

**INSTRUCTION  
MANUAL  
FV-107**

**YAESU MUSEN CO., LTD.**

TOKYO JAPAN

# **K4XL's** **BAMA**

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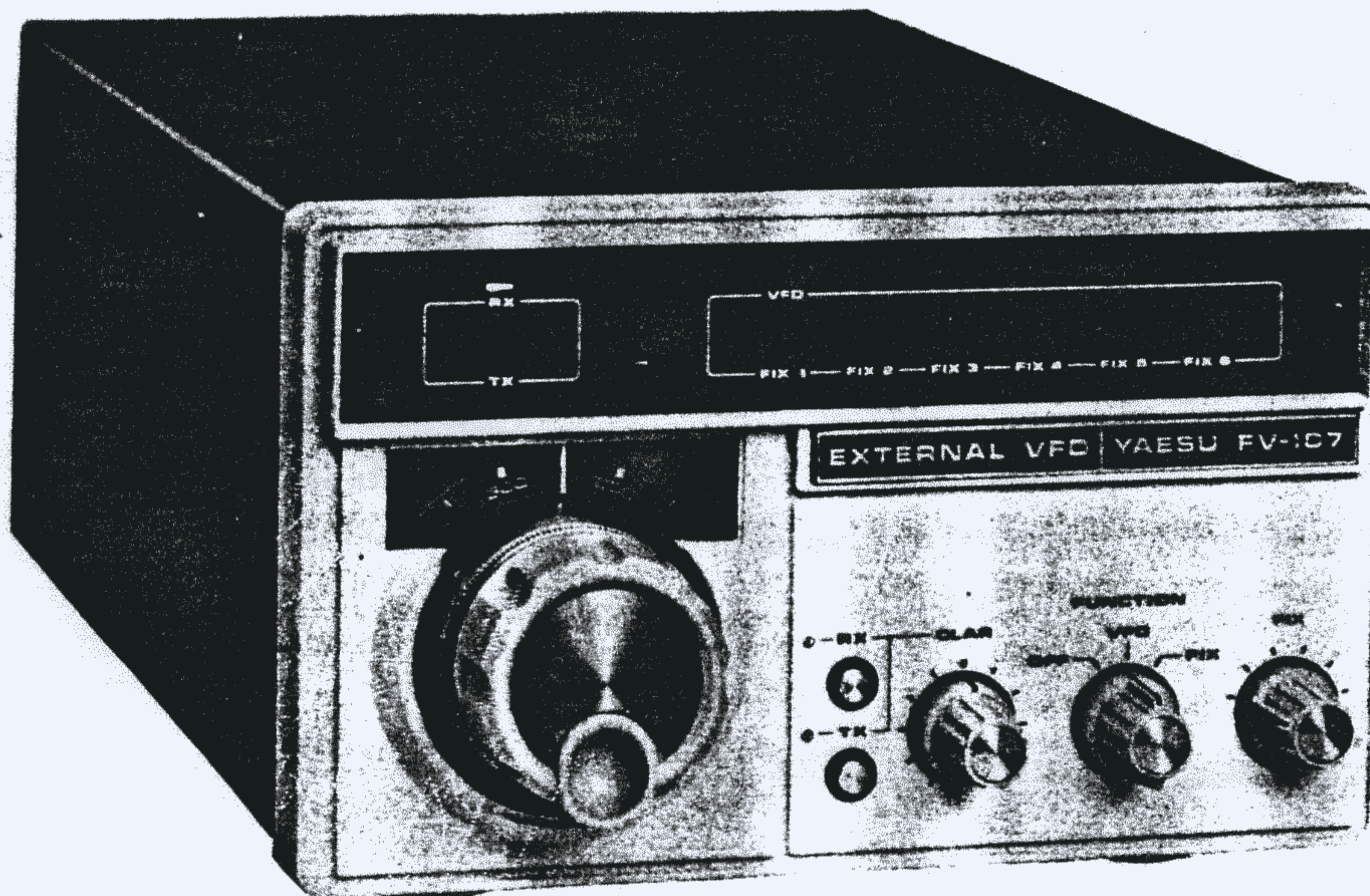
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# YAESU FV-107 EXTERNAL VFO



The FV-107 is a solid state remote VFO for the FT-107M series of HF transceivers. Featuring a precision analog dial coupled to a high quality gear mechanism, the FV-107 includes clarifiers for the transmit, receive, or transceive frequency, allowing offset of  $\pm 2.5$  kHz from the dial frequency.

As many as six crystal-controlled channels may be installed, for fixed channel operation (crystals optional). Selection of VFO or crystal operation is made by a convenient switch on the front panel of the FV-107.

All power required by the FV-107 is provided by the FT-107M transceiver. We recommend that you read this manual in its entirety, so as to become better acquainted with the versatility that the FV-107 will add to your FT-107M station.

# SPECIFICATIONS

**Frequency range:**

5.0 MHz to 5.5 MHz

**Output level:**

150 mV (rms) at 50 ohms

**Output impedance:**

50 ohms

**Stability:**

±300 Hz after 10 minute warmup; less than  
100 Hz after 30 minute warmup

**Crystal controlled channels:**

6 channels (crystals optional)

**Clarifier:**

Transmit, receive, or transmit/receive offset  
of ±2.5 kHz from the dial frequency

**Power requirements:**

DC 13.5 volts, negative ground (supplied from  
FT-107M)

**Power consumption:**

DC 0.3 amps

**Size:**

226 (W) x 128 (H) x 330 (D) mm

**Weight:**

2 kg.

**Semiconductor complement:****FET:**

2SK19GR 2

**Transistor:**

2SC372Y 2

2SC373 1

**Silicon Diode:**

1S1555 3

**Varactor Diode:**

1S2236 1

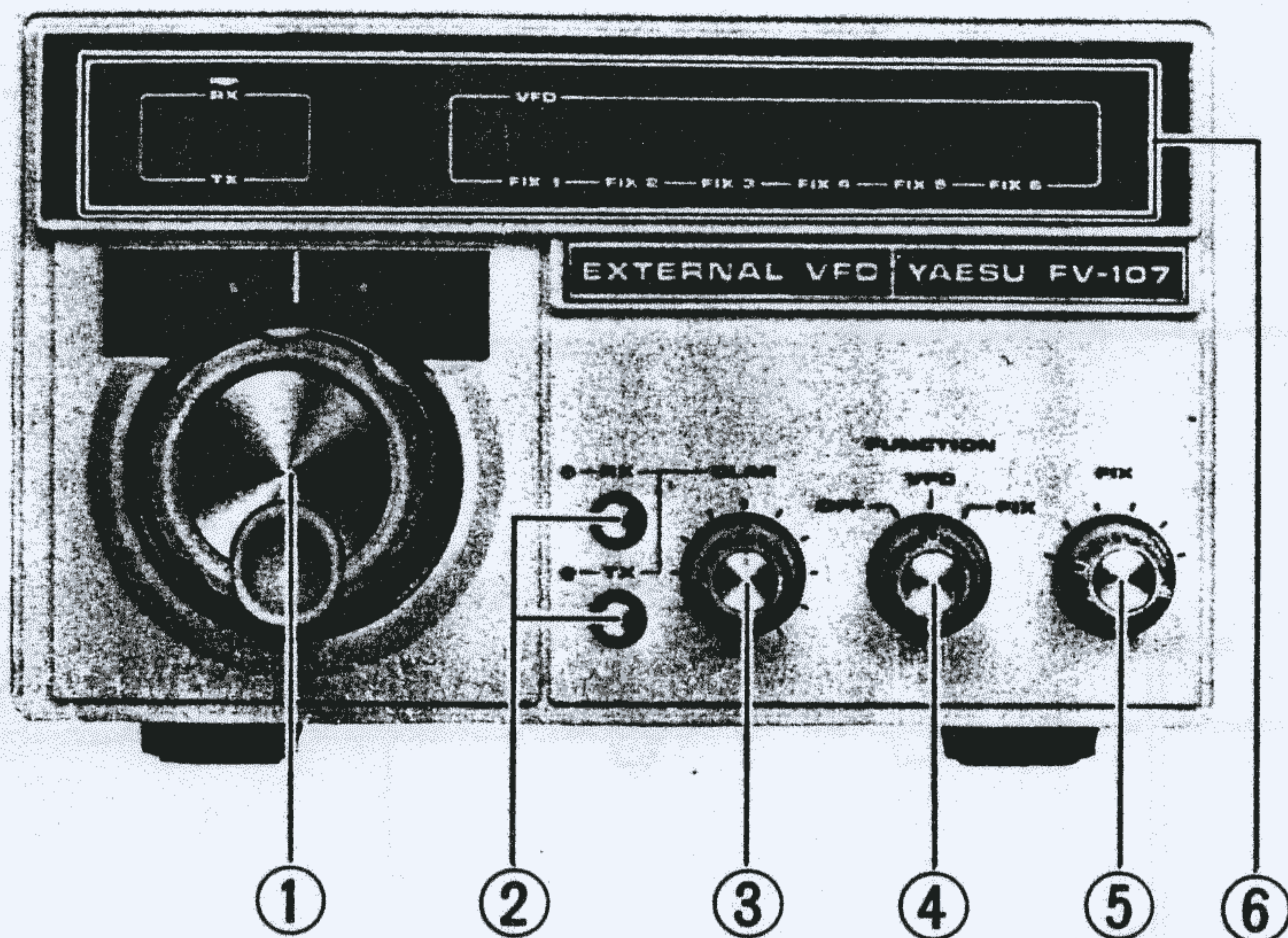
**LED:**

LN224RP 9

GD4-203SRD 2

Specifications subject to change without notice or obligation

# FRONT PANEL CONTROLS AND SWITCHES



## (1) MAIN TUNING KNOB

This is the main frequency-determining knob for the FV-107.

## (2) CLARIFIER switches

These switches select the operating mode for the clarifier circuitry:

Press the TX button to activate the transmit frequency clarifier.

Press the RX button to activate the receive frequency clarifier.

Press both the TX and RX buttons to activate the transceive frequency clarifier.

## (3) CLARIFIER control

This control allows variation of the operating frequency  $\pm 2.5$  kHz, according to the selection performed by the CLARIFIER switches.

## (4) FUNCTION switch

The FUNCTION switch selects between VFO, FIX (crystal control), and VFO OFF operation.

## (5) FIX switch

This switch selects the desired crystal controlled channel.

## (6) INDICATORS

According to the position of the FUNCTION, FIX, and CLARIFIER switches, these indicators will light up to indicate the operating mode of the FV-107.

# INSTALLATION

The only installation step that need be performed is to connect the 6-pin power connector from the FV-107 to the FT-107M rear panel EXT VFO jack. All power and switching connections are made automatically by this one interconnection cable.

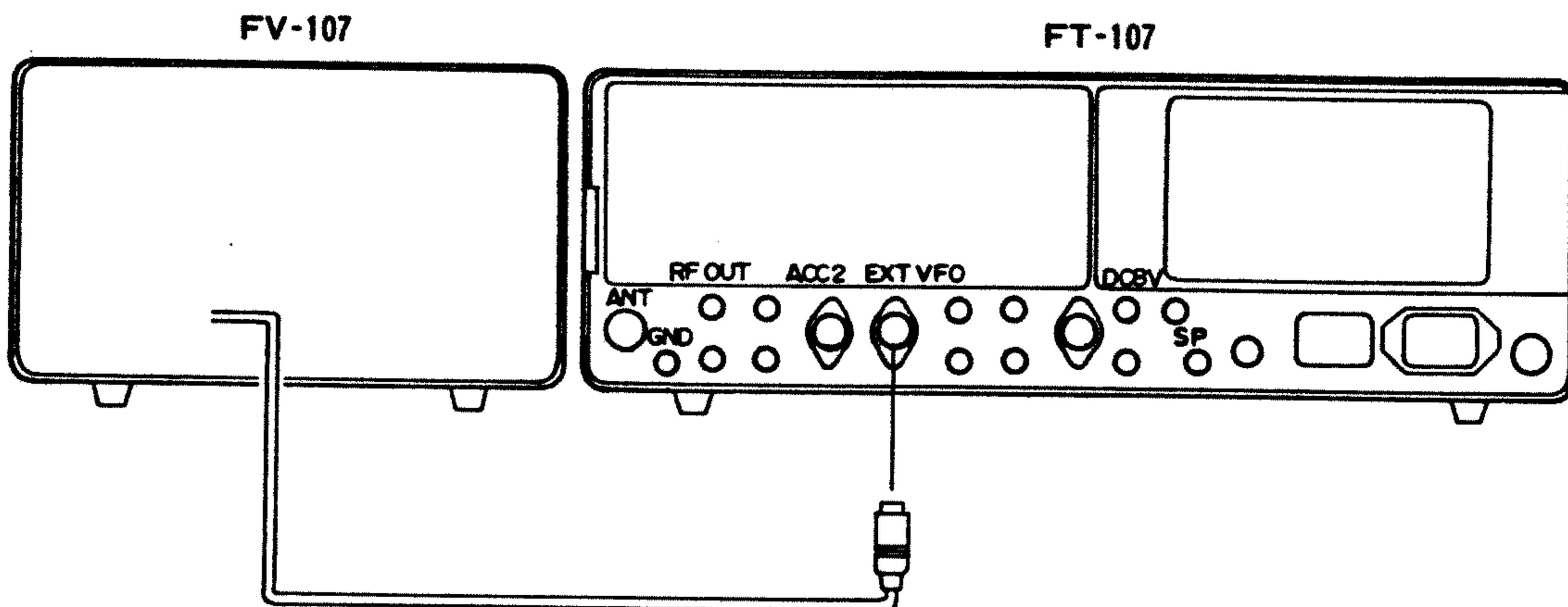
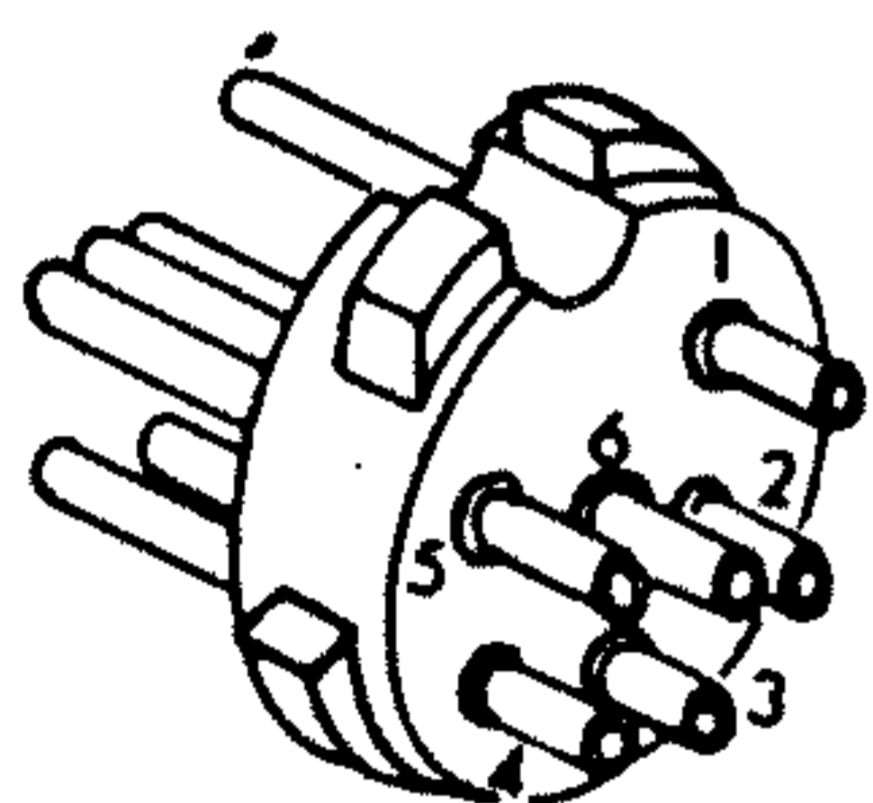


Figure 1



1. VFO IN
2. GND
3. EXT 8 V IN
4. —
5. TX 13.5V
6. 8 V

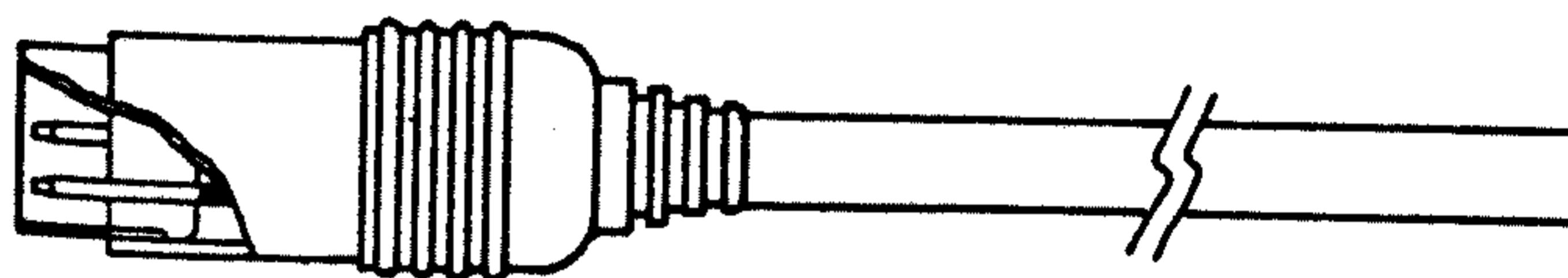


Figure 2

## BOTTOM PANEL FEET

The feet on the bottom panel may be changed, if it is desired to change the viewing angle for the VFO. In the accessory kit for your FV-107, there are two extender feet with mounting pads. These may be installed either in front or in back, according to the requirements of your station. Refer to Figure 3 for mounting details.

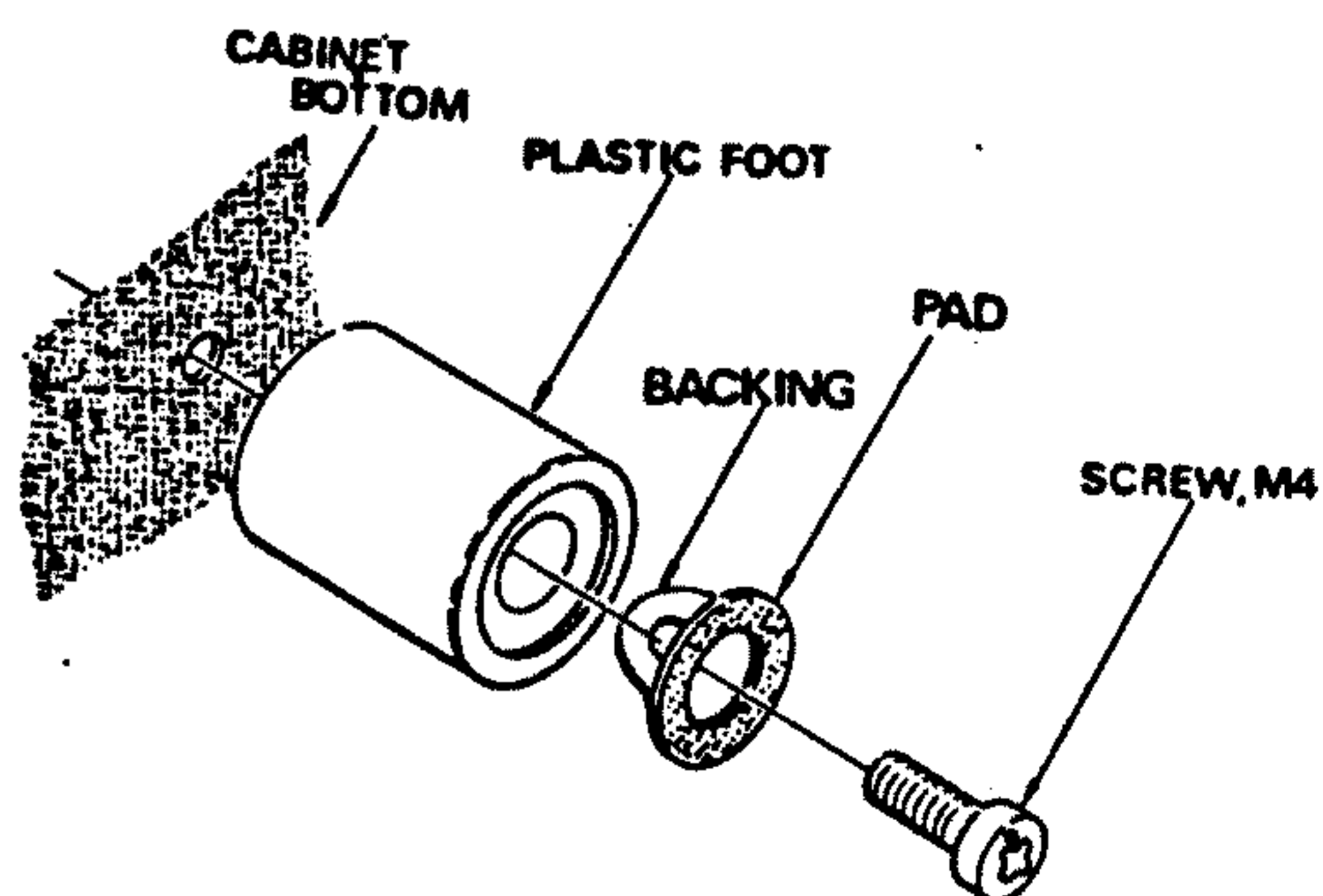


Figure 3

# OPERATION

The FV-107 expands the flexibility of your FT-107M station in several ways. The paragraphs to follow will provide some examples of typical operating techniques using the FV-107 and FT-107M.

## I. TRANSCEIVE OPERATION USING THE FV-107 VFO

Set the FT-107 SELECT switch to EXT. The FV-107 EXT indicator will light up, and full transceive frequency control will be via the FV-107 main dial. The operating frequency will be displayed on the FT-107M digital display.

Use the FV-107 RX clarifier to follow a drifting station. To activate the RX clarifier, push the RX switch on the front panel of the FV-107. To activate the TX clarifier, push only the TX button. To activate the transceive clarifier, push both the TX and RX buttons. The CLARIFIER control allows variation of up to  $\pm 2.5$  kHz from the operating frequency.

## II. TRANSCEIVE OPERATION USING CRYSTAL CONTROLLED CHANNELS

Once the optional crystals are installed, they may be selected via the front panel FIX switch. Set the FT-107M SELECT switch to EXT, in order to transfer full frequency control to the crystal controlled channels.

## III. OPERATION USING BOTH FT-107M AND FV-107 VFO CONTROL

Use the FT-107M SELECT switch to choose the method of frequency control desired.

For transmit frequency control on the FV-107, but receive frequency control on the FT-107M, set the FT-107M SELECT switch to TX EXT.

For receive frequency control on the FV-107, but transmit frequency control on the FT-107M, set the FT-107M SELECT switch to RX EXT.

Note that the FT-107M SELECT switch transfers control of the frequency determining circuitry on a particular mode, transmit or receive. Therefore,

if you have the FV-107 TX CLARIFIER button pushed, but the FT-107M SELECT switch set to RX EXT, the FV-107 clarifier will have no effect on the operating frequency (the transmit frequency clarifier function will be performed by the FT-107M clarifier).

## IV. OPERATION USING MEMORY-EQUIPPED FT-107M

If your FT-107M is equipped with the memory option, the FV-107 may be used for frequency input.

For example, let us say that you have set the FT-107M SELECT switch to RX EXT. You hear a station which you want to store into memory. There is no reason for you to switch to the FT-107M VFO in order to store this station; simply rotate the M CH switch on the FT-107M to the desired memory channel, and press the M button. You may then recall the memory frequency by proper setting of the SELECT switch. (Note that it is not possible to use a split TX/RX combination of the FV-107 and the FT-107M memory.)

## FREQUENCY DETERMINATION ON THE FV-107

The FV-107 operating frequency is displayed on the FT-107M digital display when the transceiver SELECT switch is correctly set. The FV-107 contains an analog dial which provides frequency determination to better than 1 kHz.

To align the subdial skirt on the FV-107, first set the transceiver SELECT switch to EXT. Now tune the FV-107 dial so that the frequency displayed on the FT-107M is an even multiple of 5 kHz (e.g. 14.225 MHz). If the analog dial skirt is not aligned such that the bold calibration marking on the skirt is aligned with the vertical mark on the dial window, then rotate the dial to the nearest bold calibration mark. Grasp the analog dial skirt with your fingers, and use the other hand to rotate the main tuning knob until the frequency displayed on the FT-107M is a multiple of 5 kHz. Alignment is now complete.

The FV-107 dial skirt is marked every 1 kHz, with bold calibration markings every 5 kHz. In the dial window, the rotating dial is calibrated every 50 kHz. One rotation of the main tuning dial provides a frequency shift of 25 kHz.

### FIXED CHANNEL CRYSTAL INFORMATION

Fixed channels require only the installation and netting of crystals on the FIX Unit. Once the channels are installed, the front panel CHANNEL switch selects the desired channel.

Crystals must fall within the specifications shown in Table 1, and must fall within the operating range 5.5–5.0 MHz. Frequency calculation for the crystals is made from the formula

$$F_x = F_1 - F_0$$

where  $F_x$  is the crystal frequency,

$F_1$  is a constant derived from Table 2,

and  $F_0$  is the operating frequency.

For example, let us say it is desired to operate on 7199 kHz LSB. Referring to Table 2, we see that for 40 meter LSB,  $F_1$  is 12501.5 kHz. Subtracting  $F_0$  (7199 kHz) from  $F_1$  (12501.5 kHz) yields 5302.5 kHz, the crystal frequency ( $F_x$ ).

For operation on 21420 kHz USB, compute the crystal frequency as follows:

$$F_x = 26498.5 - 21420 = 5078.5 \text{ kHz.}$$

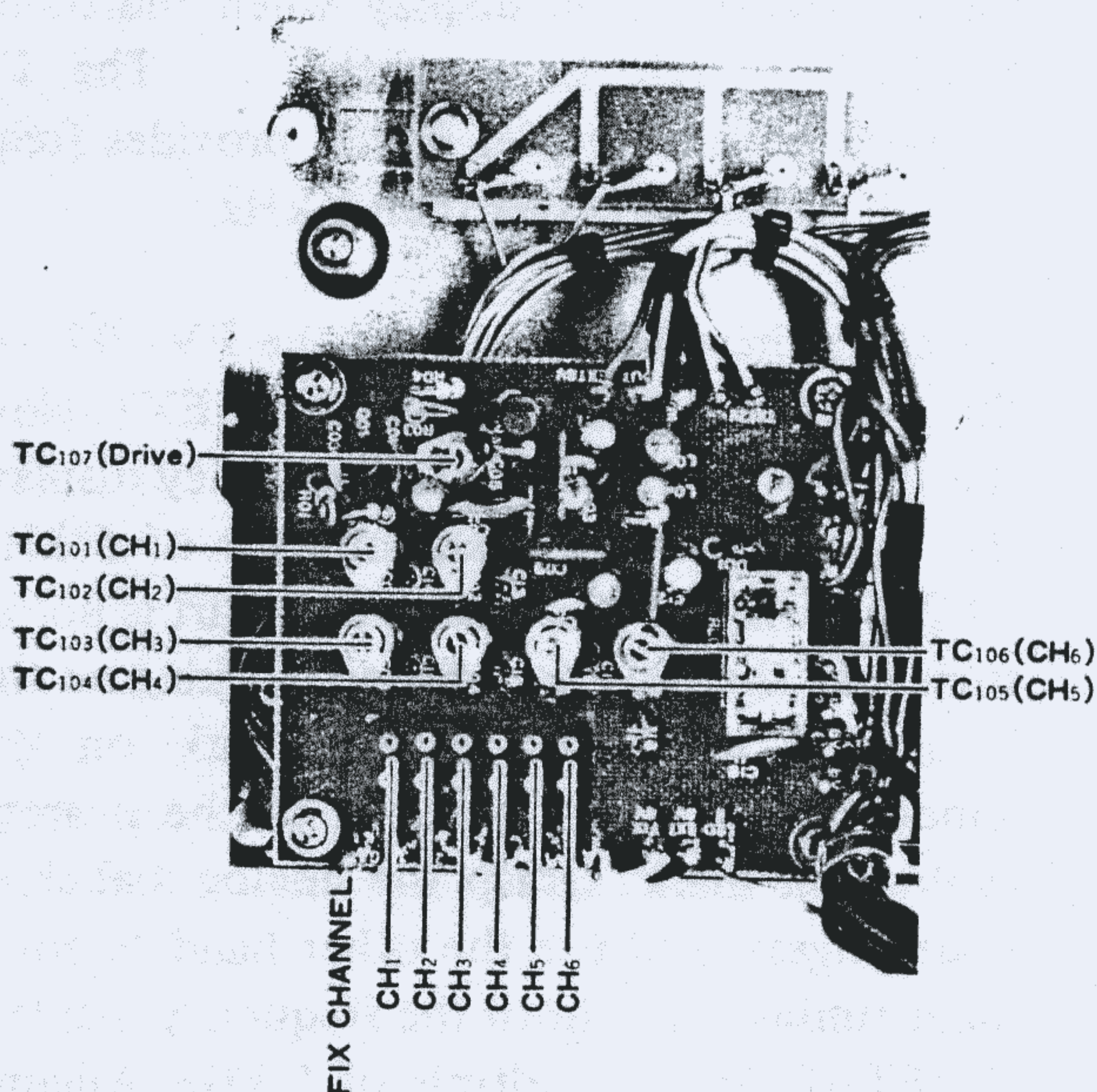
Inspection of the values of  $F_1$  in Table 1 will reveal that the 7199 kHz crystal for LSB will work on 14199 kHz, 21199 kHz, etc. Of course, LSB is not normally used on these bands. If the operator switches to USB, the operating frequency will be moved 3 kHz (in this case, to 14196 kHz, 21196 kHz, etc.). If the move is made from LSB to CW, the frequency will move 2.3 kHz down.

To net the crystals on frequency, when using the FT-107M, use the transceiver digital display to adjust the trimmers for each crystal (TC<sub>301</sub> for channel 1, TC<sub>302</sub> for channel 2, etc.). Be sure that the FIX FINE control is set to the 12 o'clock position during trimmer adjustment.

The optional crystals are available from your Yaesu dealer.

Holder	HC-25/U
Load C	30pF
Effective R	25Ω
Drive level	5mW

Table 1



MODE BAND	MODE		
	U S B	L S B	AM/CW
160m	6995.5	6998.5	6996.3
80m	8995.5	8998.5	8996.3
40m	12495.5	12498.5	12496.3
20m	19498.5	19501.5	19499.3
15m	26498.5	26501.5	26499.3
10mA	33498.5	33501.5	33499.3
10mB	33998.5	34001.5	33999.3
10mC	34498.5	34501.5	34499.3
10mD	34998.5	35001.5	34999.3

$F_1$  (kHz)

Table 2

	USB	LSB	AM/CW
12m	30.998.5	31.001.5	30999.3
10m	23.498.5	23.501.5	23.499.3
30m			



# CIRCUIT THEORY

## VFO UNIT (PB-1440B-3490)

Q<sub>801</sub> (2SC372Y) oscillates in a modified Colpitts circuit. The main tuning dial is geared to the tuning capacitor, producing a 5.0–5.5 MHz VFO signal. The sub-blades of tuning capacitor VC<sub>801</sub> compensate for temperature variations in the main blades, thus providing excellent thermal stability.

Varactor diode D<sub>801</sub> (1S2236) is controlled by the tuning of L<sub>806</sub>, thus providing  $\pm 2.5$  kHz variation of the operating frequency by way of the clarifier control.

The VFO signal is amplified by buffers Q<sub>802</sub> (2SK19GR) and Q<sub>803</sub> (2SC372Y) and delivered, through a low-pass filter, to pin 1 of the output jack.

## MAIN UNIT (PB-2051)

A crystal controlled signal at 5.0–5.5 MHz is generated by Q<sub>101</sub> (2SC380TMY), in accordance with the selection of optional crystals X<sub>101</sub>–X<sub>106</sub> performed by the FIX switch. The signal is then amplified by Q<sub>102</sub> (2SC373) and fed through a low-pass filter to the OUT jack.

# MAINTENANCE AND ALIGNMENT

This instrument has been carefully aligned and tested at the factory prior to shipment. With proper use, it will provide many years of trouble-free operation.

Service work must only be performed by qualified personnel. Any attempt to align this apparatus without the proper knowledge or test equipment will result in degraded performance.

## VFO UNIT

We recommend that all cases of VFO trouble be referred to a qualified technician. The VFO Unit is not normally subject to alignment; most cases of "VFO drift" can usually be traced to malfunctions elsewhere in the station (unstable supply voltage, etc.). The VFO is extremely critical in its adjustment, and should not be touched by other than an experienced technician.

From a service standpoint, two controls are of interest on the VFO Unit.

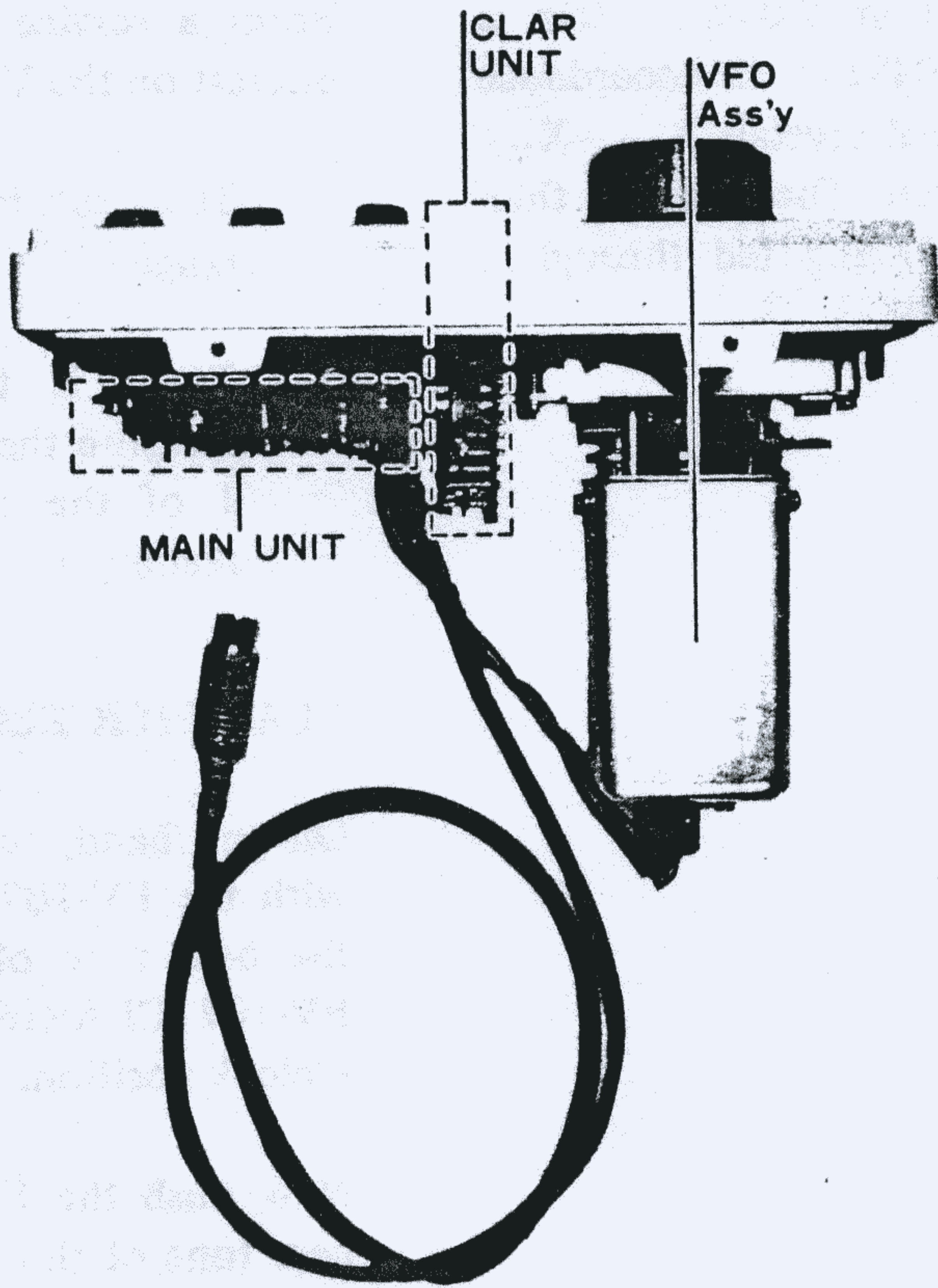
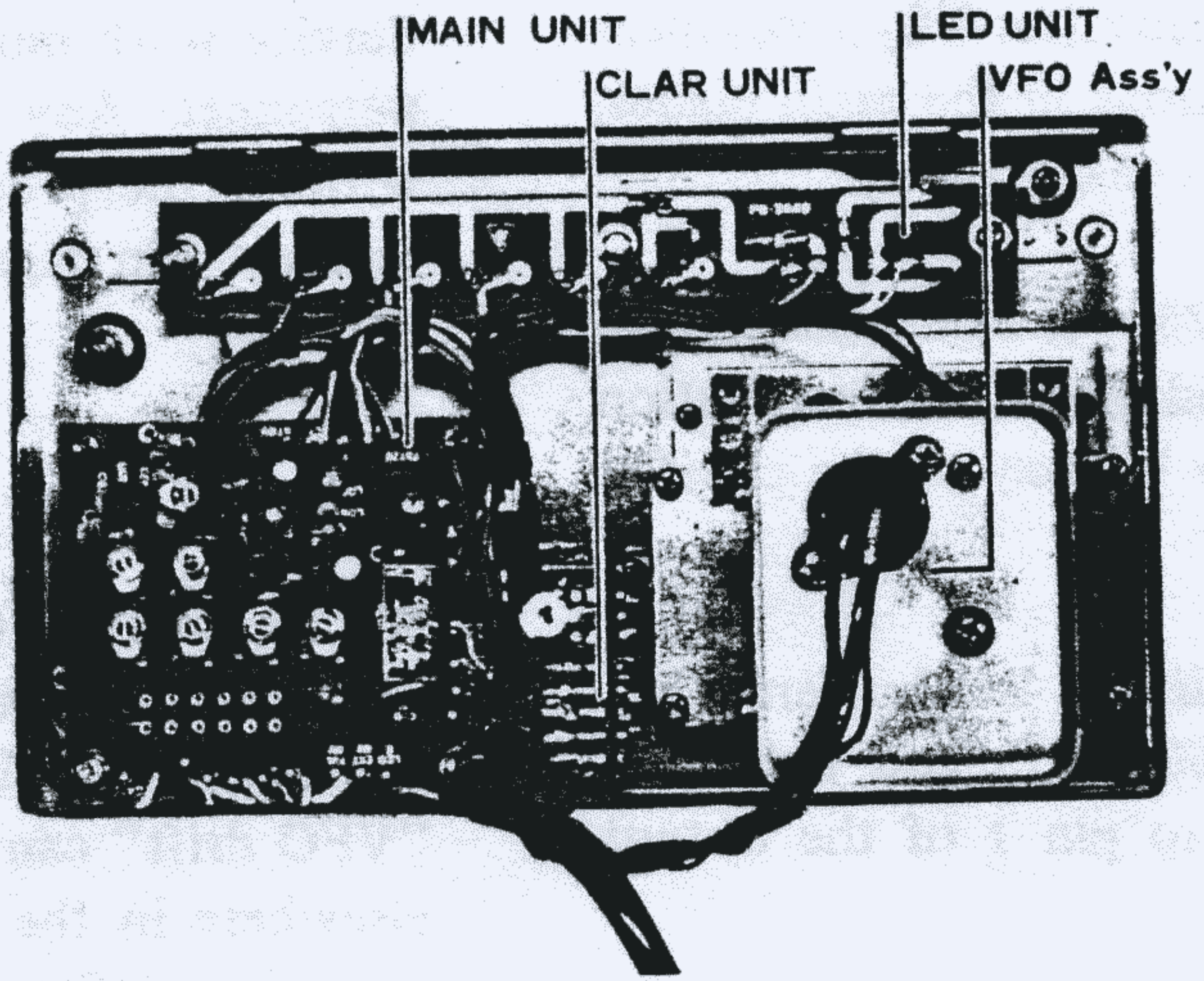
TC<sub>801</sub> sets the band edge for the 5.0–5.5 MHz range.

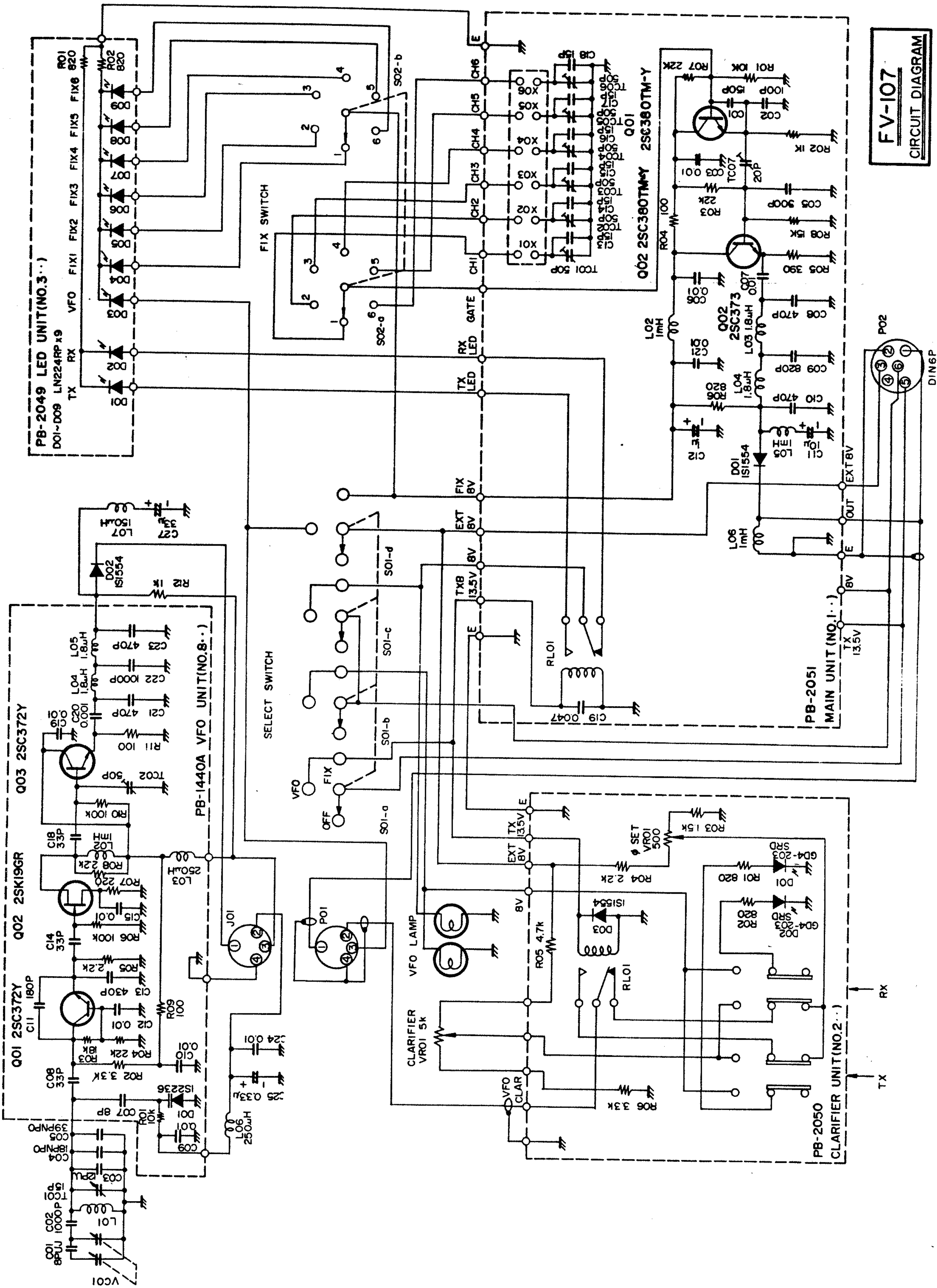
TC<sub>802</sub> is the VFO output level control. Measure the output level with a VTVM at pin 1 of the output jack. Adjust TC<sub>802</sub> for a reading of 150 mV on the VTVM.

## CLARIFIER ZERO SETTING

On any band, tune in the FT-107M marker signal with the FV-107 main dial (Clarifier OFF). Note the beat tone of the marker signal, and set the FV-107 CLARIFIER control to exactly the 12 o'clock position.

Now push the FV-107 RX button, and note the beat tone of the marker signal. If it changes at all, adjust VR<sub>201</sub> so that the frequency is the same as when the clarifier was off. Switch back and forth several times between the ON and OFF condition of the clarifier to ensure proper frequency alignment.





**FV-107**  
CIRCUIT DIAGRAM

# PARTS LIST

MAIN CHASSIS			***** VFO BOARD ASSEMBLY *****		
Symbol No.	Parts No.	Description	PB-1440B	F0001440B	Printed circuit board
		<b>POTENTIOMETER</b>			
VR1	J60800036	VM10A592A5KB 5kΩB			<b>FET &amp; TRANSISTOR</b>
			Q802	G3800190G	FET 2SK19GR
		<b>SWITCH</b>	Q801,803	G3303720Y	Tr 2SC372Y
S1	N0190048	SRN1043N			
S2	N0190047	SRN1026N			<b>DIODE</b>
			D801	G2022360	Varactor 1S2236
		<b>RECEPTACLE</b>			
J1 (with wire)	T9202450	E6-725D-00			<b>RESISTOR</b>
			R809,811	J00245101	Carbon film 1/4W VJ 100Ω
		<b>PLUG</b>	R807	J00245221	" " " " 220Ω
P1	P0090002	SI-5908	R805,808	J00245222	" " " " 2.2kΩ
			R802	J00245332	" " " " 3.3kΩ
			R801	J00245103	" " " " 10kΩ
			R803	J00245183	" " " " 18kΩ
			R804	J00245223	" " " " 22kΩ
			R806,810	J00245104	" " " " 100kΩ
VFO UNIT (5090)					
Symbol No.	Parts No.	Description			<b>CAPACITOR</b>
	C0014404	VFO ASSEMBLY	C814	K30176330	Dipped mica 50WV 33pF
	C9014404	VFO BOARD ASSEMBLY	C818	K30176390	" " " " 39pF
			C811	K30176181	" " " " 180pF
			C813	K30176431	" " " " 430pF
			C821,823	K30176471	" " " " 470pF
			C822	K30209001	" " " " 1000pF
		<b>DIODE</b>	C807	K02173080	Ceramic " CH 8pF
D802	G2015550	Si 1S1555	C808	K02175390	" " " " 39pF
			C809,810,812, 815,819,820	K13170103	" " " " 0.01μF
		<b>RESISTOR</b>			
R812	J00245102	Carbon film 1/4W VJ 1kΩ			
					<b>TRIMMER CAPACITOR</b>
		<b>CAPACITOR</b>	TC802	K91000016	EVC-1ZW 50x32 50pF
C802	K30209001	Dipped mica 50WV 1000pF			
C801	K06173080	Ceramic " UJ 8pF			
C803	K06173090	" " " " 9pF			
C804	K02175180	" " CH 18pF	L804,805	L1190007	<b>MICRO INDUCTOR</b>
C805	K02175390	" " " " 39pF	L803	L1190001	FL-4H 1R8M 1.8μH
C824,826	K13170103	" " " " 0.01μF	L802	L1190040	S4-102K 250μH
C825	K70167334	Tantalum " 0.33μF			1mH
C827	K40120336	Electrolytic 16WV 33μF		Q5000011	Wrapping terminal C
		<b>VARIABLE CAPACITOR</b>			
VC801	K90000012	C521C-112B			
		<b>TRIMMER CAPACITOR</b>			
TC801	K90000001	TSN-100D15 15pF			
			MAIN (FIX) UNIT (5090)		
			Symbol No.	Parts No.	Description
		<b>INDUCTOR</b>			
L801	L0020268		PB-2051A	F0002051A	Printed circuit board
L806	L1190001	FL0710 251K 250μH		C0020510	PCB with components
L807	L1190037	LAL04NA 151K 150μH			
					<b>TRANSISTOR</b>
P802	P1090012	<b>JACK</b> SI-6303-1	Q101,102	G3303800Y	2SC380TMY
		<b>PILOT LAMP</b>			<b>DIODE</b>
	Q1000035	BQ044-22836A	D101	G2015550	Si 1S1555
	S2000006	Color cap			
	Q5000005	Lighthouse type terminal			<b>RESISTOR</b>
	Q5000011	Wrapping terminal C	R104,105	J00245101	Carbon film 1/4W VJ 100Ω
			R106	J00245821	" " " " 820Ω

			LED UNIT		
Symbol No.	Parts No.	Description			
R102	J00245102	Carbon film 1/4W VJ 1kΩ			
R101	J00245103	" " " " 10kΩ			
R108	J00245153	" " " " 15kΩ	PB-2049	F0002049	Printed circuit board
R103,107	J00245223	" " " " 22kΩ		C0020490	PCB with components
			LED		
CAPACITOR			D301~309	G2090094	LN224RP
C105	K30176301	Dipped mica 50WV 300pF			
C108,110	K30176471	" " " " 470pF			
C109	K30176821	" " " " 820pF	R301,302	J01245821	RESISTOR Carbon film 1/4W TJ 820Ω
C101	K30176102	" " " " 1000pF			
C113~118	K02175150	Ceramic " CH 15pF			
C103,106,107	K13170103	" " " 0.01μF			
C119	K13170473	" " " 0.047μF			
C112	K40170105	Electrolytic " 1μF			
C111	K40120106	" 16WV 10μF			
			ACCESSORIES		
Symbol No.	Parts No.	Description			
TRIMMER CAPACITOR				R3054620	Foot L=30mm
TC101~106	K91000016	ECV-1ZW 50x32 50pF			
TC107	K91000017	ECV-1ZW 70x32 70pF			
			MICRO INDUCTOR		
L103,104	L1190007	FL-4H 1R8M 1.8μH			
L101,102,105,106	L1190017	FL-5H 102K 1mH			
			CRYSTAL SOCKET		
XS301	P3090045	S-14 6P			
			RELAY		
RL301	M1190002	FBR211A D012M			
	Q5000011	Wrapping terminal			
			CLARIFIER UNIT		
Symbol No.	Parts No.	Description			
PB-2050	F0002050	Printed circuit board			
	C0020500	PCB with components			
			DIODE		
D203	G2015550	Si 1S1555			
			RESISTOR		
R201,202	J00245821	Carbon film 1/4W VJ 820Ω			
R203	J00245152	" " " " 1.5kΩ			
R204	J00245222	" " " " 2.2kΩ			
R206	J00245332	" " " " 3.3kΩ			
R205	J00245472	" " " " 4.7kΩ			
			POTENTIOMETER		
VR201	J50710501	V10K-8-1-2-500 500ΩB			
			SWITCH		
S201	N4090018	SUE23			
			RELAY		
RL201	M1190002	FBR211A D012M			