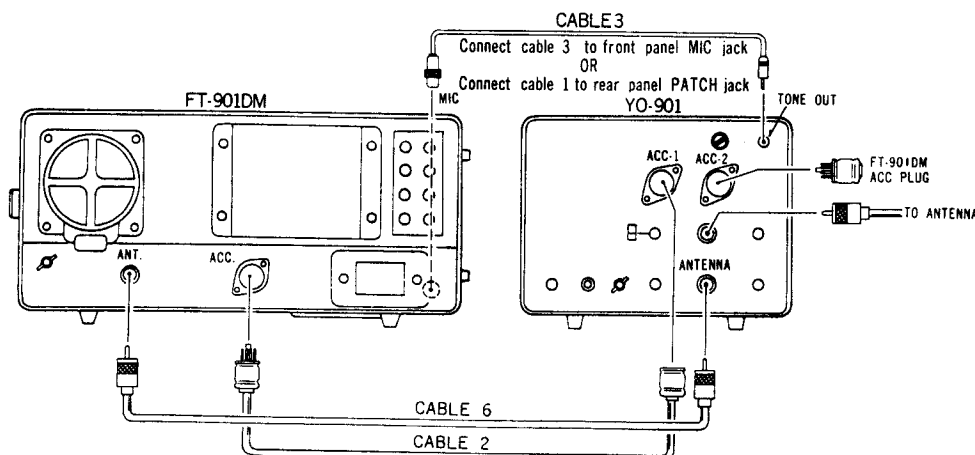


Figure 2.

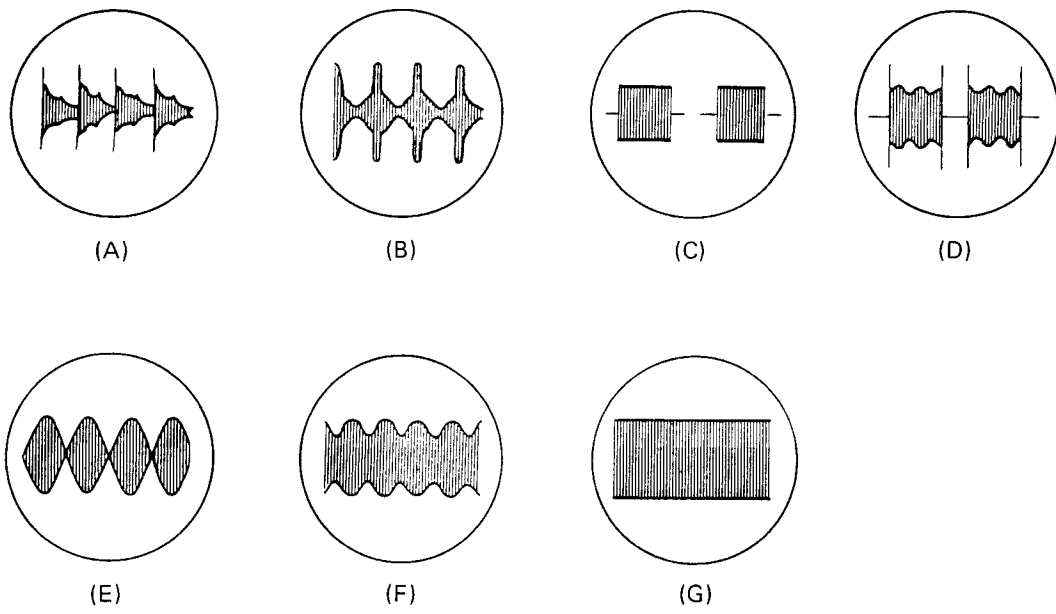


Figure 3.

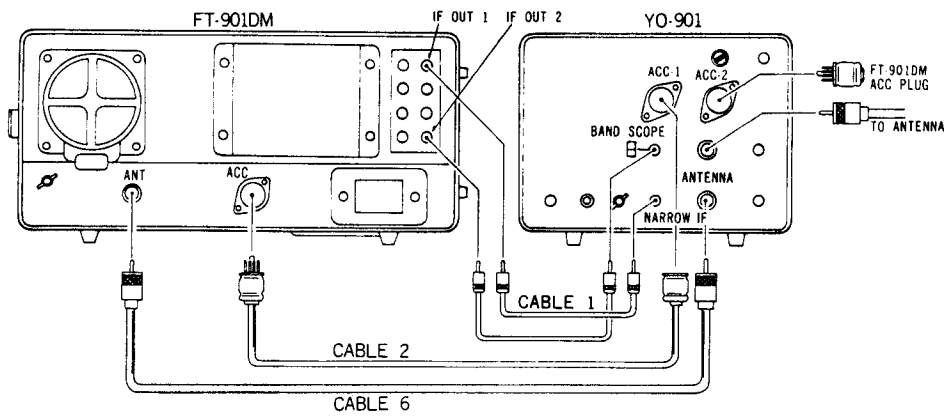


Figure 4

## RECEIVER MONITOR

- (1) Make connections as shown on page 9 , Figure 4.
- (2) Press the IF button for input to the vertical amplifier.
- (3) Set the MODE switch to AUTO or BAND SCOPE.
- (4) As you tune the band, set the V. GAIN and VAR controls as required to produce a satisfactory display.

## BAND SCOPE (OPTION)

When the Band Scope option is installed, monitoring of band activity can be accomplished, over a range of  $\pm 10$  kHz,  $\pm 50$  kHz, or  $\pm 100$  kHz. Connections are the same as those on page 9 .

- (1) Set the MODE switch to AUTO or BAND SCOPE.
- (2) Press the BAND SCOPE button.
- (3) To set the center frequency of the band scope, set the LIN-MARK ON-LOG switch to MARK ON, with the WIDTH switch at the 20 kHz/div position. Adjust the CENTER FREQ control for precise centering of the marker indication on the scale.

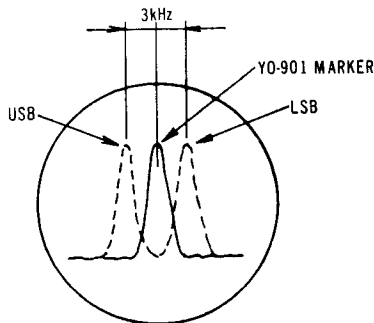


Figure 5

- (4) Now switch the WIDTH control to the 2 kHz div position, and adjust the CENTER FREQ control for a precise centering of the marker signal on the scale.
- (5) Now switch back to the 20 kHz/div scale. If the display jumps off center, adjust the H. POS control to recenter the display. Switch back and forth between the 2 kHz/div and 20 kHz/div scales, carefully adjusting the CENTER FREQ and H. POS controls until coincidence of the centers is accomplished.
- (6) Note that when changing modes on the FT-901DM that the carrier frequency will be 1.5 kHz offset from center for LSB and USB. This difference will, then, be 0.75 division.
- (7) The FT-901DM marker signal can also be used for centering the display. In this case, set the LIN-MARK ON-LOG switch to LIN or LOG, and switch on the FT-901DM marker. The 100 kHz calibration marks will be of slightly higher amplitude than the 25 kHz marks. Be sure that the preselector control on the FT-901DM is peaked on the marker signal. When the center frequency adjustment is complete, set the MARK ON switch to LIN or LOG.
- (8) When a strong signal enters the passband of the receiver, the AGC action of the receiver will cause the display to become lower in amplitude. For adjustment of the display amplitude, rotate the VAR control (or set the HI/LOW switch on the rear apron to LOW, to introduce a mismatch intentionally).

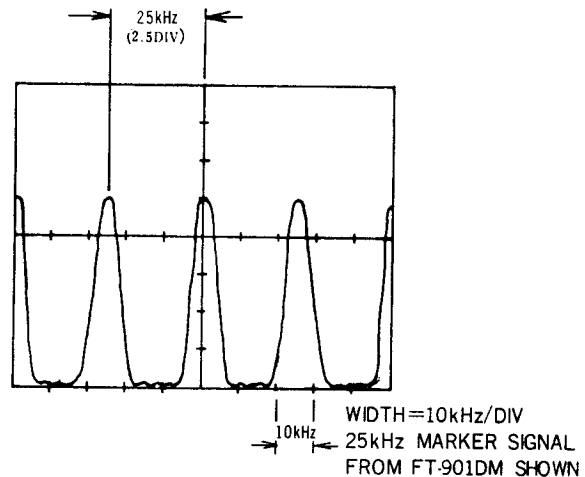


Figure 6

## RF TRAPEZOID TEST

Set up the YO-901, FT-901DM, and FL-2100F as shown in Figure 8. Be certain to observe the precaution regarding proximity to the amplifier transformer. When using equipment other than the FT-901DM and FL-2100F, be certain not to exceed the power limitations stipulated earlier.

- (1) Place the MODE SWITCH TO THE TX MONITOR position.
- (2) Place the ENVEL/TRAP switch in the TRAP position
- (3) Place the V. INPUT switch in the IF position.
- (4) Activate the 1500 and 1900 Hz tone generator switches.
- (5) Activate the transmitter and amplifier, and adjust the H. GAIN control for the desired pattern height. Proper operation of the amplifier, and operating difficulties, are shown in Figure 7.

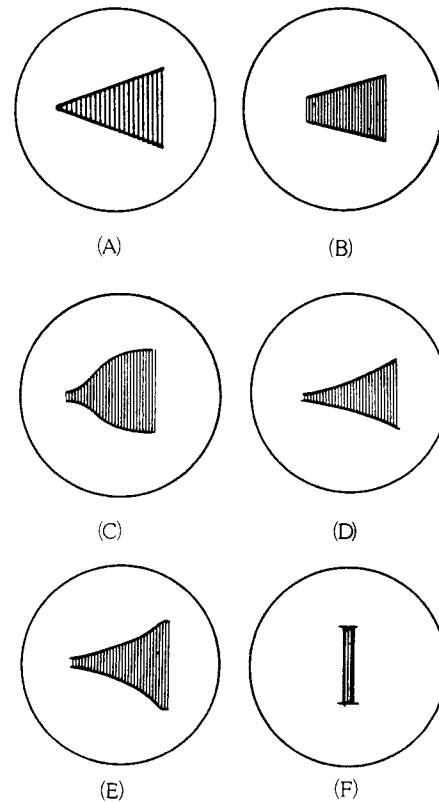


Figure 7

- (A) Good linearity. Proper amplifier operation.
- (B) Modulation less than 100%, but 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 pattern, with parasitic oscillation occurring on modulation peaks.
- (F) Unmodulated carrier.

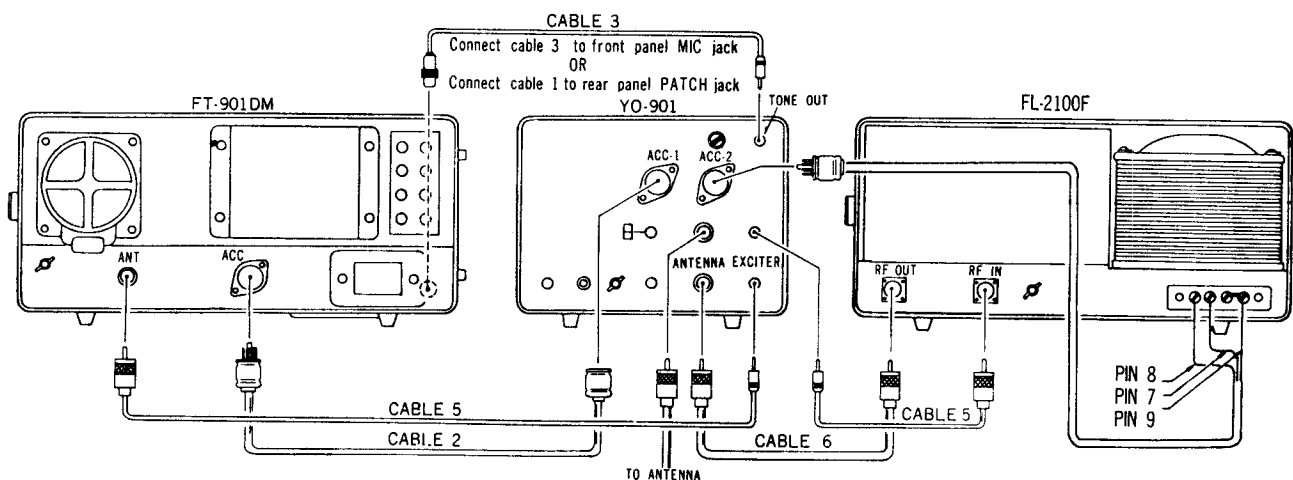


Figure 8

## RTTY CROSS PATTERN TEST

Set up YO-901, terminal unit, and FT-901DM as shown in Figure 10.

- (1) Set the V. INPUT to AF.
- (2) Set the SWEEP FREQ control to EXT (RTTY). Be certain that the INTENSITY control is set to a low level, as RTTY patterns are often displayed for long periods of time, with little or no change. High intensity under these conditions can cause burning of the CRT phosphor.
- (3) The MARK and SPACE outputs from the terminal unit should be adjusted for equal levels when the received signal is properly tuned in. In order to accomplish this, alternately inject the MARK and SPACE signals into the vertical input of the YO-901, and adjust the balance potentiometer of the terminal unit until an equal height is obtained for both MARK and SPACE.
- (4) Now set the V. GAIN and H. GAIN controls on the YO-901 for a symmetrical cross pattern. Once the desired pattern has been achieved, the gain controls on the YO-901 should not be changed.

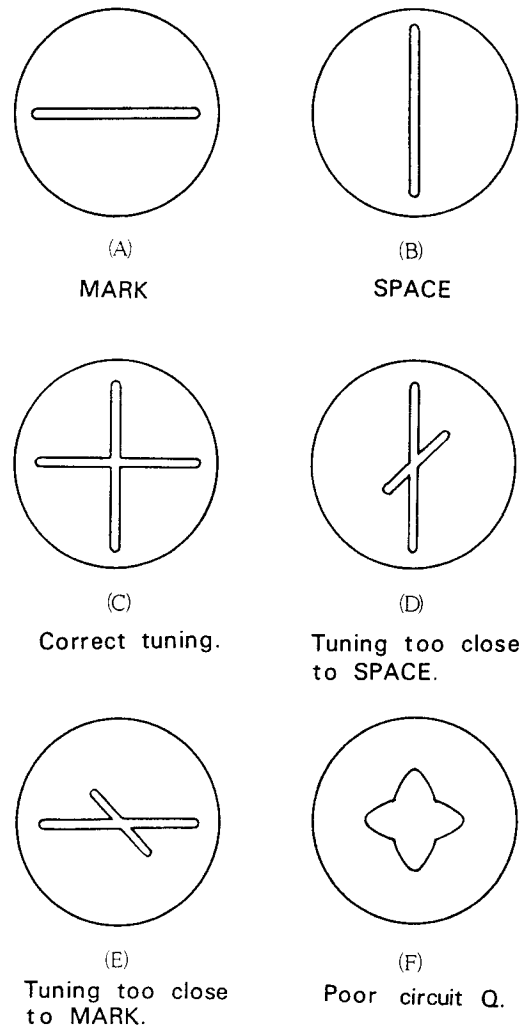


Figure 9

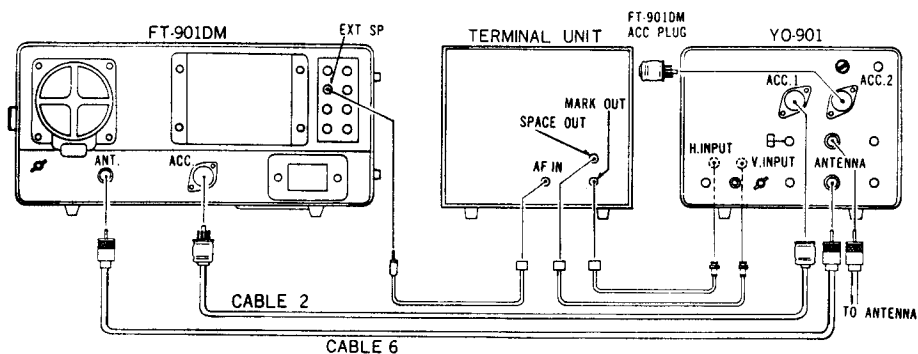
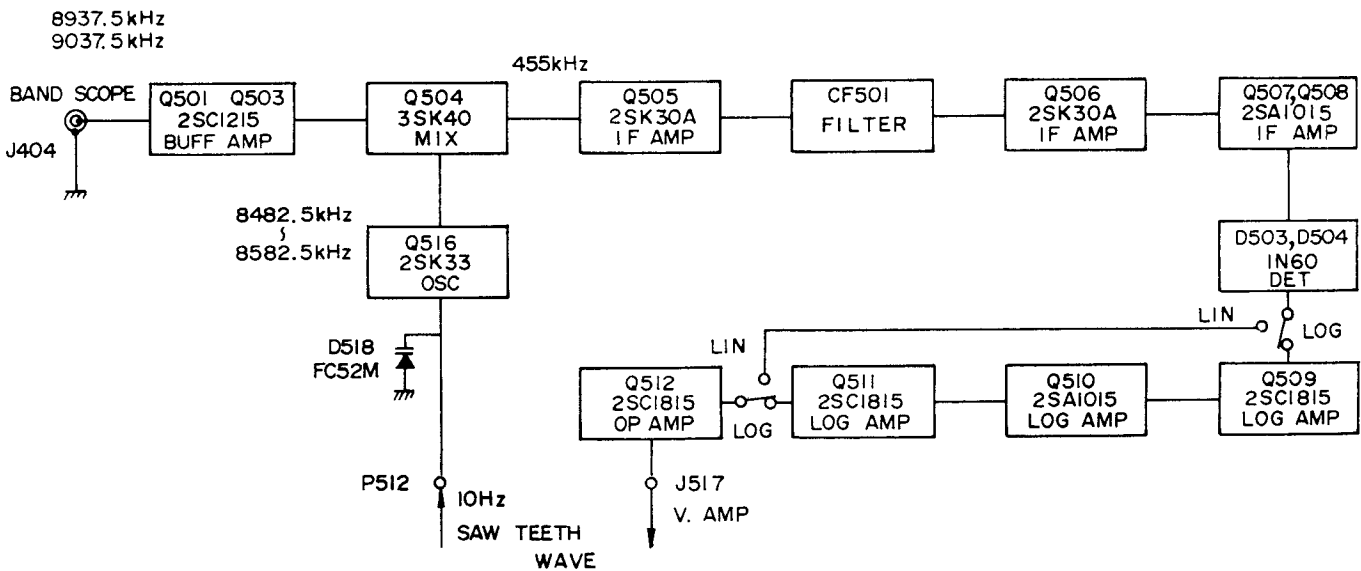
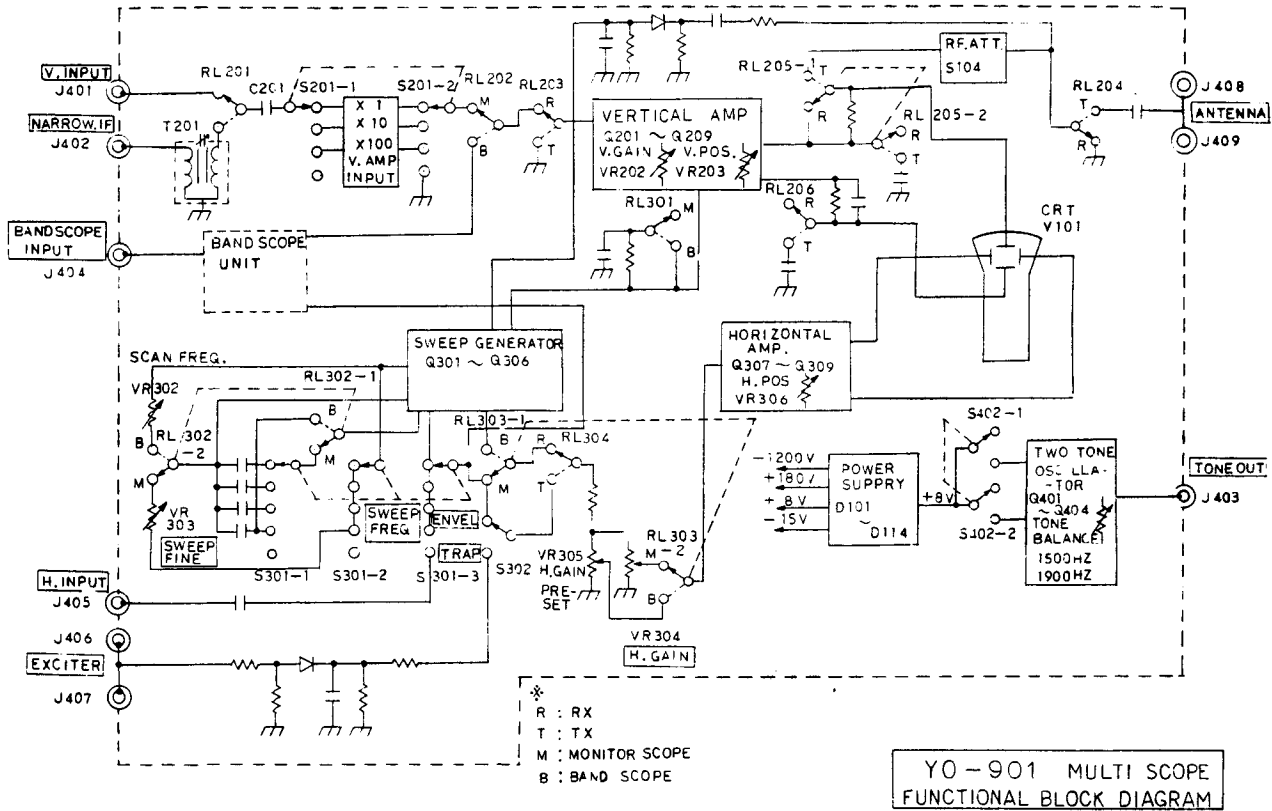


Figure 10

# GENERAL OSCILLOSCOPE TESTING

This instrument can be used as an oscilloscope, with a sweep range of up to 100 kHz. The useful operating range of the scope is 2 Hz–4 MHz (–3 dB), and 8.9 MHz–10.7 MHz.

For oscilloscope use, place the V. INPUT switch to the AF position, connect the test cable to the V. INPUT terminal on the front panel of the YO-901, and adjust the V. GAIN, VAR, SWEEP FREQ, and FINE controls for the desired display.



BANDSCOPE UNIT BLOCK DIAGRAM

## CIRCUIT DESCRIPTION

Please refer to the block diagram, as well as the schematic diagram, while following the description of the circuitry employed in the YO-901 Multi-scope.

### VERTICAL AMPLIFIER

The input signal to the vertical amplifier is applied to the V. INPUT jack J<sub>401</sub>, the IF monitor input jack (NARROW IF) J<sub>402</sub>, or the BAND SCOPE INPUT jack, J<sub>404</sub>. The V. INPUT and BAND SCOPE switches perform the required switching.

The signal applied to J<sub>401</sub> or J<sub>402</sub> is fed through RL<sub>201</sub> to an attenuator, controlled by S<sub>201</sub>, as well as the VAR potentiometer, for setting the input level. When S<sub>201</sub> is set to the GND position, the input is grounded.

The preset input signal is then fed through Q<sub>201</sub> and Q<sub>203</sub> (2SC1815O) to the input amplifier, Q<sub>202</sub> (2SK30AY), which also transforms the input high impedance to a low impedance for the following stage. Q<sub>201</sub> and Q<sub>203</sub> clip the input signal peaks, providing protection against high input voltages.

The output from Q<sub>202</sub> is then applied to a differential amplifier, consisting of Q<sub>204</sub> and Q<sub>205</sub> (2SC1215), which balances the signal for delivery to push-pull buffer amplifiers Q<sub>206</sub> and Q<sub>207</sub> (2SC1215). The signal is further amplified by the vertical amplifier, Q<sub>208</sub> and Q<sub>209</sub> (2SC1012A), for delivery to the vertical deflection electrodes (Y+ and Y-) of the cathode-ray tube, V<sub>101</sub> (C312P1).

### HORIZONTAL AMPLIFIER

The horizontal signal selected by the SWEEP FREQ switch S<sub>301</sub> is amplified by Q<sub>307</sub> (2SK30AY), which converts the high input impedance to a low output impedance. The signal is then further amplified by Q<sub>308</sub> and Q<sub>309</sub> (2SC1514), for delivery to the horizontal deflection electrodes, X+ and X-, of V<sub>101</sub>.

### TRANSMITTER MONITOR

A portion of the transmitter output signal, connected through the rear apron ANTENNA

jacks, is sampled through C<sub>211</sub>, and delivered through the INPUT LEVEL switch S<sub>104</sub> to the CRT vertical deflection plate. The RF voltage is sensed by envelope detector D<sub>201</sub> (1N60), for synchronization of the sweep generator, thus providing stable signal display on the CRT screen.

When the exciter output is fed through the EXCITER jacks J<sub>406</sub> and J<sub>407</sub>, and the output of the linear amplifier is fed through the ANTENNA jack J<sub>408</sub> and J<sub>409</sub>, a portion of the exciter signal is sensed by envelope detector D<sub>301</sub> (1N60). The signal is then fed to the horizontal deflection plate. The linear amplifier signal is sampled and fed to the vertical deflection plate. Thus, when the ENVEL/TRAP switch is placed in the TRAP position, a trapezoidal display will be provided, allowing adjustment of the amplifier for maximum linearity.

### SWEEP GENERATOR

A saw-tooth sweep signal is produced by multivibrator Q<sub>304</sub> and Q<sub>305</sub> (2SC752GO). The saw-tooth signal is then amplified by the amplifier chain, consisting of Q<sub>304</sub>, Q<sub>305</sub>, and Q<sub>306</sub> (2SC1815O), and fed through the SWEEP FREQ switch and the SWEEP FINE control to the horizontal amplifier.

The sweep frequency may be varied continuously over the range of 10 Hz to 100 kHz.

A portion of the vertical signal is fed to buffer amplifier Q<sub>301</sub> (2SK30AY), the output signal of which is used for synchronization of the sweep frequency.

### TWO-TONE GENERATOR

Oscillators Q<sub>402</sub> and Q<sub>404</sub> (2SK30AGR), configured in a Wien-bridge circuit, provide sine wave signals at 1900 and 1500 Hz, respectively. The bias voltage is stabilized by Q<sub>401</sub> and Q<sub>403</sub> (2SA733P), and the output level for each tone is set by VR<sub>401</sub> and VR<sub>402</sub>. The rear apron TONE BALANCE control, VR<sub>403</sub>, is used for equalizing the tones. Q<sub>405</sub> (2SC1815O) acts as a buffer amplifier, which delivers the output signal to the rear apron TONE OUT jack.



## REMOTE SWITCH(NG)

When using the convenient interconnections to the FT-901DM series of transceivers, the YO-901 will provide automatic TX/RX switching of the scope display mode.

RL<sub>201</sub> provides switching between the V. INPUT jack and the NARROW IF jack.

Switching between the optional band scope and the TX monitor is accomplished by RL<sub>202</sub>, RL<sub>301</sub>, RL<sub>302</sub>, and RL<sub>303</sub>.

Switching between TX and RX modes is provided by RL<sub>203</sub>–RL<sub>206</sub> and RL<sub>304</sub>.

## BAND SCOPE (OPTION)

When the optional band scope unit is installed, the wide-band IF signal from the FT-901 IF OUT-2 jack is applied through HI/LOW impedance switch S<sub>601</sub> to the band scope circuit. The IF signal in the FT-901 is sampled prior to any IF filtering. The signal is then amplified by buffer Q<sub>501</sub>, amplifier Q<sub>502</sub>, and buffer Q<sub>503</sub> (2SC1215), and applied to gate 2 of mixer Q<sub>504</sub> (3SK40). A local oscillator signal generated by Q<sub>516</sub> (2SK33F) is fed to gate 1 of Q<sub>504</sub>, resulting in an output signal of 455 kHz.

The YO-901 saw-tooth 10 kHz signal is used to control varactor diode D<sub>518</sub> (FC-52M). WIDTH switch S<sub>603</sub> sets the voltage level, allowing sweep widths of 2 kHz/div. 10 kHz/div. or 20 kHz/div.

The 455 kHz signal is then amplified by Q<sub>505</sub> (2SK30AGR) and fed through ceramic filter CF<sub>501</sub>, which filters the wideband FT-901 IF signal for the band scope. The signal is then amplified by Q<sub>506</sub> (2SK30AGR), Q<sub>507</sub>, and Q<sub>508</sub> (2SA1015), detected by D<sub>503</sub> and D<sub>504</sub> (1N60), and then delivered to the final amplifiers, Q<sub>509</sub> (2SC1815O), Q<sub>510</sub> (2SA1015O), and Q<sub>511</sub> (2SC1815) for delivery to the vertical deflection electrodes.

When the front panel LIN-MARK-LOG switch is in the LIN position, the output from the final amplifiers is fed to operational amplifier Q<sub>512</sub>, to modify the display for the linear mode.

Q<sub>517</sub> (2SC1815O) generates a marker signal of 8987.5 kHz, via crystal X<sub>501</sub>. This signal is fed to gate 2 of Q<sub>504</sub> for calibration of the band scope.

## POWER SUPPLY

The power transformer primary has a dual winding, allowing selection of a variety of AC supply voltages. The secondary has three windings, which deliver four different DC voltages, plus AC heater voltage to the cathode ray tube.

Diodes D<sub>101</sub>–D<sub>104</sub> (SIR150) are configured in a full-wave doubler circuit, providing –1200 volts DC from the 470 volt winding of the power transformer; this voltage is used for the CRT. D<sub>109</sub> and D<sub>110</sub> (1S1830) provide 180 volts DC from a full-wave rectifier circuit, for the vertical and horizontal amplifiers.

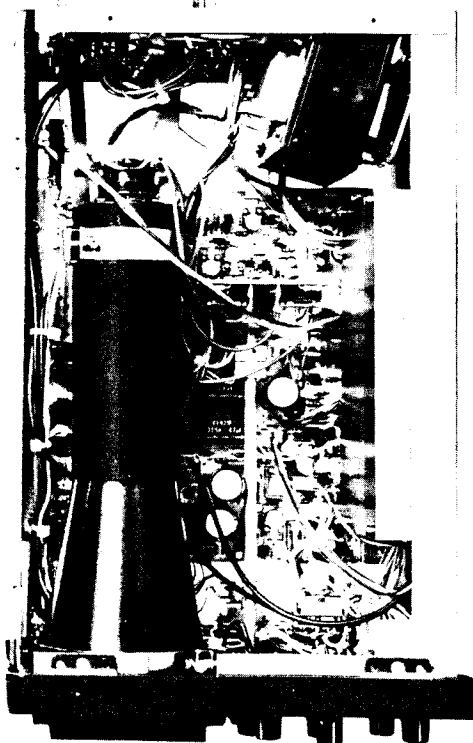
The transistor supply voltages are provided by Q<sub>103</sub> (MC7915CP) (–15 V), Q<sub>102</sub> (μPC14308) (+8 V), and Q<sub>101</sub> (μPC14312H) (+12 V).

## MAINTENANCE AND ALIGNMENT

The YO-901 has been carefully aligned and tested at the factory prior to shipment. With normal use, this instrument should not require other than the normal attention given to any electronic apparatus. Service, or replacement of major components, may require substantial realignment. However, should trouble arise, under no circumstances should realignment be attempted unless the operation of the YO-901 is fully understood, and the malfunction definitely traced to misalignment. Parts failures are most often to blame for sudden difficulties. Service work should only be performed by an experienced technician, using the proper test equipment.

### WARNING

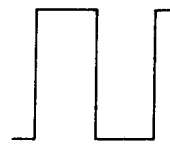
DANGEROUS HIGH VOLTAGES IN EXCESS OF 1200 VOLTS ARE PRESENT WITHIN THE CABINET. EXTREME CAUTION MUST BE EXERCISED WHEN THE CABINET IS REMOVED. BEFORE REMOVING THE CABINET, REMOVE THE POWER PLUG FROM THE WALL SOCKET. DISCHARGE THE HIGH VOLTAGE CAPACITORS BY SHORTING THE HIGH VOLTAGE LINE TO GROUND WITH AN INSULATED SCREWDRIVER AFTER THE POWER HAS BEEN REMOVED.



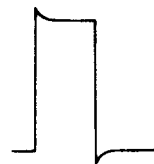
**THESE VOLTAGES CAN BE FATAL. DO NOT WORK ON THIS UNIT WHEN TIRED.**

#### 1. Frequency Response Compensation of Vertical Attenuator (TC<sub>201</sub>, TC<sub>202</sub>)

Apply a pure square wave (50 Hz–5 kHz) to the vertical input, and observe the display on the cathode ray tube. Adjust TC<sub>201</sub> for the X<sub>10</sub> position, and TC<sub>202</sub> for the X<sub>100</sub> position, until the same pattern is obtained as in the case of the X<sub>1</sub> position.



CORRECT



OVER-COMPENSATION



UNDER-COMPENSATION

#### 2. Vertical Amplifier Balance (VR<sub>202</sub>)

After the POWER switch is activated, wait 30 minutes. Check the position of the display while rotating the V. GAIN VAR and controls over its entire range. If the display moves up or down, adjustment of the balance is required.

Set the V. GAIN switch to GND, and the VAR control to the fully counterclockwise position. Adjust the V. POS control to set the display (horizontal line) in the center of the screen.

VR<sub>201</sub> should be adjusted so that there is no change in the position of the line as the VAR control is rotated fully clockwise.

Proper alignment may require several repetitions of the rotation-and-adjustment procedure.

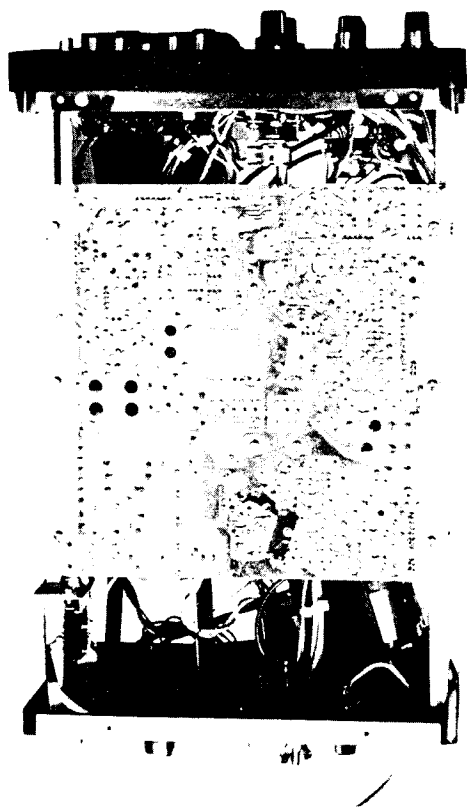
### 3. TWO-TONE GENERATOR ALIGNMENT

VR<sub>401</sub> and VR<sub>402</sub> provide adjustment of the 1900 and 1500 Hz tones, respectively. VR<sub>404</sub> provides adjustment of the gain level of the two tones. VR<sub>403</sub> is the rear apron TONE PALANCE control, which will vary the level of the 1500 Hz tone.

### 4. BASE LINE ATTITUDE SETTING

If the scope trace line is not parallel to the base line, this deficiency may easily be corrected. Be certain to unplug the YO-901 from the supply, and discharge all high voltage capacitors before making the correction.

Loosen the restraining clamps at the front and rear of the cathode ray tube. Gently turn the tube slightly in its mount; do not force the unit, or it may break! Recheck the attitude of



the line. If further adjustment is necessary, be certain to unplug the unit, and discharge the high voltage capacitors, before making each adjustment.

### 5. ASTIGMATISM (VR<sub>101</sub>)

This adjustment will only be needed when the cathode ray tube is replaced. Set the FOCUS control to the 12 o'clock position. Adjust VR<sub>101</sub> for sharp focusing of the display.

### 6. H. GAIN PRESET (VR<sub>305</sub>)

With the BAND SCOPE mode in operation, set VR<sub>305</sub> for a trace length of 11 divisions.

### 7. V. POS OFFSET (VR<sub>204</sub>)

With the BAND SCOPE activated, set the V. POS control to the 12 o'clock position. Set the LIN-MARK ON-LOG switch to LIN. Adjust VR<sub>204</sub> so that the trace is precisely along the base line. In the IF position, the trace should be along the center line of the scope screen.

### 8. WIDTH (VR<sub>506</sub>, VR<sub>507</sub>, VR<sub>508</sub>)

This alignment allows precise calibration of the band scope. Activate the band scope, and set the WIDTH control at the 2 kHz/div position.

Activate the FT-901DM marker, and align the marker display with the center of the screen. Now rotate the main tuning dial of the FT-901DM precisely 10.0 kHz. The display should move 5 divisions, to the edge of the screen. If the display did not move exactly 5 divisions, adjust VR<sub>508</sub> for the proper width, and repeat the test.

In the same manner, VR<sub>507</sub> will adjust the 10 kHz/div width, and VR<sub>506</sub> will adjust the 20 kHz/div scale.

### 9. LIN GAIN, LOG GAIN (VR<sub>501</sub>, VR<sub>502</sub>)

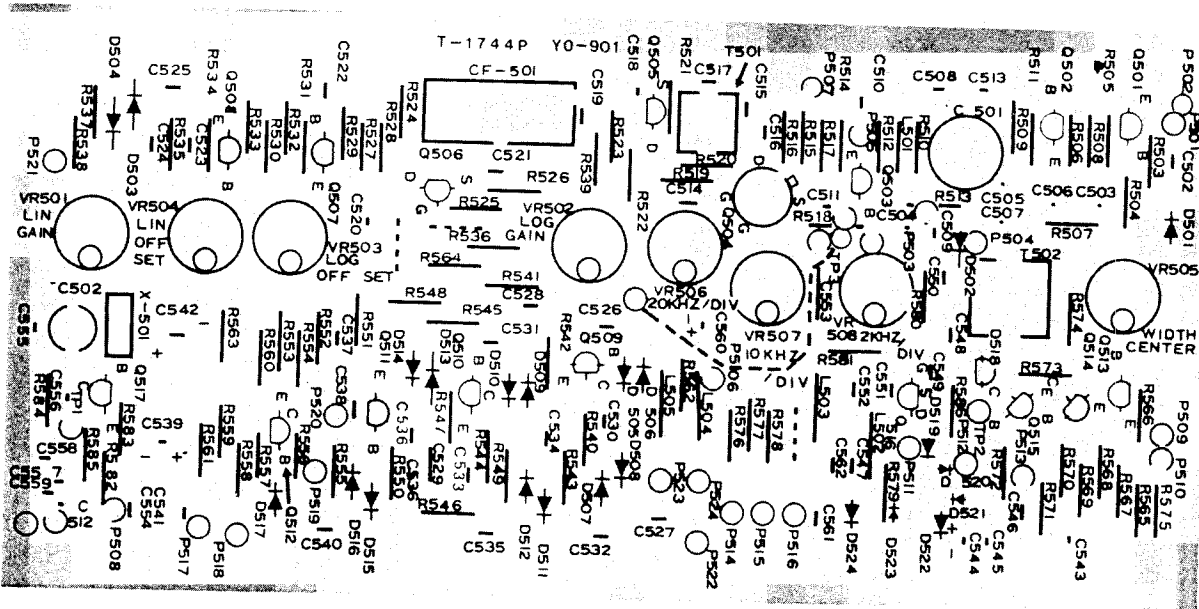
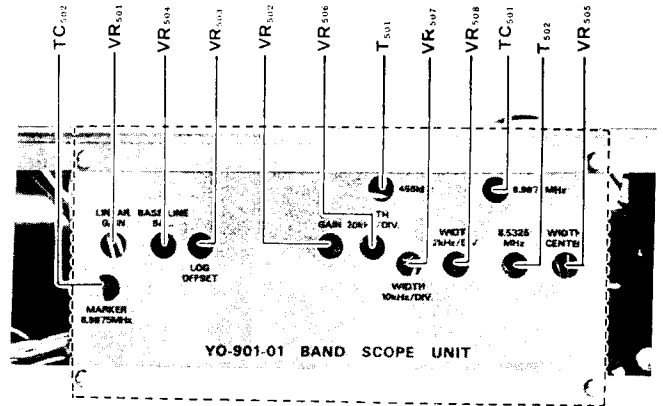
Place the LIN-MARK ON-LOG switch to LOG, and the VAR control fully clockwise. While receiving an S1 signal, set VR<sub>502</sub> for a full 8 division deflection on the screen. Now switch to the LIN mode, and receive an S5 signal. Adjust VR<sub>501</sub> for a deflection of 2 divisions.

### 10. BASE LINE BALANCE (VR<sub>504</sub>)

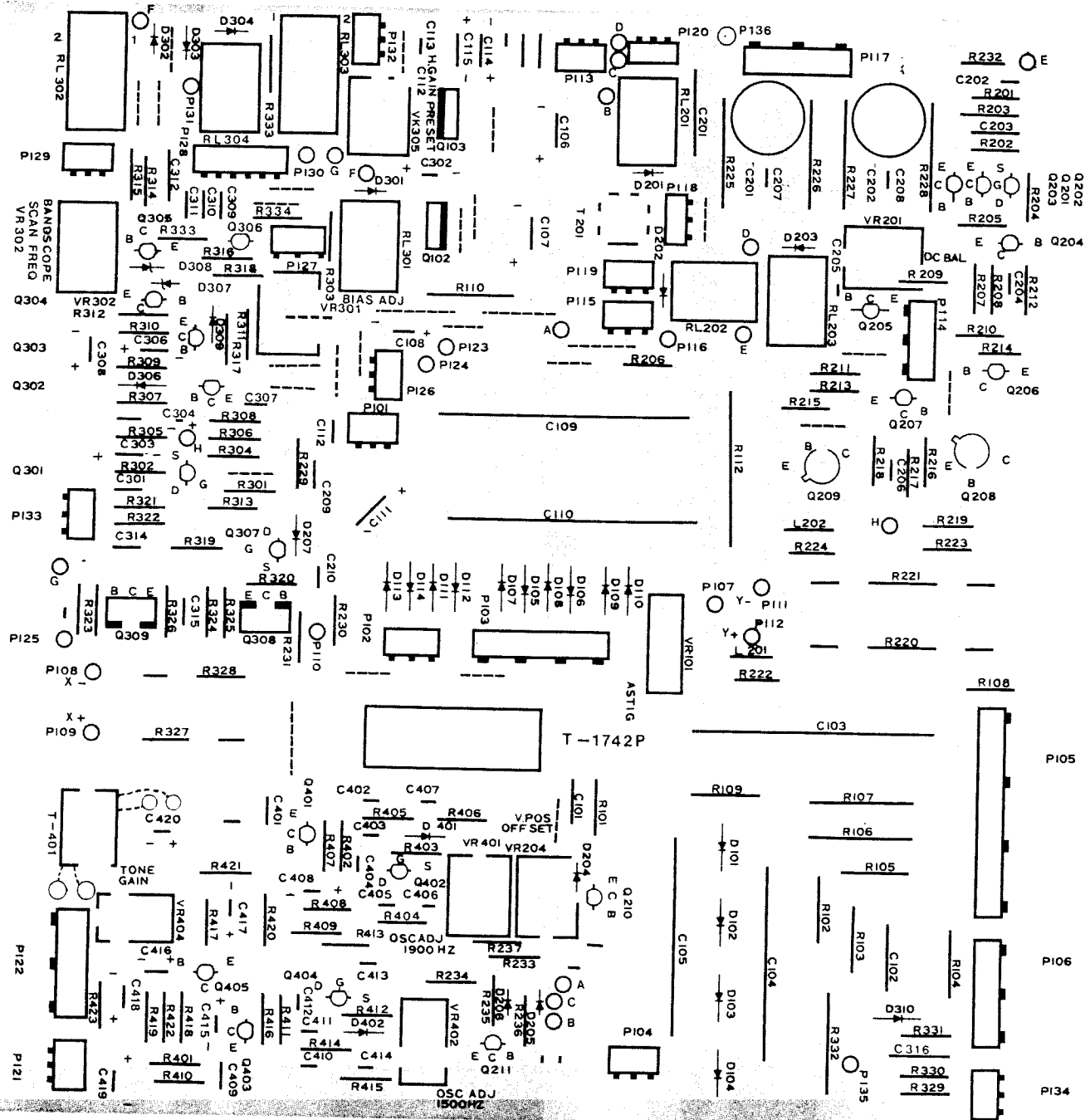
In the BAND SCOPE mode, rotate the VAR control throughout its range, in the same manner as in alignment procedure #2. If the line changes position at all, VR<sub>504</sub> can be adjusted to eliminate this problem. Perform the alignment on either the LIN or LOG mode.

### 11. LOG OFFSET (VR<sub>503</sub>)

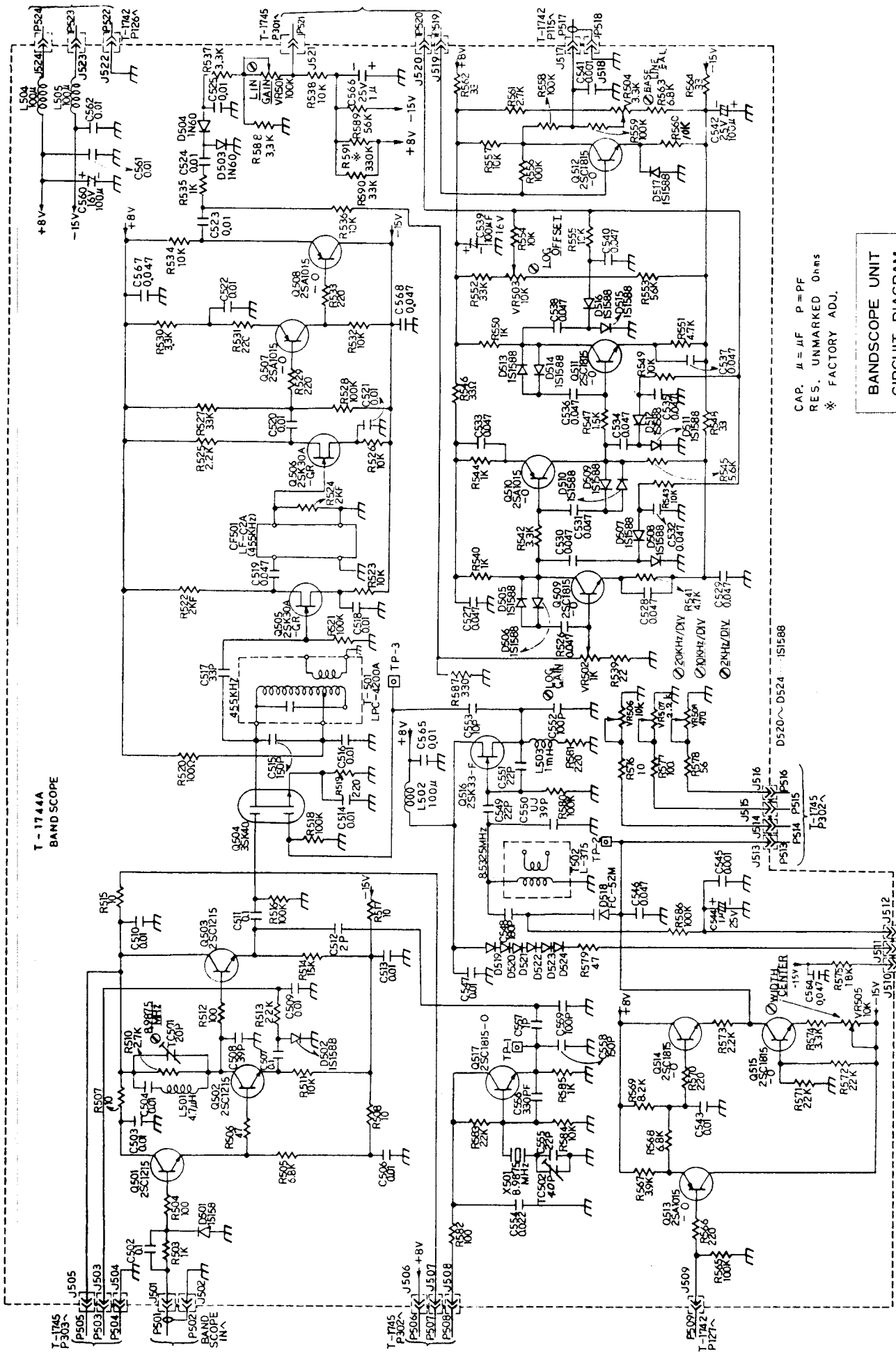
Set the LIN-MARK-LOG switch to LOG, with the BAND SCOPE mode activated. Set the V. POS control to the 12 o'clock position. Adjust VR<sub>503</sub> so that the trace line is precisely along the base line, in the same manner as in alignment procedure #7.



BAND SCOPE UNIT PARTS LOCATION



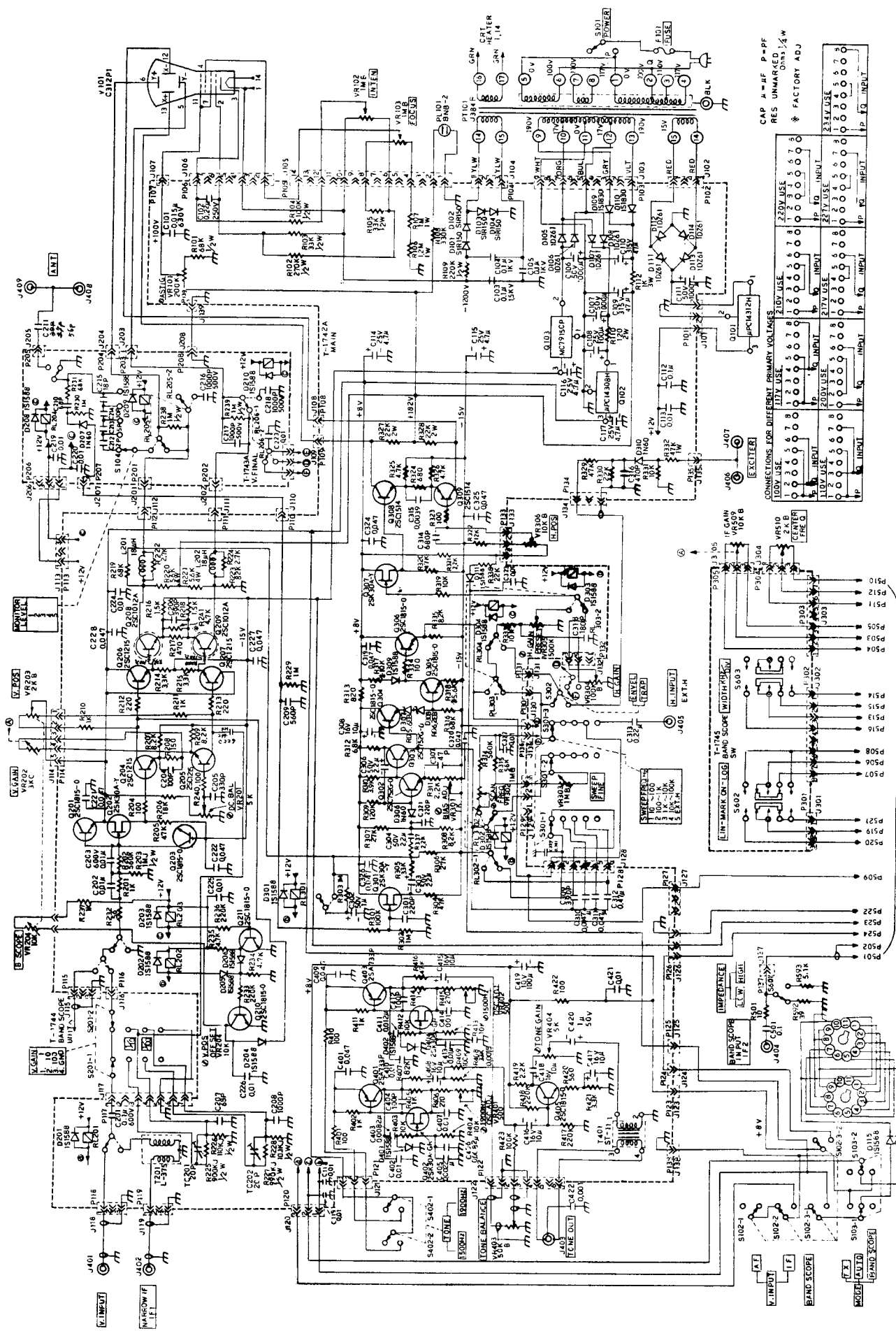
MAIN BOARD PARTS LOCATION



T-1744A  
BAND SCOPE

CAP.  $\mu$  =  $\mu$ F P = PF  
RES. UNMARKED Ohms  
\* FACTORY ADJ.

BANDSCOPE UNIT  
CIRCUIT DIAGRAM



YO-901  
CIRCUIT DIAGRAM

T-1744 BAND SCOPE UNIT

151088 PA4038.00 SAG028.00  
1-ACC-2

CONNECTIONS FOR DIFFERENT PRIMARY VOLTAGES

100V USE	115V USE	120V USE	125V USE	130V USE	135V USE	140V USE	145V USE	150V USE	155V USE	160V USE	165V USE	170V USE	175V USE	180V USE	185V USE	190V USE	195V USE	200V USE
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114

CAP A = 47 P-PF  
RES UNMARKED OHMS 1/4W  
\* FACTORY ADJ

