

MAINTENANCE SERVICE MANUAL FT-101ZD



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INDEX

| | (Page) |
|---|--------|
| FOREWORD | i |
| SECTION 1 – GENERAL | |
| GENERAL DESCRIPTION | 1-1 |
| SPECIFICATIONS | 1-2 |
| RECOMMENDED ACCESSORIES | 1-3 |
| CONTROLS AND SWITCHES | 1-4 |
| REAR APRON CONNECTIONS | 1-6 |
| MICROPHONE CONNECTIONS | 1-9 |
| INTERCONNECTIONS | 1-12 |
| INSTALLATION | 1-14 |
| OPERATION | 1-16 |
| SECTION 2 – TECHNICAL NOTES | |
| PARTS DESIGNATIONS ON CIRCUIT BOARDS | 2-1 |
| AUGMENTED BLOCK DIAGRAMS | 2-2 |
| FREQUENCY RELATIONSHIPS/CRYSTAL DATA | 2-7 |
| CIRCUIT DESCRIPTION | 2-8 |
| SECTION 3 – SERVICING | |
| OUTER COVER REMOVAL | 3-1 |
| FRONT PANEL REMOVAL | 3-2 |
| CIRCUIT BOARD LAYOUT | 3-3 |
| PILOT LIGHT REPLACEMENT | 3-4 |
| CW FILTER INSTALLATION | 3-5 |
| COUNTER UNIT INSTALLATION ON FT-101Z | 3-6 |
| AUX BAND INSTALLATION | 3-7 |
| DC-DC CONVERTER INSTALLATION | 3-10 |
| COOLING FAN INSTALLATION | 3-11 |
| SOLDERING AND DESOLDERING TECHNIQUE | 3-12 |
| CIRCUIT TRACE REPAIR | 3-14 |
| MODIFICATIONS | |
| REVERSAL OF FV-901DM DIAL SENSE | 3-16 |
| RECTIFIER B UNIT MODIFICATION | 3-18 |
| LOW-PASS FILTER ADDITION | 3-20 |
| VOX CIRCUIT MODIFICATION | 3-21 |
| COUNTER CIRCUIT MODIFICATIONS | 3-22 |
| VFO DRIFT WHEN ADJUSTING DIMMER CONTROL | 3-23 |
| FT-101Z (ANALOG) SPURIOUS AT 21.2 MHz | 3-24 |
| AF UNIT CAPACITOR POLARITY CHECK | 3-25 |

| | |
|--|------|
| MAINTENANCE AND ALIGNMENT | 3-26 |
| FAULT LOCALIZATION | 3-37 |
| TROUBLESHOOTING | 3-38 |
| TROUBLESHOOTING CHART | 3-40 |
| RELAY CONNECTION INFORMATION | 3-47 |
| CIRCUIT BOARD LAYOUTS AND TEST VOLTAGES | |
| RF UNIT (PB-1960A) | 3-48 |
| NB/FIX UNIT (PB-1961B) | 3-50 |
| PRE MIX UNIT (PB-1962A) | 3-52 |
| IF UNIT (PB-1963C) | 3-54 |
| AF UNIT (PB-1964) | 3-58 |
| PREMIX LOCAL UNIT (PB-1965) | 3-62 |
| VFO ASSEMBLY (PB-1440B-3420) | 3-64 |
| RECTIFIER A UNIT (PB-1967) | 3-66 |
| CAPACITOR UNIT (PB-1969A) | 3-67 |
| RECTIFIER B UNIT (PB-1968B) | 3-68 |
| TRIMMER BOARDS (PB-1970A/B, PB-1902) | 3-70 |
| LED UNIT (PB-1974A), SELECT SW UNIT (PB-1966C) | 3-72 |
| BANDWIDTH CONTROL UNIT (PB-1972) | 3-73 |
| CLARIFIER UNIT (PB-1973) | 3-73 |
| LEVER SWITCH UNIT (PB-1975A) | 3-74 |
| COUNTER/DISPLAY UNITS (PB-1978/1979/1980) | 3-75 |
| DRIVER/FINAL AMPLIFIER STAGES (PB-1714A/1715A) | 3-78 |
| AM UNIT (PB-2040) | 3-80 |

SECTION 4 – REPAIR PARTS

| | |
|------------------------------------|-----|
| PARTS LIST AND ORDERING DATA | 4-1 |
| PARTS LIST | 4-5 |

FOREWORD

The purpose of this manual is to provide the reader with information critical to the operation and maintenance of the FT-101ZD transceiver. Technical details are geared for maximum comprehension by the technician or owner, rather than the design engineer. To this end, the descriptions have been kept brief, while photographs and drawings are utilized liberally.

Use of this manual is entirely at the owner's risk. While we believe the material presented herein to be correct and factual, we assume no liability for damage which may occur when this manual is used as a reference.

The FT-101ZD has had an enviable service record, and we trust that you will seldom have recourse to this manual. Should reference be necessary, though, we hope and trust that the information presented will be sufficient for your service needs.

The author wishes to express his gratitude to the engineering and service staffs of Yaesu Musen Company and Yaesu Electronics Corporation, whose skills and insights have contributed significantly to the completion of this manual.

73,



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Public Relations Manager
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Introduction

The purpose of this study is to investigate the effects of the proposed system on the performance of the system. The study is divided into two parts: a theoretical analysis and an experimental evaluation. The theoretical analysis is presented in Chapter 2, and the experimental evaluation is presented in Chapter 3.

The theoretical analysis is based on the assumption that the system is a linear system. The experimental evaluation is based on the assumption that the system is a nonlinear system. The results of the theoretical analysis and the experimental evaluation are compared in Chapter 4.

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Chapter 2

Chapter 3

Chapter 4

Chapter 5

SECTION 1 – GENERAL

| | |
|-------------------------------|------|
| GENERAL DESCRIPTION | 1-1 |
| SPECIFICATIONS | 1-2 |
| RECOMMENDED ACCESSORIES | 1-3 |
| CONTROLS AND SWITCHES | 1-4 |
| REAR APRON CONNECTIONS | 1-6 |
| MICROPHONE CONNECTIONS | 1-9 |
| INTERCONNECTIONS | 1-12 |
| INSTALLATION | 1-14 |
| OPERATION | 1-16 |

HIGH-PERFORMANCE HF TRANSCEIVER

YAESU FT-101ZD



GENERAL DESCRIPTION

The FT-101Z series was introduced early in 1979 as the culmination of a decade of experience with the FT-101 series. Borrowing heavily from the highly regarded FT-901 series, the FT-101Z series brings together a number of "top of the line" features at a "bottom of the line" price.

As with the FT-901, the receiver section of the FT-101Z is particularly impressive. Careful gain distribution has produced wide dynamic range, without compromising sensitivity. Variable IF bandwidth allows continuous adjustment of the width of the IF passband from 300 Hz to 2.4 kHz, and an all-new noise blanker provides significantly improved blanking capability.

The transmit side includes a high-performance RF speech processor, which provides a significant increase in average power without the distortion found in some AF clipping systems used in other makes of equipment. The final tubes utilize RF negative feedback, for improved linearity.

Built into every FT-101ZD transceiver are digital plus analog readout of the operating frequency, VOX, semi-break-in CW with sidetone, a 25 kHz crystal calibrator, selectable AGC, and a 10 dB/

20 dB attenuator in the receive line. For the economy FT-101Z model, the counter and display units are options, which may easily be added at a later date, should you decide to upgrade your station.

Compatibility with the FT-901DM series accessories lets you take advantage of such advanced features as the scanning and memory of the FV-901DM external synthesized VFO; the FTV-901R VHF/UHF transverter; and the YO-901 Multiscope. Read on for details of these accessories and their use with the FT-101Z.

All circuits, except for the driver and final amplifier tubes, are solid state. If the ratings of the solid state devices are not exceeded, they will exhibit practically infinite lifetimes. The FT-101Z series may be operated from AC supplies of 100/110/117/200/220/234 volts, and a DC-DC converter is an available option.

The pages to follow will describe more fully the high-performance features and ease of operation of the FT-101ZD. For today's active amateur, the 101Z series is, indeed, "THE RADIO."

GENERAL

SPECIFICATIONS

Frequency coverage:

| | |
|---------|-----------------|
| 160 m | 1.8 - 2.0 MHz |
| 80 m | 3.5 - 4.0 MHz |
| 40 m | 7.0 - 7.5 MHz |
| 20 m | 14.0 - 14.5 MHz |
| 15 m | 21.0 - 21.5 MHz |
| 10 m | 28.0 - 29.9 MHz |
| WWV/JJY | 5.0 - 5.5 MHz |

Power requirements:

AC 100/110/117/200/220/234 volts,
50/60 Hz
DC 13.5 volts $\pm 10\%$
(DC-DC converter optional)

Power consumption:

AC 85 VA receive
(73 VA HEATER OFF)
330 VA transmit
DC 5.5 amps receive
(1.1 amps HEATER OFF)
21 amps transmit

Size:

345 (W) x 157 (H) x 326 (D) mm

Weight:

Approx. 15 kg.

TRANSMITTER

Emission type:

LSB, USB, CW
AM (after prod. lot #8)

Power input:

180 watts DC (SSB, CW)
50 watts DC (AM)

Carrier suppression:

Better than 40 dB

Unwanted sideband suppression:

Better than 40 dB (14 MHz, 1 kHz)

Spurious radiation:

Better than 40 dB down

Transmitter frequency response:

300 - 2700 Hz (-6 dB)

Third order distortion products:

Better than 31 dB down

Transmitter frequency stability:

Less than 300 Hz after 10 minute warmup;
less than 100 Hz after 30 minute warmup.

Antenna output impedance:

50 - 75 ohms, unbalanced

Microphone input impedance:

500 - 600 ohms (low impedance)

RECEIVER

Sensitivity:

0.25 μ V for S/N 10 dB (SSB, CW)
0.5 μ V for S/N 10 dB (AM)

Image rejection:

Better than 60 dB (160 - 15 m)
Better than 50 dB (10 m)

IF rejection:

Better than 70 dB (160, 80, 20, 15, 10 m)
Better than 60 dB (40 m)

Selectivity:

SSB, AM 2.4 kHz at 6 dB down, 4.0 kHz at
60 dB down
CW (with optional CW filter) 600 Hz at 6 dB
down, 1.2 kHz at 60 dB down

Bandwidth control:

Continuous from 2.4 kHz to 300 Hz

Audio output impedance:

4 - 16 ohms

Audio output:

3 watts at 10% THD, 4 ohm load

Specifications subject to change without notice.

TUBES AND SEMICONDUCTORS

Vacuum tubes

12BY7A 1
6146B 2

Transistors

T20A6 2
2SA496Y 1
2SA564A 3
2SA639 1
2SA733 1
2SB616 1
2SC372Y 25
2SC373 2
2SC380TMY 3
2SC535A 1
2SC732TMGR 1
2SC1000GR 2
2SC1383 1
2SC1583 2
2SC1815Y 6
2N4427 1
MPS3640 1
MPSA13 1

Field Effect Transistors

2SK19GR 11
2SK19BL 1
3SK40M 2
3SK51-03 8
J310 2

Integrated Circuits (IC)

μ PC78L05 1
 μ PC78L12 1
 μ PC14305 1
 μ PC14308 1
 μ PC2002H 1
MC3403P 1
MC10116 1
MC14024B 1
MSM561RS 6
MSM5564 1
SN76514N 1
SN74LS04N 1
SN74LS123N 1
SN74196N 1
SN74LS196N 6
TA7060P 1
TA7063P 1

Germanium Diodes

1N60 11
1S1007 (GB) 10

Silicon Diodes

1S1555 96
10D1 4
10D10 8
V06B 2

Zener Diodes

WZ061 1
WZ090 1

Varactor Diodes

1S2209 1
1S2236 1

Light Emitting Diodes

GD4-203SRD 9

LED Display

HP-5082-7623 6

FT-101ZD SERIES MODEL CHART

○ = BUILT-IN FEATURE X = AVAILABLE OPTION

| FEATURE | FT-101ZD | FT-101Z |
|-------------------|----------|---------|
| ALL BAND CRYSTALS | ○ | ○ |
| COUNTER UNIT | ○ | X |
| DC-DC CONVERTER | X | X |
| CW FILTER | X | X |
| MICROPHONE | X | X |
| RF PROCESSOR | ○ | ○ |
| COOLING FAN | X | X |

RECOMMENDED ACCESSORIES



FV-901DM



FTV-901R

**FV-901DM SYNTHESIZED, SCANNING
REMOTE VFO**

The FV-901DM external VFO provides a synthesized control system for your FT-101ZD station. A three-speed scanner will take you anywhere in the band instantly, and the auto-scan feature will sweep the band until it finds a signal.

The 100 Hz steps of the synthesizer are coupled with a 40-frequency memory bank, allowing wide versatility for contest, DX, or net operation. The TX/RX clarifier allows offset from either dial or memory frequencies, for precise tuning.

Because there is no display provided on the FV-901DM, it is not readily possible to use this unit with the analog FT-101Z, as the operating frequency cannot be determined.

FTV-901 VHF/UHF/OSCAR TRANSVERTER

In another Yaesu "first," the FTV-901R brings together three bands in the VHF and UHF regions, all in one compact case. The basic FTV-901R comes equipped for 144–148 MHz, and the 6 meter and 70 cm modules may be added as options.

The satellite 1–3 bands provide operation on OSCAR Modes A/B/J, on full duplex, when an external receiver is used. Of course, the FT-221R or FT-225RD transceivers may be used for transmission on the OSCAR 145 MHz uplink. In this case, your FTV-901R can be used for instant QSY between 29 MHz, 145 MHz, and 435 MHz.

Repeater split is provided on 6 and 2 meters.



YO-901

YO-901 MULTISCOPE

The YO-901 Multiscope provides superb monitoring capability, with instant interface to your FT-101ZD station. Output signal monitoring, trapezoidal and two-tone tests, and general oscilloscope measurements are made with ease with the YO-901.

A panoramic adapter, known as the Band Scope, is an available option, allowing quick examination of the band for activity.

IF TX and RX monitoring is not possible with the FT-101ZD/YO-901 combination.



SP-901P

SP-901P SPEAKER/HYBRID PHONE PATCH

The SP-901P features a shaped-response loudspeaker, and the hybrid phone patch allows efficient operation during patches. Styling and size match the FT-101Z series.

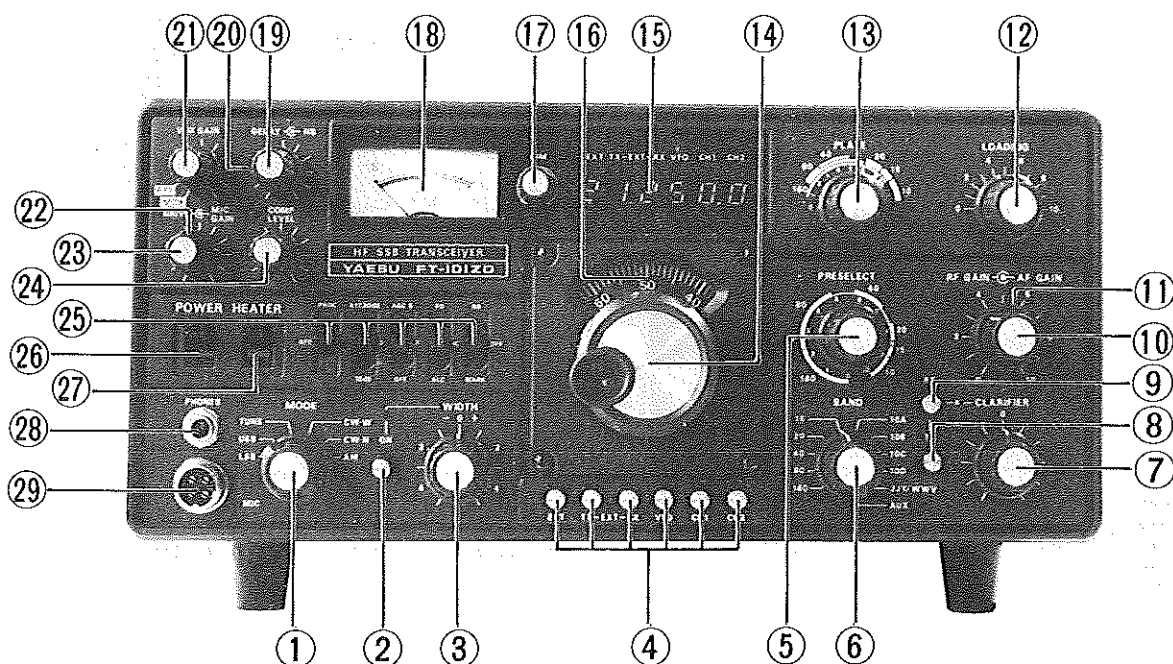


FC-901

FC-901 ANTENNA COUPLER

Present a 50 ohm load to your FT-101ZD transceiver all across the band with the FC-901 antenna coupler. As many as three coax-fed antennas, and one random wire antenna, may be accommodated. SWR and power metering allow quick determination of proper matching conditions.

CONTROLS AND SWITCHES

**(1) MODE**

Selection of LSB, USB, CW-W (SSB filter), CW-N (optional CW filter) and AM is provided.

(2) WIDTH ON

When this button is pressed, the variable bandwidth function is activated.

(3) WIDTH

This control varies the IF bandwidth from 2.4 kHz down to 300 Hz. When the WIDTH switch is OFF, the bandwidth is fixed by the filter selected at the MODE switch.

(4) SELECT switches

When using the optional FV-901DM synthesized, scanning external VFO, these switches determine which component will control the transmit, receive, or transceive frequency.

EXT..... This switch, when pressed, shifts control of the transceive frequency to the external VFO.

TX EXT... This switch, when pressed, shifts control of the transmit frequency to the external VFO.

RX EXT... This switch, when pressed, shifts control of the receive frequency to the external VFO.

VFO..... This switch selects control of the transceive frequency on the FT-101ZD internal VFO.

CH1, CH2... These switches select optional fixed channels, transceive only.

(5) PRESELECT

The preselector control peaks the RF and IF stages for the frequency in use.

(6) BAND

The bandswitch selects the frequency band in use: 160 - 10 meters, plus WWV/JJY 5 MHz.

(7) CLARIFIER

The clarifier control allows offset of ± 2.5 kHz from the frequency established by the main tuning dial.

(8) (9) CLARIFIER SELECT switches

Press the RX button for offset of the receive frequency.

Press the TX button for offset of the transmit frequency.

Press both buttons for offset of the transceive frequency.

(10) AF GAIN

The AF GAIN control varies the output level of the audio amplifier stages. Clockwise rotation increases the audio output level.

(11) RF GAIN

The RF GAIN control varies the gain of the RF and IF stages. Clockwise rotation increases the gain of these stages.

(12) LOADING

This control tunes the output circuit of the final amplifier pi network to match the feedpoint impedance of the load.

(13) PLATE

This control tunes the plate circuit of the final amplifier.

(14) MAIN TUNING KNOB

Rotation of this knob selects the operating frequency, in conjunction with the setting of the bandswitch. One revolution of the dial produces a frequency change of approximately 17 kHz.

(15) DIGITAL DISPLAY

The digital display reads out the operating frequency, with resolution to 100 Hz. The display unit is built into the FT-101ZD, and is an available option for the FT-101Z.

(16) ANALOG DIAL

The analog dial allows readout of the operating frequency to better than 1 kHz. The combination of the precision dial mechanism and drive unit provides zero backlash at slow tuning rates.

(17) DIM

This control allows dimming of the meter and dial lamps.

(18) METER

The meter displays final amplifier cathode current (IC), relative power output (PO), and ALC feedback voltage.

(19) NB

This control varies the threshold point for the noise blanker, and should be set to the minimum point that provides the desired blanking action.

(20) DELAY

This control sets the delay time for the VOX relay. For voice-actuated SSB, or semi-break-in CW, the operator may select the delay time most suitable for his or her operating habits.

(21) VOX GAIN

The threshold level for the VOX (voice operated relay) system can be varied using this control. In the PTT position, PTT (push to talk) control is provided, for relay control via the microphone PTT switch or footswitch.

(22) DRIVE

This control sets the carrier level for CW/AM and tuning purposes. When the RF processor is ON, this control varies the RF output on SSB, as well.

(23) MIC GAIN

This control sets the output level of the microphone amplifier stage. Clockwise rotation increases the mic gain level.

(24) COMP LEVEL

This control varies the compression level for the built-in RF speech processor. The processor does not function in the AM mode.

(25) FUNCTION switches

PROC This switch activates the RF speech processor.

ATT This switch allows the insertion of 10 or 20 dB attenuators in the incoming signal path.

AGC S/F/OFF .. This switch allows selection of the desired AGC decay time. In the OFF position, the AGC is switched off, and the S-meter will not function.

PO/IC/ALC ... In the PQ position, relative power output is displayed on the meter. In the IC position, final amplifier cathode current is displayed. In the ALC position, ALC voltage is displayed. Regardless of the setting of the meter switch, the meter functions as an S-meter on receive.

NB/MARK In the NB position, the noise blanker is activated. In the MARK position, the internal crystal calibrator is activated.

GENERAL

(26) POWER

This is the main ON/OFF switch for the transceiver.

(27) HEATER

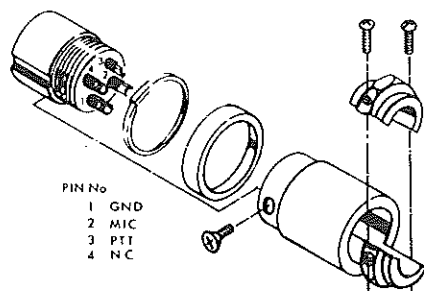
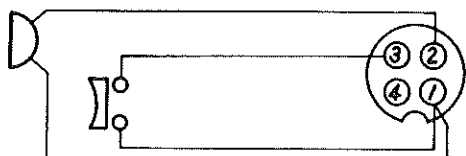
With the HEATER switch on, heater voltage is applied to the driver and final amplifier tubes. This switch may be turned off during periods of RX, when energy conservation is critical.

(28) PHONES

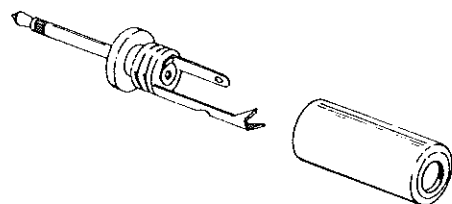
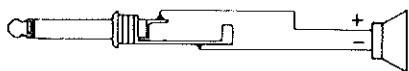
This is a standard ¼" phone jack for use with headphones.

(29) MIC

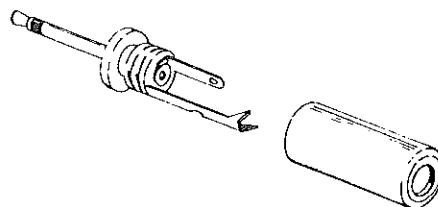
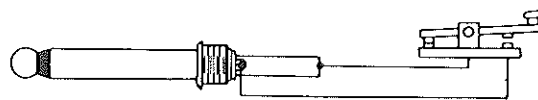
This is a 4 conductor jack for microphone and PTT input.



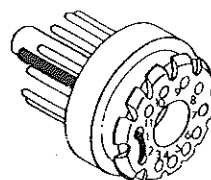
Mic plug



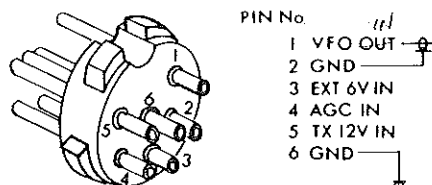
Headphone and external speaker plug



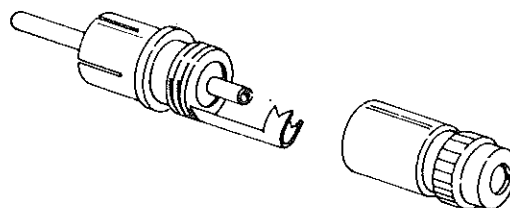
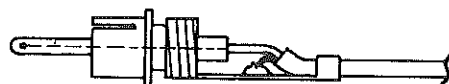
Key plug



ACC plug

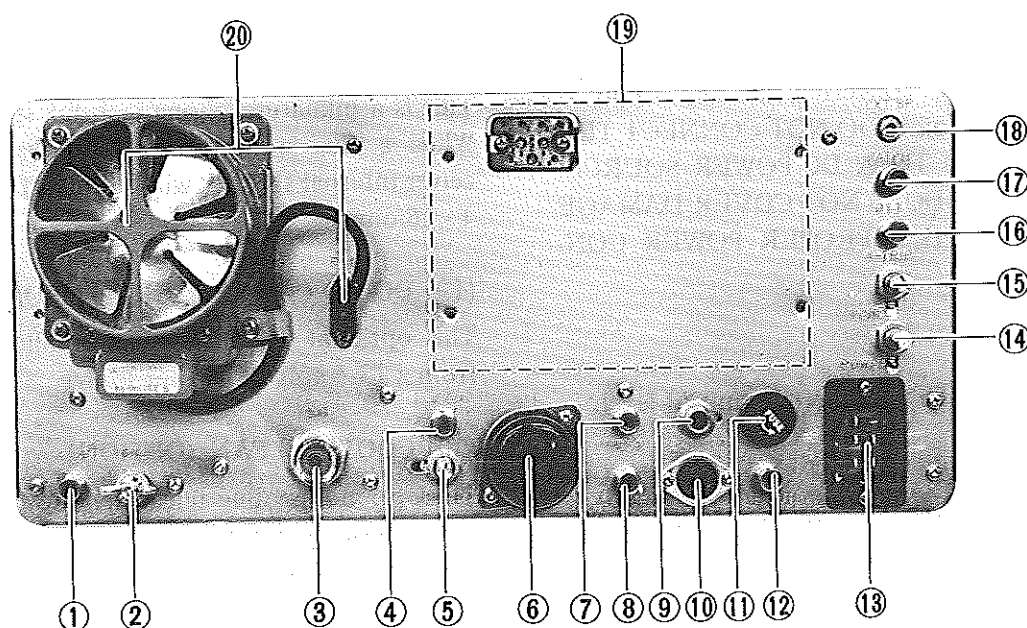


VFO Plug



Pin plug

REAR APRON

**(1) RF OUT**

RF output of 3 volts RMS is available at this jack for use with a transverter. Output is from the driver stage.

(2) GND

For best transceiver performance, as well as protection from electrical shock, a good ground connection should be made at this point, using a heavy, braided wire of the shortest length possible.

(3) ANT

Standard "UHF" connector for the antenna.

(4) RCV ANT

This jack is switched in parallel with the ANT jack on receive, for use with an external receiver.

(5) PO ADJ

This control adjusts the relative power output meter.

(6) ACC

Transceiver operating voltages and relay connections can be accessed through the accessory jack. Please insert the ACC plug at all times, to provide heater voltage for the driver and final amplifier tubes.

(7) TONE OUT

The CW sidetone may be fed to an external receiver through this jack.

(8) A TRIP IN

Anti-trip input from an external receiver may be made via this jack, to prevent the receiver audio output from tripping the FT-101ZD VOX.

(9) KEY

The CW key may be connected at this point. Key-up voltage is 7 volts, and key-down current is 1.5 mA. Be sure your electronic keyer's output switch will handle these levels.

(10) EXT VFO

Connection of an external VFO, such as the FV-901DM, can be made at this jack.

(11) FUSE

This is the fuse holder. For 100 - 117 volts, replace with only a 5 amp fuse. For 200 - 234 volts, use a 3 amp fuse. Replace fuses only with a fuse of the proper rating.

(12) IF OUT

Wideband IF output is available at this jack for use with a spectrum analyzer, etc.

GENERAL

(13) POWER

Connect the AC power cord at this point, being certain that your AC supply voltage matches the voltage specification for your transceiver. See the transformer primary connection chart. When using the optional DC-DC converter, the DC supply is connected at this point. **DO NOT CONNECT THE AC POWER CORD TO A DC POWER SOURCE. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY SUCH IMPROPER POWER CONNECTIONS.**

(14) TONE

This control varies the CW sidetone output level.

(15) A TRIP

This control varies the level of the VOX anti-trip circuit.

(16) PTT

External control of the transceiver PTT (push to talk) system may be made at this jack, for use with a footswitch, etc.

(17) PATCH

Microphone or phone patch input may be made at this jack. Impedance is 500 ohms.

(18) EXT SP

This is a miniature phone jack for speaker output. When a plug is inserted into this jack, the transceiver internal speaker will be cut off. Impedance is 4 - 16 ohms.

(19) DC-DC CONVERTER (OPTION)

The optional DC-DC converter allows operation from a 13.5 volt DC power source.

(20) COOLING FAN (OPTION)

The optional cooling fan keeps the tubes at a safe operating temperature, when they are used in a hot environment. The 2 pin fan power jack supplies 100 volts to the fan.

ACCESSORIES

The following accessories are included with your new transceiver:

(1) AC POWER CORD 1

The power cord comes equipped with a 6-prong connector for connection to the AC supply.

(2) ACC PLUG 1

The accessory plug allows access to relay contacts and transceiver operating voltages. The ACC plug must be inserted in the accessory socket for proper operation of the transceiver, whether or not external connections are being made.

(3) PHONO PLUG 2

Use these plugs for interface with station equipment via the FT-101ZD rear panel.

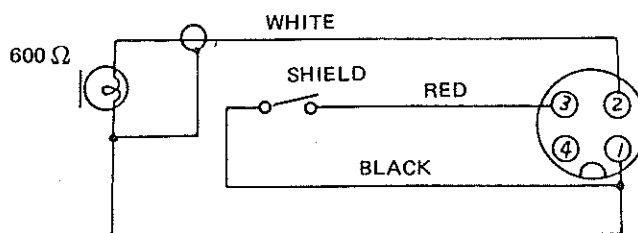
(4) SPARE FUSES 5A (3A) 1 each

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.** For 100 - 117 volt AC operation, use a 5 amp fuse. For 200 - 234 volt operation, use a 3 amp fuse.

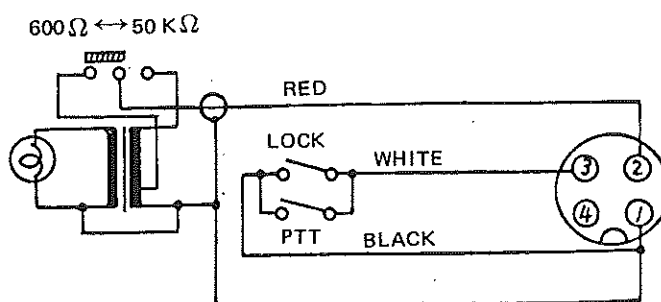
MICROPHONE CONNECTIONS



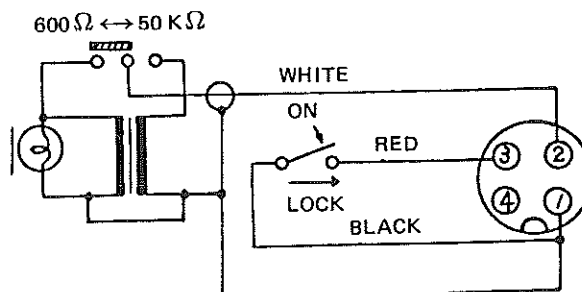
YE-7A

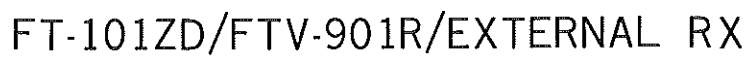


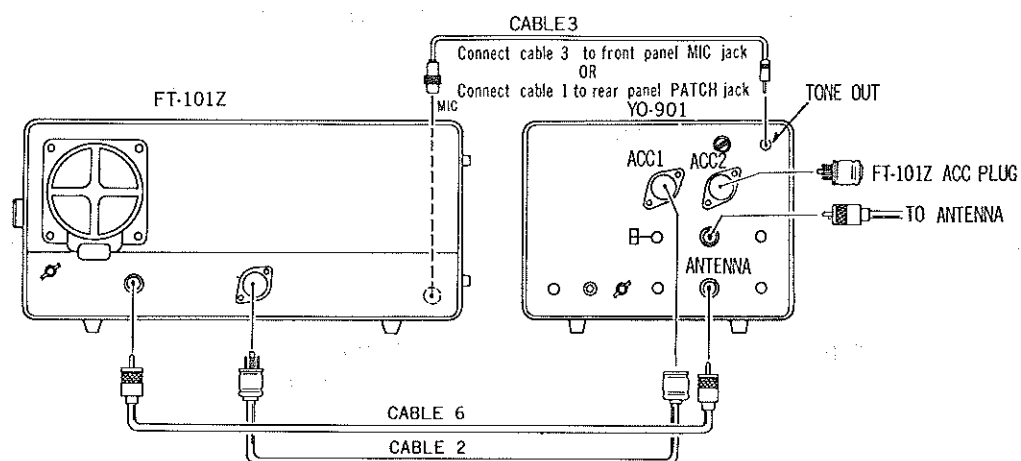
YD-844A



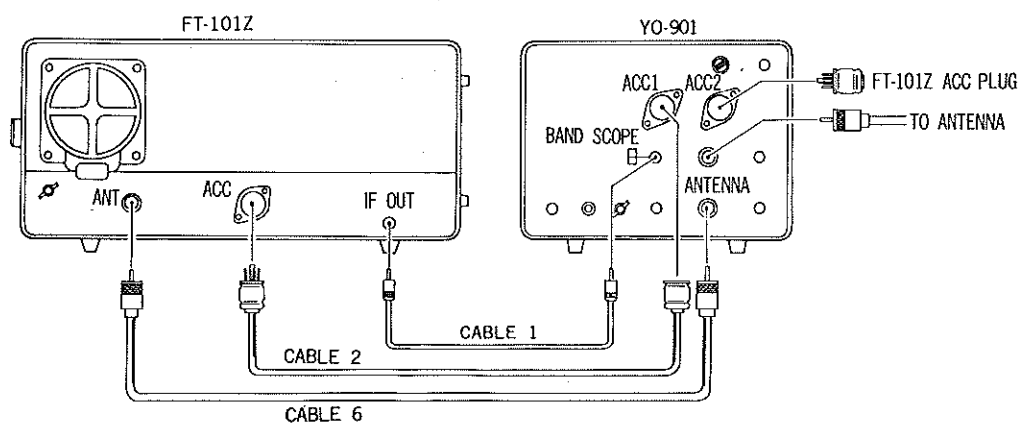
YD-148



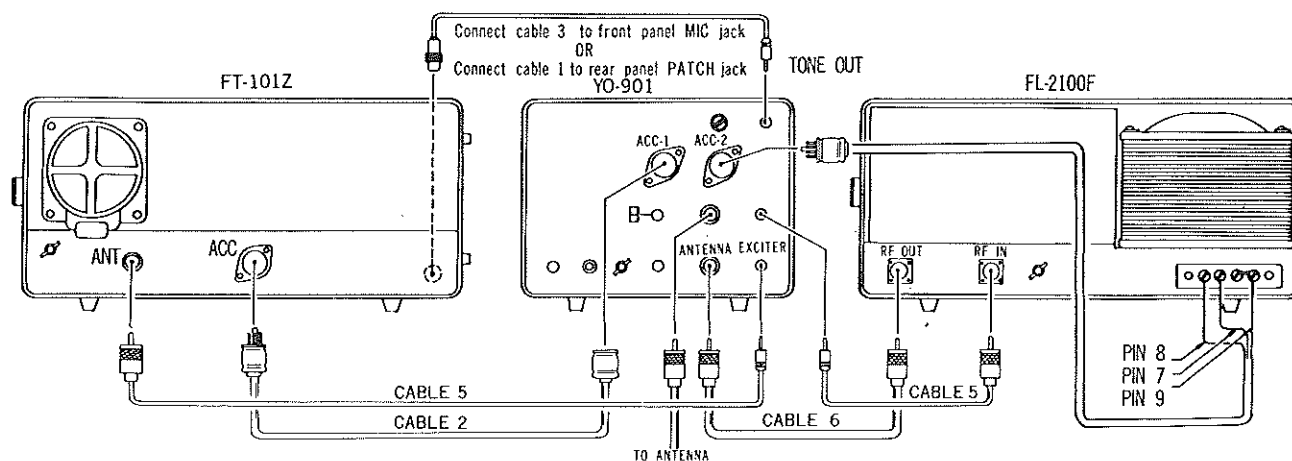




FT-101ZD/YO-901
(monitorscope mode)



FT-101ZD/YO-901
(Band scope mode)



FT-101ZD/YO-901/FL-2100F

INSTALLATION

The FT-101ZD is designed to be a single-unit station for fixed or portable operation from AC power. Power supply connections providing for operation from a variety of source voltages are available. Please read the following sections carefully, so as to ensure proper installation of your new transceiver.

PRELIMINARY INSPECTION

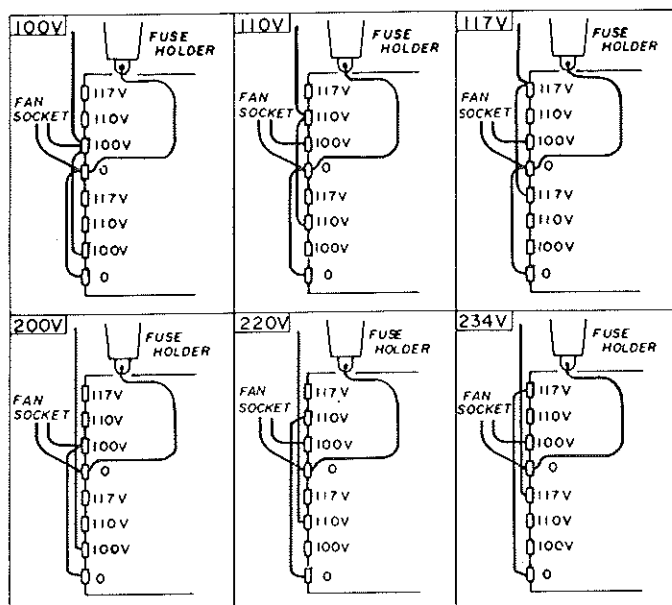
Upon opening the packing carton, immediately give the transceiver a thorough visual inspection. Check to see that all controls and switches are working freely, and inspect the cabinet for any signs of damage. If any damage has been sustained, immediately contact the shipping company, and document the damage completely. Save the packing carton and foam packing material for possible use at a later date.

BASE STATION INSTALLATION

The FT-101ZD is designed for use in many areas of the world, using supply voltages that may differ from your local supply voltage. For this reason, be absolutely certain that the voltage specification marked on the rear of the transceiver agrees with the local AC supply voltage. **THIS INSPECTION MUST BE MADE BEFORE CONNECTING THE AC POWER CORD TO THE REAR APRON OF THE TRANSCEIVER.**

CAUTION

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSCEIVER. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF IMPROPER SUPPLY VOLTAGE. DO NOT CONNECT THE AC POWER CORD TO A DC POWER SOURCE.



The transceiver should be connected to a good earth ground. The ground lead should be made of a heavy, braided wire, and should be connected to the GND terminal on the rear apron of the transceiver.

MOBILE INSTALLATION

(Note: The DC-DC converter described herein is optional equipment. See your Yaesu dealer.)

When the optional DC-DC converter is installed, the FT-101ZD will operate satisfactorily from a 13.5 volt DC power source capable of providing the required current. The DC power cord is included with the DC-DC converter kit.

For under-dash mobile mounting, a special mobile mounting bracket is an available option for your transceiver. The FT-101ZD should be located away from heater ducts, and a minimum of two inches of air space on all sides is recommended, to allow proper air flow around the cabinet. Never stack other units above or below the FT-101ZD, as the accumulated heat from both units could cause damage.

The transceiver requires an average of 14 amps on transmit, with 20 amps on voice peaks. The DC power cable comes equipped with a 20 amp fuse. Be certain to use only a 20 amp fuse when making replacement.

When making battery connections, be absolutely certain that the RED lead is connected to the POSITIVE battery terminal, and the BLACK lead is connected to the NEGATIVE battery terminal. Reversed connections could cause permanent damage to the transceiver. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER SUPPLY CONNECTIONS.**

It is recommended that the power connections be made directly to the battery, instead of to the ignition switch, etc. The battery provides considerable filtering action against ignition noise, and connection to the ignition switch can place the power line in a noisy circuit. Keep the power lead as short as possible, and keep the lead away from ignition cables.

Before connecting the DC power cable to the transceiver, check the battery voltage with the engine running (battery charging). If the voltage exceeds 15 volts DC, the vehicle voltage regulator should be adjusted, so as to limit the highest charging rate to less than 15 volts. As well, do not operate the transceiver if the DC supply voltage is less than 12 volts. The transceiver should always be turned off when the car is started, to prevent voltage transients from damaging the power supply components.

ANTENNA CONSIDERATIONS

The FT-101ZD is designed for use with an antenna system presenting a 50 - 75 ohm resistive load at the antenna jack. While the transmitter output circuitry is designed for uniform response within this impedance range, significant departures from the 50 - 75 ohm specification will result in seriously degraded transceiver performance, and may result in damage to the final amplifier tubes.

If an open-wire feedline is used, or if the input impedance of the antenna system presents a higher or lower impedance than specified, some sort of antenna tuner must be used to provide the proper impedance for the transceiver. See your Yaesu dealer for details of the FC-901 antenna coupler.

For mobile operation, most of the commercially-available antennas will provide satisfactory results, if care is taken to tune the antenna for minimum SWR. The outer conductor of the coaxial cable should be securely grounded to the automobile chassis at the antenna mount. See your Yaesu dealer for details on the RSL series of mobile antennas.

OPERATION

The tuning procedure for this transceiver is not complicated. However, care should be exercised when tuning so that peak performance of the equipment is secured. The following paragraphs describe the procedure for receiver and transmitter tuning.

INITIAL CHECK

Before connecting the transceiver to the power source, be certain that the voltage specification marked on the rear of the transceiver matches your local supply voltage, and also confirm that a fuse of the proper rating is being used.

FREQUENCY SELECTION

Frequency readout on the FT-101ZD is by digital as well as analog displays. The FT-101Z uses analog display only. The analog readout dial provides resolution to 1 kHz, while the FT-101ZD digital display provides resolution to 100 Hz. The digital display may be added to the FT-101Z as an option. See your Yaesu dealer for details.

RECEIVE OPERATION

- (1) Preset the controls and switches as follows:
 - POWER OFF
 - HEATER OFF
 - VFO Switch pushed
 - VOX GAIN . . . PTT position
 - RF GAIN Fully clockwise
 - AF GAIN Adjust later for comfortable level
 - BAND Desired band
 - MODE Desired mode
 - PRESELECT . . . Desired band segment
 - AGC OFF
 - ATT OFF
 - MARK/NB . . . OFF
- (2) Turn the power switch to ON. The meter will light up, and the operating frequency will be displayed on the dial window (FT-101ZD). Adjust the AF GAIN control for a comfortable listening level, and adjust the PRESELECT control for maximum receiver noise or signal level. The PRESELECT control may require repeaking as the transceiver is tuned across the band.

- (3) The RX CLARIFIER may be utilized if the received signal is drifting. Push the RX button, and rotate the CLARIFIER control for offset of up to 2.5 kHz. A red LED indicator will light up when the clarifier is in use.
- (4) When pulse-type noise is encountered, the NB (Noise Blanker) switch should be activated. Advance the noise blanker level control (located on the front panel) to the point which provides the desired blanking. Do not advance the level control beyond the point required to eliminate the noise pulses.
- (5) For varying the width of the IF passband, press the WIDTH button, and rotate the WIDTH control. In the IF, two 8-pole crystal filters are used. One filter is fixed, and presents a boundary for the bandwidth. The center frequency is then varied across the passband of the second filter, using a mixing scheme that provides no change of pitch in the received signal.

The result is continuously variable bandwidth, from 2.4 kHz down to approximately 300 Hz. When the WIDTH switch is turned OFF, the second IF filter is instantly aligned with the first filter, returning the receiver to a 2.4 kHz bandwidth.

- (6) For extremely strong signals, the ATT (attenuator) switch may be activated, providing 10 dB or 20 dB of attenuation on the incoming signal path, depending on the position of the ATT switch.

TRANSMITTER TUNING

The following tuning procedure must be performed prior to commencing operation on the desired mode. See the paragraphs relating to the specific mode after basic transmitter tune-up has been accomplished.

Be certain that a dummy load or matched antenna is connected to the antenna receptacle on the rear apron of the transceiver. It is possible to damage the final amplifier components of this equipment if this simple precaution is not followed prior to commencing transmission.

Do not exceed 10 seconds of key-down time while tuning.

As well, be certain that the ACC plug is inserted into the rear apron ACC jack. Without this plug, there will be no power applied to the tube heaters. Heater voltage is applied through pins 1 and 2 of the accessory socket.

- (1) Preset the controls and switches as follows:

MODE TUNE
 DRIVE Fully counterclockwise
 DELAY Fully counterclockwise
 MIC GAIN..... Fully counterclockwise
 COMP LEVEL ... Fully counterclockwise
 HEATER ON
 PROC OFF
 PO/IC/ALC IC
 PLATE Set to desired band segment
 LOADING 0
 PRESELECT Peaked on receive for maximum response
 TX CLARIFIER .. OFF (button not pushed)

- (2) Turn the HEATER switch ON, and wait 1 minute for the tube heaters to warm up.
- (3) Set the VOX GAIN switch to the MOX position. Observe the reading on the IC meter: it should read 50 mA with no drive applied. If it is not, adjust the PB-1968 BIAS control for a resting current of 50 mA on the IC meter. Be certain that the DRIVE control is fully counterclockwise for this adjustment. See page 3-29
- (4) Set the VOX GAIN switch to MOX. Advance the DRIVE control for a reading of 150 mA.
- (5) Peak the PRESELECT control for a maximum meter reading. If the meter reading exceeds 150 mA, reduce the setting of the DRIVE control.
- (6) Rotate the PLATE control for a minimum reading ("dip") on the IC meter. Return the transceiver to the receive mode by rotating the VOX GAIN switch out of the MOX position.

LOADING POSITIONS

| BAND | FREQUENCY | POSITION |
|-------|-----------|----------|
| 160 m | 1.8 MHz | 0 |
| | 2.0 MHz | 5 |
| 80 m | 3.5 MHz | 1 |
| | 4.0 MHz | 5 |
| 40 m | 7.0 MHz | 4.5 |
| | 7.5 MHz | 6 |
| 20 m | 14.0 MHz | 3.5 |
| | 14.5 MHz | 4 |
| 15 m | 21.0 MHz | 2 |
| | 21.5 MHz | 2.5 |
| 10 mA | 28.0 MHz | 2 |
| 10 mB | 28.5 MHz | 2 |
| 10 mC | 29.0 MHz | 2 |
| 10 mD | 29.5 MHz | 2 |

NOTE: LOADING positions are nominal. Minor variations from positions shown are to be expected.

FINAL TUNING

Final transmitter tuning uses the relative power output setting of the METER switch. At full rated output, using a 50 ohm load, the PO meter will indicate between 1/2 and 2/3 of full scale deflection. If the PO reading is too high (off scale) or too low (1/4 scale or less), and if the load impedance is very close to 50 ohms, the PO ADJ control on the rear apron may be varied to provide the proper deflection. Once the PO meter is calibrated, off-scale deflections are the result of reflected power (high SWR), and corrective action may be required in the antenna system.

Set the controls as follows for final tuning:

- (1) Set the METER switch to PO. Rotate the DRIVE control to the 9 o'clock position.
- (2) Rotate the VOX GAIN control to the MOX position, and rotate the PRESELECT control for a maximum meter reading.
- (3) Rotate the LOADING control for a maximum meter reading. Rotate the PLATE control for a maximum meter reading.
- (4) Again rotate the LOADING control and PLATE control, each time advancing the

GENERAL

DRIVE control approximately 2 steps, until the DRIVE control is fully clockwise. The transmitter is now tuned for maximum power output. Do not exceed the maximum tuning time stipulated previously. Return the VOX GAIN switch to the VOX position (out of the MOX position), return the METER switch to IC, and return the DRIVE control to the fully counterclockwise position.

SSB OPERATION

After completing the above tuning procedure, set the MODE switch to USB or LSB as desired. Set the VOX GAIN control to PTT, and activate the transmitter by pushing the microphone PTT switch or the footswitch, if used. With the METER switch set to the ALC position, speak into the microphone in a normal voice. Advance the MIC GAIN control until the meter kicks up to the midscale of the green-colored portion of the meter scale.

Note: When the METER switch is set to IC, voice modulation peaks will indicate 150 - 200 mA. Actual peak current, though, is approximately 2 times the indicated value.

To set the sensitivity of the VOX (voice-operated T/R switching) system, advance the VOX GAIN control slowly while speaking into the microphone. Advance the VOX GAIN control to the point where the speech signal activates the transmitter.

Set the antitrip potentiometer on the rear apron to the minimum point which prevents the speaker output from tripping the VOX. Do not use more VOX gain nor antitrip than is necessary. Adjust the front panel DELAY control for the desired relay recovery time.

RF SPEECH PROCESSOR ADJUSTMENT

The FT-101ZD RF speech processor, when correctly adjusted, will improve the intelligibility threshold at the receiving end, by increasing the average SSB power output. RF clipping is applied to the IF signal, which is then filtered to remove harmonics and out of band intermodulation products. RF envelope clipping causes much less distortion than that caused by an equivalent amount of AF clipping, and the result is an output signal with more "punch".

Set the PROC switch to OFF, and set the MIC GAIN control as described previously (voice peaks falling within the green zone of the ALC meter scale). Now set the PROC switch to ON, and set the COMP LEVEL control to the 10 o'clock position. Advance the DRIVE control so that the desired power output is obtained, and be sure that the ALC meter indication is within the green zone.

With the RF speech processor activated, the ALC meter indication may not be quite as high as when the processor is off. This is entirely normal, because the average power output is higher with the processor, although the peaks are being clipped.

Setting the COMP LEVEL control up to the 12 o'clock position will provide up to 10 dB of compression. Advancing the control beyond the 10 o'clock point may, however, degrade the voice-to-noise ratio, so caution is recommended.

CW OPERATION

After completing the tuning procedure, insert the key line into the KEY jack on the rear panel.

The operator may select any power output desired by advancing the DRIVE control. Once the maximum power output level has been reached, the DRIVE control should not be advanced further.

The transmitter may be activated by the VOX circuit, or by the PTT or MOX systems. The TONE control on the rear apron of the transceiver sets the CW sidetone level.

The key-up voltage at the key jack is 7 volts, and the key-down current is 1.5 mA.

For receiving, two positions of selectivity are provided. When the optional CW filter is installed, the operator may select between the 600 Hz bandwidth of the CW filter and the 2.4 kHz bandwidth of the SSB filter. The WIDTH control may be used with either position of the MODE switch: CW-W or CW-N.

AM OPERATION

AM operation of the transmitter is accomplished by setting the MODE switch to the AM position and inserting the proper amount of carrier with the DRIVE control.

After completing basic transmitter tune-up, place the MODE switch in the AM position. Activate the transmitter, and rotate the DRIVE control until the meter reads .10 (100 mA) in the IC position of the METER switch. While speaking into the microphone in a normal voice, increase the MIC GAIN control until the meter indicates very slight movement with voice peaks. Care must be exercised that the DRIVE control is not advanced too far. Do not exceed .10 (100 mA) meter indication during AM operation or damage to the transmitter final amplifier tubes may result.

SELECT SWITCHES

The SELECT switches allow selection of internal or external VFO frequency control, as well as selection of up to 2 optional crystal-controlled channels.

When the crystal-controlled channels are installed, they may be selected by pressing CH1 or CH2, as desired. See the crystal information elsewhere for full information on crystal requirements.

When using the FV-901DM synthesized, scanning external VFO, available from your Yaesu dealer, your FT-101ZD will have available a 40-frequency memory bank, as well as a three-speed scanner. Because there is no calibrated display for the FV-901DM, the FV-901DM cannot be used with the analog FT-101Z.

For transceive frequency control on the external VFO, press EXT. For external VFO control of the transmit frequency, with receive frequency control on the FT-101ZD, press TX EXT. For receive frequency control on the external VFO, and transmit frequency control on the FT-101ZD, press RX EXT. For full transceive control on the FT-101ZD, press VFO.

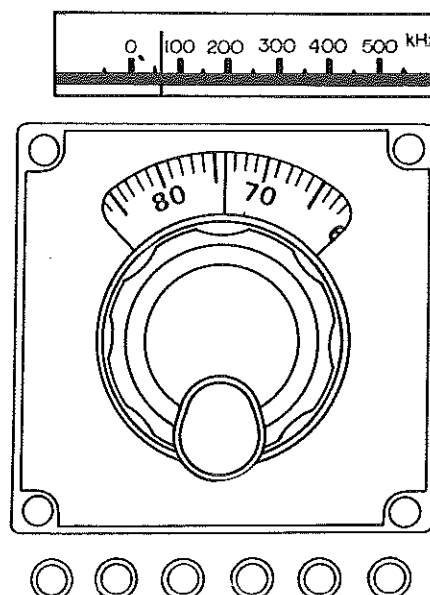
DIAL CALIBRATION AND FREQUENCY DETERMINATION

The FT-101ZD mixing scheme accounts for the difference in carrier frequencies between USB and LSB. For this reason, no recalibration is required. Once the calibration is properly aligned (at the factory, or in shop), no further adjustment is required for accurate frequency derivation. The 25 kHz calibrator is included largely for alignment purposes, as it provides a useful reference signal for signal peaking, etc.

Frequency readout on the FT-101ZD digital display is straightforward. The full operating frequency is displayed, with resolution to 100 Hz.

The analog display on the FT-101Z and FT-101ZD transceivers provides easy determination of the operating frequency. The frequency displayed on the analog sub dial (and the main display window, for the FT-101Z) is added to the lower band edge frequency.

For example, if the analog dial indicates 074, as shown in the example, and the BAND switch is on 40 meters (lower band edge: 7000 kHz), the operating frequency will be 7074 kHz. By rotating the BAND switch, this position of the analog display will produce 14074 kHz for 20 meters, 21074 for 15 meters, etc. For 80 meters, the lower band edge is 3500 kHz, while for 160 meters the band edge is 1.5 MHz. Therefore, the dial should read 074 to produce 3574 kHz, but 374 for 1874 kHz. Be careful so as not to operate outside the amateur bands.



GENERAL

FIXED CHANNEL CRYSTAL INFORMATION

Two fixed channels may be used with your FT-101ZD, using optional crystals. Crystals are available from your Yaesu dealer. Crystals must meet the specifications shown in Table 2, and must fall within the operating range 5500 - 5000 kHz. Frequency calculation 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 1
 F_0 is the operating frequency.

For example, let us say it is desired to operate on 7199 kHz LSB. Referring to Table 1, 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.

| MODE BAND | U S B | L S B | C W A M |
|--------------|---------|---------|------------|
| 160m | 6998.5 | 7001.5 | 6999.2 |
| 80m | 8998.5 | 9001.5 | 8999.2 |
| 40m | 12498.5 | 12501.5 | 12499.2 |
| 20m | 19498.5 | 19501.5 | 19499.2 |
| 15m | 26498.5 | 26501.5 | 26499.2 |
| 10m A | 33498.5 | 33501.5 | 33499.2 |
| 10mB | 33998.5 | 34001.5 | 33999.2 |
| 10mC | 34498.5 | 34501.5 | 34499.2 |
| 10mD | 34998.5 | 35001.5 | 34999.2 |

Table 1

| Type | HC-25/U |
|--------------------|-----------------|
| Load Capacitance | 30pF |
| Series Resistance | 25 Ohms or less |
| Static Capacitance | 7pF or less |
| Drive Level | 5mW |

Table 2