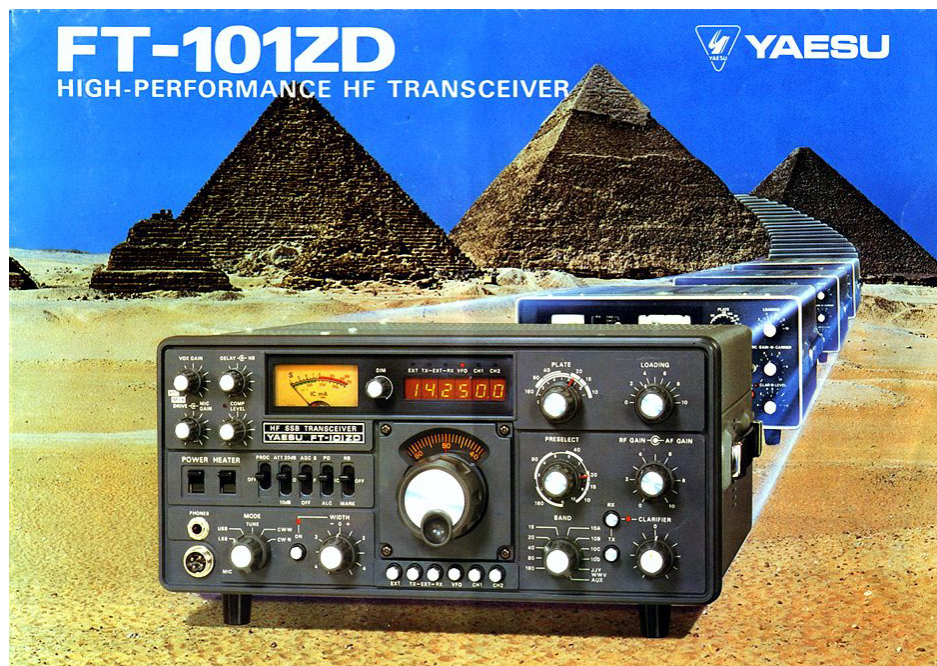




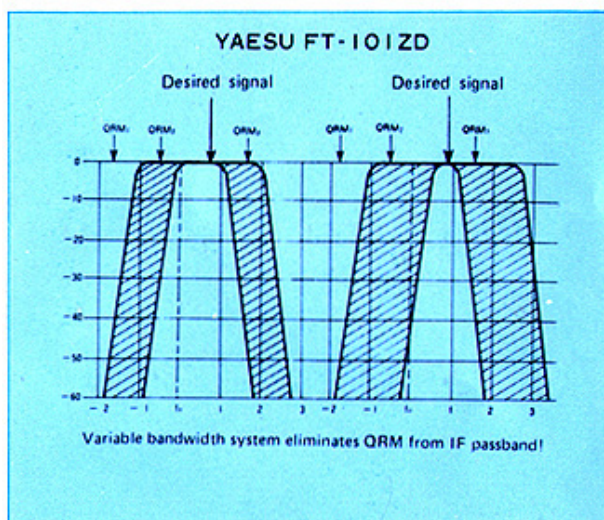
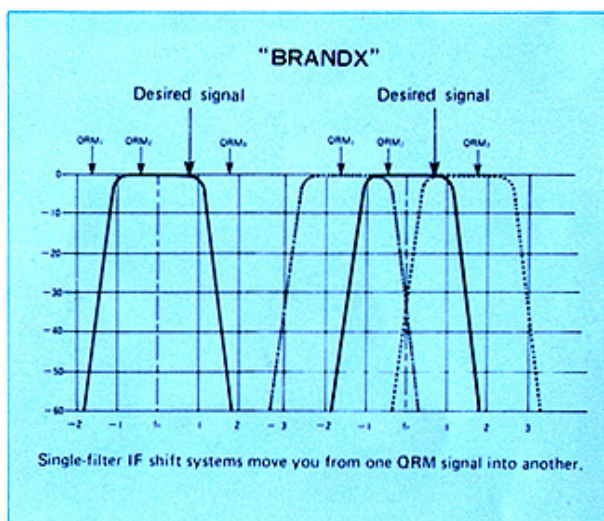
Yaesu

FT-101ZD

Survival Guide



FT-101Z MK0



Yaesu FT-101Z/ZD series transceiver



Yaesu FT-101ZD page

Presented by:

**Fox Tango International
and PAØPGA**

The FT-101 history

The Yaesu FT-101 series transceivers, produced in 1970-1978 were a very good alternative for the very expensive American made receivers and transmitters of the time.

They were full of useful options, for which you had to pay much \$\$\$ extra (if available) in other ham equipment. Build like a battleship, with a modular construction, it was easy to repair, and the big numbers which are still around, prove the sound work of the Yaesu engineers at the time.

The FT-101 series was very successful, and there were many versions of it, starting with the FT-101, released in 1970 to the FT-101F, who was released in 1978. See the FT-101 page for more information for the FT-101 series of transceivers.

The Yaesu FT-101ZD was brought on the market in 1979, as a low-cost alternative for the FT-901ZD, which is the real descendant of Yaesu's famous FT-101 series of transceivers.

As Yaesu already had a very good reputation for performance and durability, it is no wonder that the new series transceivers became very popular in the ham community, special in Europe, because the high \$\$\$ price of the available American equipment and the high import taxes on them, and the fact that there were almost no agents prohibited a broad distribution of American equipment. I still think the American industry at the time missed a chance here. Only Heathkit had a representative over here, and was very popular at the time for their nice kits.

Yaesu had a small sales network in Europe and the Swiss firm Sommerkamp imported the same sets with other typenumbers and under the name Sommerkamp, they were a big success in Italy and Germany.



The FT-101Z/ZD

In 1979 Yaesu announced a new version of the FT-101, called the FT-101Z (analog dial) and ZD, (with digital dial). The FT-101ZD looked very much like the FT-901, but had a simpler internal construction with just a couple of plug-in boards for HF, premixer and oscillator. The IF and the audio board, were connected with plugs from a wire harness, the power supply boards are soldered direct to the wire harness, thus not the overall modular construction that made the older FT-101 and new FT-901 so popular.

Although the construction of the FT-101ZD was simpler, the transceiver was packed with useful features, that appealed to many hams, (including myself, I bought one in 1979, and still use it almost daily,).

It had a very sensitive receiver, SSB and CW modes, a digital display, very linear VFO, smooth tuning, a good set of filters, a PA with real transmitting tubes (6146B's), speech processor, IF shift with passbands between 300hz and 2.4khz, a clarifier, a calibrator and a noise blanker, making it a very complete package for a very reasonable price. Later models had also AF notch/peak filters, WARC bands and AM/FM capability. There were outputs for connection to a transverter and linear amplifier, inputs for a second VFO and phone patch. It was one of the best buys you could make at the time.

The FT-901 had even more bells & whistles, but had also a \$ 1000 higher pricetag.

The transceiver is very well build, with good quality components, and, if used normally, will last forever. Weight is in excess of 15 kg, due the built-in power supply, giving it the feel of a battleship.

The powersupply can be fed from 100/110/117 or 200/220/235 Volts 50/60hz, and with the optional switching unit, even from 13.8 Vdc, although you need a heavy-duty car battery. (current in voice peaks around 20 Amps).



Analog model FT-101Z



FT-101ZD MK1

Specifications FT-101Z, FT-101ZD:

Type:	Amateur HF transceiver		
Frequency Range:	10-160m,	(early models had no WARC bands)	
Mode:	SSB/CW,	(later models also AM or FM)	
RF Power output:	SSB/CW	100W	
	AM	35W	
Sensitivity:	SSB/CW:	0.25 uV (10db S/n)	
	AM:	0.5 uV (10db S/n)	
Selectivity:	SSB/AM	2.4 khz @ -6db,	4 khz @ -60db
	CW	600 or 300 hz, (optional)	
Image rejection:		- 60 db (160-15m)	- 50 db (10m)
Display	FT-101Z	analog dial	
	FT-101ZD	analog + digital dial	
Power:	Mains,	100-235 V ac 50/60hz	13.8 Vdc option
Current drain DC:	Receive:	5.5 Amps,	1.1 Amps with heater off)
	Transmit:		Max. 21 Amps.
Impedance:	50 – 75 ohms,	SO-239 connector	
Dimensions		345 * 157 * 326 mm (W*H*D)	
Weight:	15 kilograms		
Manufactured:	1979 – 1982		
Accessoires:	FV-101Z	external VFO	
	FV-101DM	external scanning VFO	
	FL-2100Z	Linear Amplifier 1200W SSB, 1000W CW	
	SP-901P	External Speaker/Phone Patch	
	FC-901	Antenna Coupler	

The FT-101ZD is updated several times during its lifetime, and there are in fact 4 different types, using the same designator. By the introduction in 1979, the transceiver had only SSB and CW, later there was a AM (tx/rx) option, still later the Warc bands were introduced, and the last version had it all, including a optional AM or FM board, and Audio notch/peak filter. The later models have more features, so they are more in demand, and are normally higher priced in auctions or on the internet. It seems difficult to see what the difference is between the first and last models because there is not much changed on the front.

Fortunately there is a easy way to see at a glance the difference between the various models, the only thing you need to know is the serial number of the set.

The Yaesu serial number on the back of the set consists of a number, a letter and 6 numbers:

The first number is the year of production: 9=1979, 0=1980, 1=1981 a.s.o.

The letter is the production month: C=jan D=feb E=march a.s.o.

The next 2 numbers are the production run: from 01 (first series) to 24 and higher (last series)

The next 4 numbers are the serial numbers: from 0001 to 9999



Identification of the model is easy by the use of the production run:

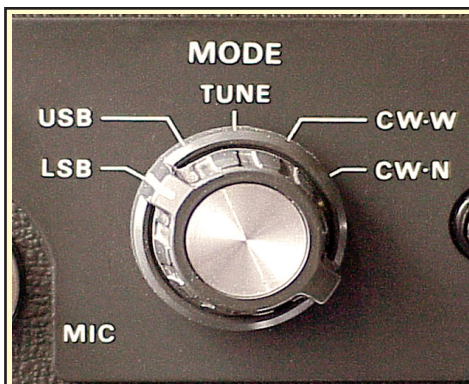
FT-101Z/ZD MK0 Production run: 01 – 07, all in 1979
160-10m, SSB/CW, only, WWV rx-only, aux

FT-101Z/ZD MK1 Production run: 08 – 16
160-10m, SSB/CW/AM, WWV rx-only, aux
Only Run 16 has the new type counter.

FT-101Z/ZD MK2 Production run: 17 – 23
160-10m + WARC, SSB/CW/AM

FT-101Z/ZD MK3 Production run: 24 – 30? up
160-10m + WARC, SSB/CW/AM or FM
The last serie is also easily identified by the grey and silver knobs on the front.





The **MK0** model has SSB and CW only, and covers the bands 160,80,40,20,15 and 10m.



The **MK1** model has SSB, CW and AM, and covers the bands 160,80,40,20,15 and 10m.



The **MK2** model has SSB, CW and AM and covers the bands 160,80,40,30,20,17,15,12 and 10m.



Differences between the MK0/1/2/3



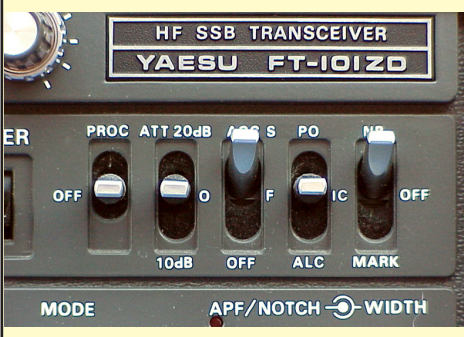
The **MK3** model has SSB, CW and AM or FM and covers the bands 160,80,40,30,20,17,15,12 and 10m.

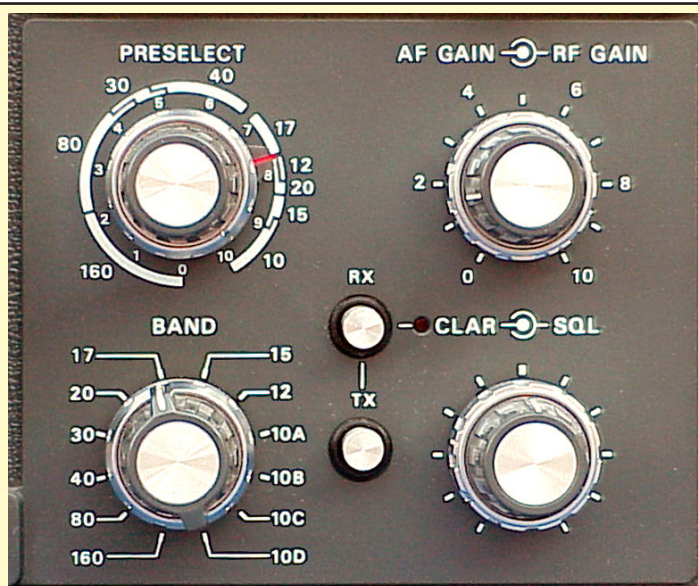


The switchboard in all models of the FT-101ZD has the same functions, but in the MK0, MK1 and MK2 models they have black tumblers, in the Mk3 they have silver tips, fitting by the silver rings on the knobs.



All models have a width control for varying the passband of the IF filter(s), the MK3 has additional a audio APF/Notch filter.

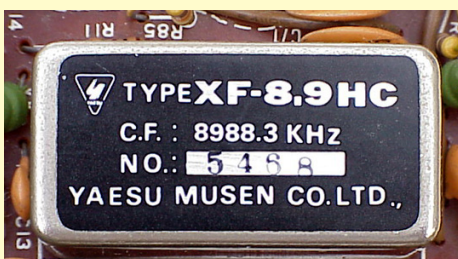
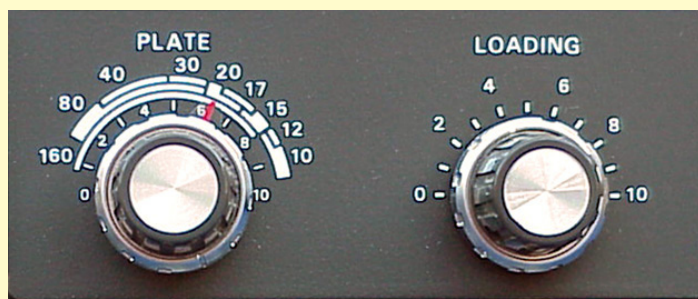




The Bandswitch of the MK0 and MK1 have 11 positions for the standard amateurs bands 160, 80, 40, 20, 15, 10m, a receive only position for 5 - 5.500 Mhz, and a position for an optional band. The MK2 and MK3 bandswitch has 12 positions for the 160, 80, 40, 30, 20, 17, 15, 12 and 10M bands, so including the WARC bands.

The Preselector and the Plate tuning have in the MK0 and MK1 positions for the "old" ham bands, in the MK2 and MK3 they have also positions for the WARC bands, resulting in a more cluttered arrangement.

All three models have a clarifier, which allows tuning of +/- 5 kHz around the original frequency, just enough for split-frequency DX work, or for round-table QSO's, if one of the members is not spot-on the frequency. The clarifier can be used in receive or transmit mode, or both. In the MK3 model (here on the right) there is also a Squelch knob for use with the optional FM board.



Optional CW Filter

In the FT-101ZD, a CW filter is an option, and can easily be installed on the IF board. The normal filter has a bandwidth of 600 Hz. Later there was also a filter of 300 Hz, but using this filter, there is a serious loss of signal, both on receive and transmit, because of the smaller bandwidth.

The FT-101Z story

The FT-101Z was the budget version of the FT-101ZD, with a nice and surprisingly exact mechanical dial instead of a digital dial, but otherwise both models are the same in every way.

The FT-101Z was delivered in all the versions, from MK0 to MK3.

The digital counter module was an option and update is easy if you can find one because all wiring is available in every transceiver. Just plug it in.

For all models with a serial number under 159999 you need the early type counter module with TTL IC's, above 16000 the newer counter with LSI chip.



The various models and the used boards

	FT-101ZD MK0	FT-101ZD MK1	FT-101ZD MK2	FT-101ZD MK3
Sn#	01 – 07xxxx	08 – 16xxxx	17 – 23xxxx	24 – upxxxx
RF board	PB1960A	PB1960A	PB2154	PB2154
NB/Fix	PB1961B	PB1961B	PB1961B	PB1961B
Premix	PB1962A	PB1962A	PB2152	PB2152
IF	PB1963B	PB1963C	PB1963C	PB1963C
AF	PB1964A	PB1964A	PB1964A	PB1964A
Premix LO	PB1965	PB1965	PB2153	PB2153
Sel.switch	PB1966C	PB1966C	PB1966C	PB1966C
VFO	PB1440B-3420	PB1440B-3420	PB1440B-3420	PB1440B-3420
Rect A	PB1967	PB1967	PB1967	PB1967
Rect B	PB1968A	PB1968A	PB1968A	PB1968A
Capacitor	PB1969A	PB1969A	PB1969A	PB1969A
Trimmer A	PB1970	PB1970	PB1970	PB2193B
Trimmer B	PB1970	PB1970	PB1970	PB2192B
Trimmer C	PB1092	PB1092	PB1092	PB1092
Bandwidth	PB1972	PB1972	PB1972	-
APF	-	-	-	PB2217
Driver	PB1714A	PB1714A	PB1714A	PB1714A
Final	PB1715A	PB1715A	PB1715A	PB1715A
Clarifier	PB1973A	PB1973A	PB1973A	PB1973A
LED	PB1974A	PB1974A	PB1974A	PB1974A
Lever switch	PB1975A	PB1975A	PB1975A	PB1975A
Display	PB1978	PB1978 (*)	PB2098A	PB2098A
Decoder	PB1979	PB1979 (*)	-	-
Counter	PB1980	PB1980 (*)	PB2086A	PB2086A
AM (**)	-	PB2040	PB2040	PB2040
FM (**)	-	-	-	PB2218

(*)

only production numbers starting 16xxxx had the PB2086A counter

(**)

optional, the AM board, or the FM board can be installed (MK3 only).

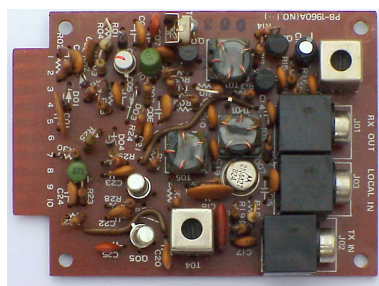
The used boards in detail:

RF boards

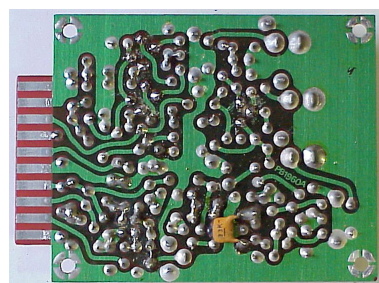
PB1960A and PB2154A

Contains the RF pre-amplifier, the receiver and transmitter mixer and a buffer stage, The mixer output of 8.9875Mhz goes to the IF board. The in and output tuning of the RF amplifier is done by permeability-tuned circuits, resulting in high sensitivity and excellent rejection of unwanted out-of-band signals.

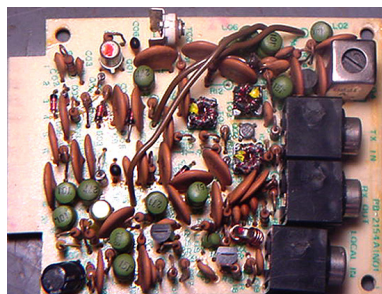
The difference between the two boards is the mixer. The PB1960A uses a balanced mixer with 2 Fet's, the later PB2154A board uses a diode ring mixer, for a better big signal behavior.



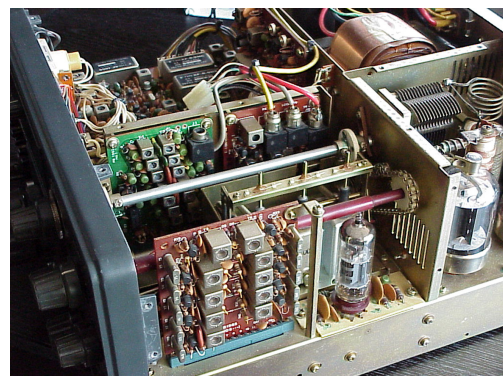
PB-9060A RF board component side

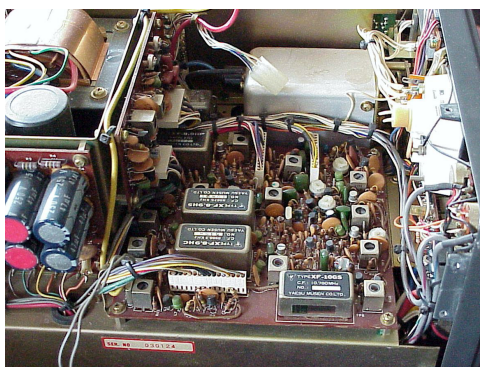
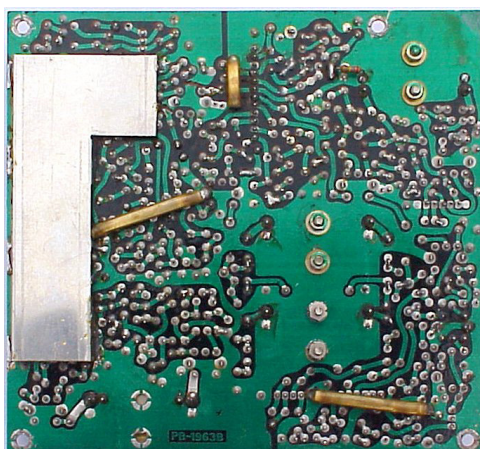
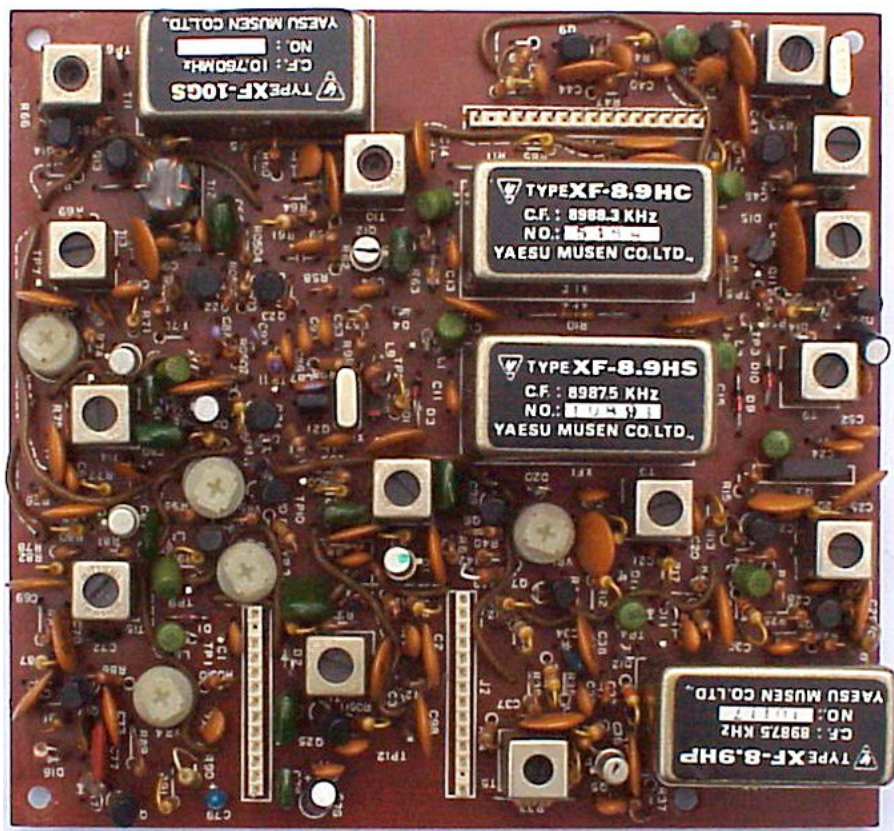


PB-9060A RF board solder side



PB-2154A RF board component side





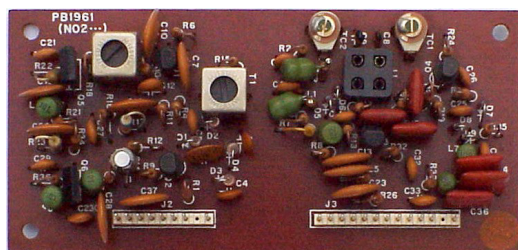
IF board PB1963B/C

The IF board is the heart of the transceiver, and is the same in every type of FT-101ZD.

The signal is first passed through a monolithic filter with a bandwidth of 10 kHz, to have a wide band point for noise blanking. The signal then passes through the noise blanker gate and is fed through the SSB filter or the optional CW filter to the IF first mixer. Here the incoming signal is heterodyned with a 19.7475 MHz local signal. This local signal is delivered from a XCO and the resulting mixing frequency is 10.76 MHz. This 10.76 MHz signal is fed through a second SSB filter, and mixes with the same 19.7475 MHz local signal back to the original IF frequency of 8.9875 MHz. The 19.7475 MHz XCO is tuned with a varicap over a close range, and the result is that the passband of the first and second filter shifts along each other, so in effect making the passband smaller or broader, depending on the frequency of the XCO. It is a very useful item, you can make the band pass as low as 300 Hz, and as high as the original passband of the first filter. (SSB 2.4 kHz, CW 300 or 600 Hz). The skirts of the filters add, so the filter passband improves too.

The output from the second IF mixer is fed to a 2-stage IF amplifier, and is delivered to the AF unit.

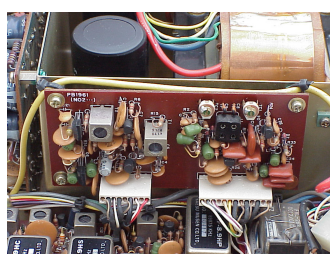
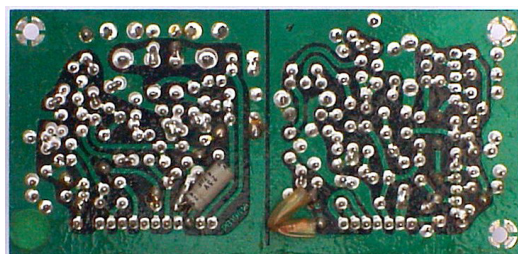
On the board are also a AGC amplifier and S-meter amplifier, the SSB tx IF filtering and the speech processor with filter. The board has the SSB filter installed, and there is room for installing a 300 or 600 Hz CW filter.

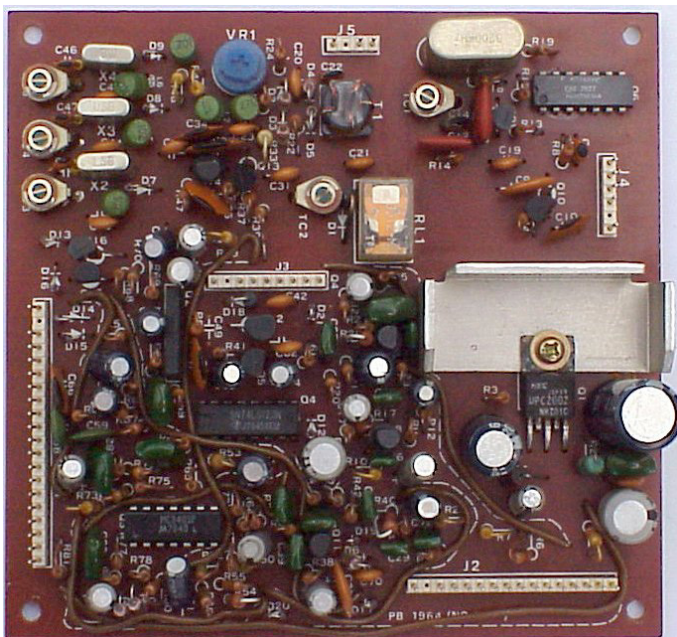


NB-Fix unit PB1961

This board is also used in every FT-101ZD, and contains the noise blanker circuitry and a x-tal oscillator for 2 fixed frequencies. The fixed frequencies are sideband dependent, so the operating frequency is on LSB 3 kHz higher than on USB at a given x-tal frequency.

The necessary x-tals have to be in the VFO (5 – 5.5 MHz) range.





AF Unit PB1964

The AF unit board contains the SSB/CW diode ring demodulator and the carrier oscillator:

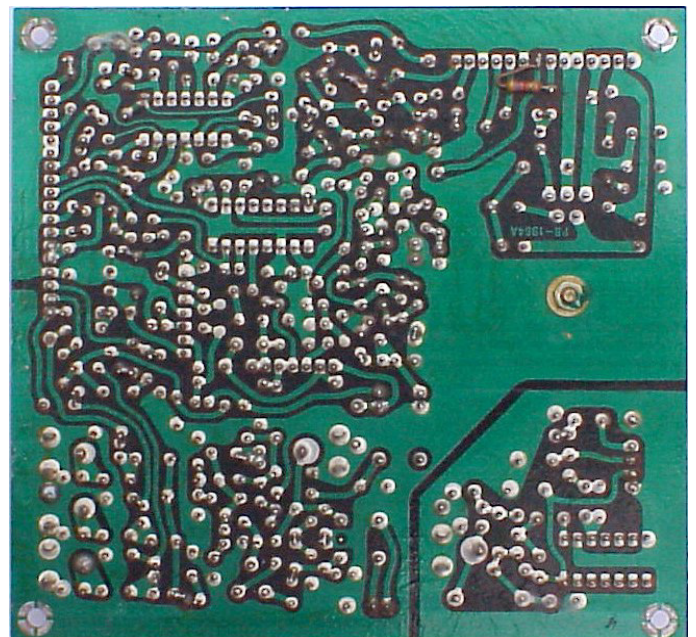
USB, CW rx 8989 khz

LSB 8986 khz

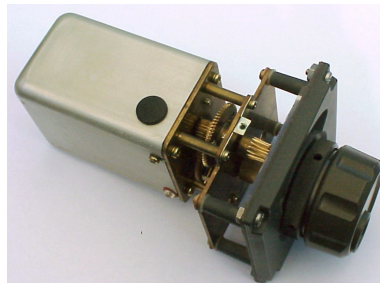
CW tx 8988.3 Khz

The audio signal is amplified and delivered to the internal or external speaker.

On the AF board is also the marker generator, who provides a 25 khz marker signal for alignment and testing purposes. The tx microphone amplifier with sideband generator, and a 800 hz sidetone generator for CW are also a part of the AF unit. The AF unit board is used in every model.



VFO Unit PB1440B-3420

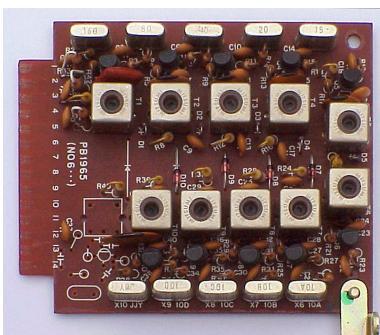


The VFO uses a modified Collpitts type oscillator to generate a 5 –5.5 Mhz VFO signal, producing a 500 khz tuning range. The VFO tuning is extremely liniair over the entire range, no small feat with the use of a "normal" tuning condenser. Stability is very good, and tuning is very exact with the smooth precision gear. The VFO is one of the reasons for the good overall stability of the transceiver.

The VFO frequency can varied by a small amount, providing a offset of +/- 2.5 Khz, by a varicap diode and a controlling voltage. (Clarifier), very useful when you are in a net, if all members are not exactly at the same frequency.

Can be used in TX and Rx mode, or both.

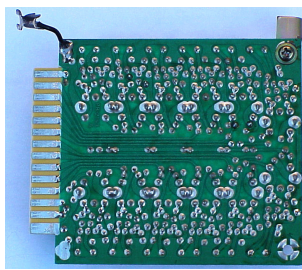
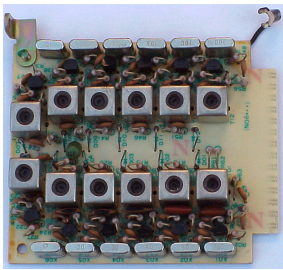
This VFO unit is used in all the FT-101ZD series transceivers.



Premix Local Unit PB1965

This plug-in board has 10 crystal oscillators, who are selected by diode switches, they generate the premix local signal for each of the amateur bands + WWV. It is possible to add another band on the board, by adding the neccessary components and rewire the bandswitch.

The local signal is delivered to the Premix Unit.

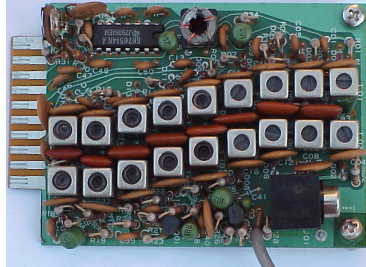
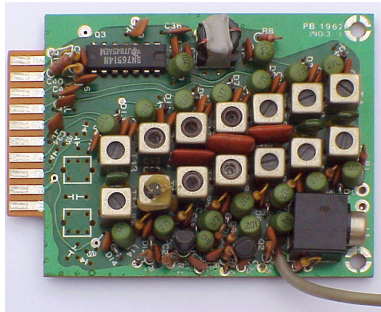


PB2153

This is the newer plug-in board, used in FT-101ZD MK2 and MK3, that has all amateur bands including the WARC bands 30m, 17m, and 12m. This board has no WWV or a optional AUX band.

Premix Unit PB1962, PB2152

The premix unit mixes the signal from the Premix Local Unit with the VFO or crystal controlled signal in a double balanced mixer. The premix signal is passed through a bandpass filter and delivered to the RF Unit. The older board PB1962 has 7 filters, the newer WARC board PB2152 has 9 filters, for coverage of all amateur bands, including the WARC bands in the FT-101ZD MK2 and MK3. See the table.



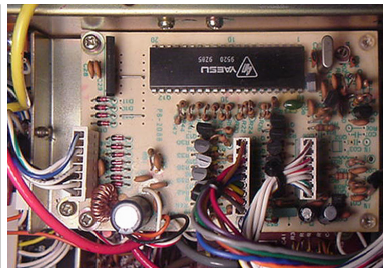
Counter Unit PB1978, PB1979, PB1980,

Used in production runs 01 to 15 in the 101ZD This counter is a complete enclosed unit, consisting of a display board, a counter board and a count/decode board. The unit uses standard TTL circuits. The counter has a offset programming to display the correct frequency of the carrier in a ingenious manner. The counter is programmable for other offsets with dipswitches. The counter uses 6 HP LED displays, for a frequency readout to 100 hz.



The MSM-9520RS was produced solely for Yaesu, and was never on the market. There is a kit available, with a PIC processor, which substitutes all functions. See the page 19 or the site:

http://homepage3.nifty.com/RadioGaGa/COUNTER_e/

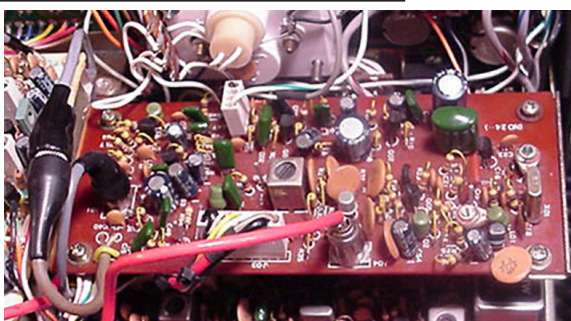


PB2086A-3420, PB2098

Used in production runs 16- to the end in the 101ZD This counter uses a custom LSI chip, the OKI MSM-9520RS, which has all the possibilities of the older counter including the frequency offset in one chip. The rest of the board is used for the transistor digit and segment drivers. The LED displays in this counter are multiplexed.

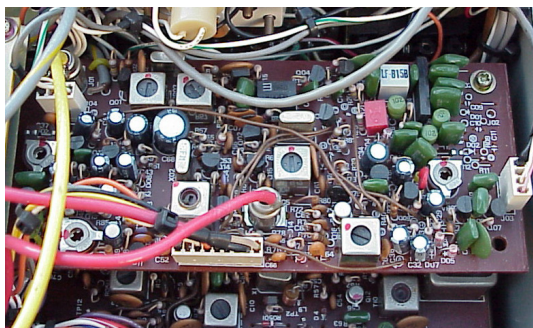
AM Unit PB2040

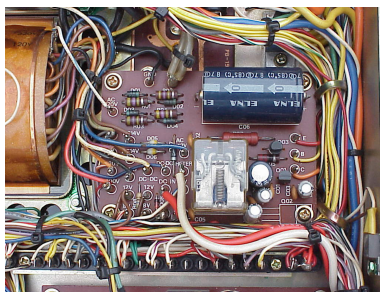
The AM print has a AM detector and audio pre-amplifier, and at the transmitting side the necessary circuits for the production of a AM signal. This board is used in the FT-101ZD MK1, MK2 and MK3. It is a optional board, so it is not used in all transceivers.



FM Unit PB2219

This optional board is used for receiving and transmitting in FM mode. The board uses the same connections as the AM board, which must be removed (if installed) when installing the FM board. One board can be installed at a time, so you must make a choice. Installing is rather easy. This board can be installed in production runs from 24 up, the FT-101ZD MK3



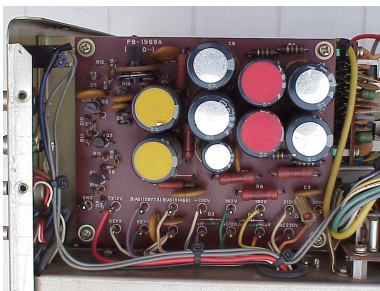


Power Supply PB1967 Rectifier A board.

This board delivers all the high and low voltages used in the transceiver, so be careful, there are points with 900 Volts dc on this board, and that voltage can do serious damage to a unsuspecting Ham to say the least. Unload always the condensers, preferably with a resistor, before starting to work at this circuits.

The board is positioned in the underside of the transceiver and delivers the various low voltages (6, 8, 12 Volt dc) and the 900Vdc for the Power Amplifier.

This board is used in all models of the FT-101ZD



PB1968 Rectifier B board

This board delivers the bias voltages of the PA unit, the 150, 160, 200 and 300 Vdc for the driver and Power amplifier. This board is mounted at the left side of the transceiver.

On this board is also the CW keyer circuit.

The board is used in all models.

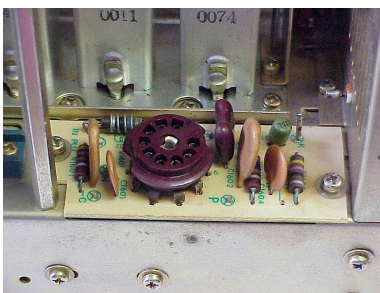


APF/NOTCH unit PB2217

The APF unit is placed in the audio circuit by the APF/Notch switch on the front panel. For APF operation forms it a selective active filter, to narrow the passband of the receiver.

The notch function eliminates selective some audio frequencies, like carriers or other interfering signals. The center frequency of the APF/Notch is adjustable from the front.

This unit is used only in the MK3 model.



12BY7A Driver board PB-1714A

The driver board amplifies the SSB/CW signal and feeds it to the PA.

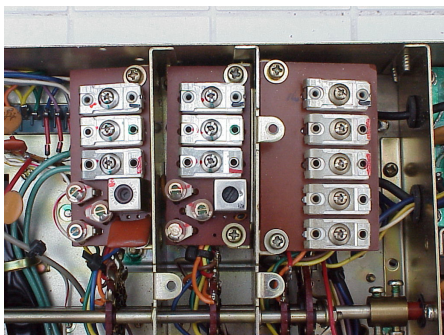
The driver uses a tube (12BY7A) for delivering the necessary power, and the tube is also used in the automatic level control circuit (ALC).

Part of the output is available at a connector at the back, for use with transverters or other purposes.

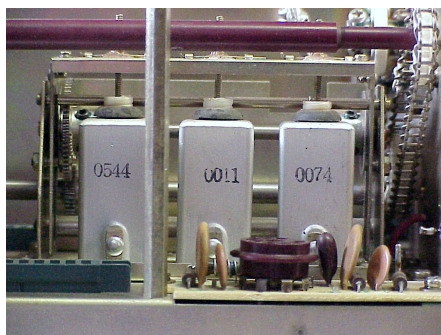
Tuning is done with the same inductive tuning unit, that is used by the RF board.

The inductive tuning allows a constant output over a greater range.

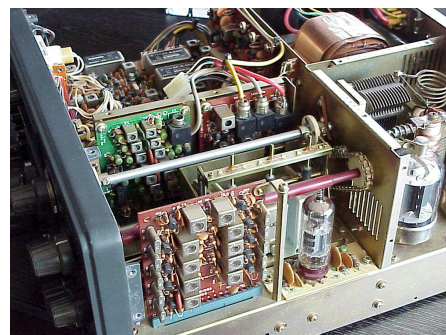
The heater of the tube is switched by the heater switch on the front. By using this switch during longer receiving-only periods, the tube will last much longer, and there is less heating up. Warming up time for the tubes is 60 seconds.



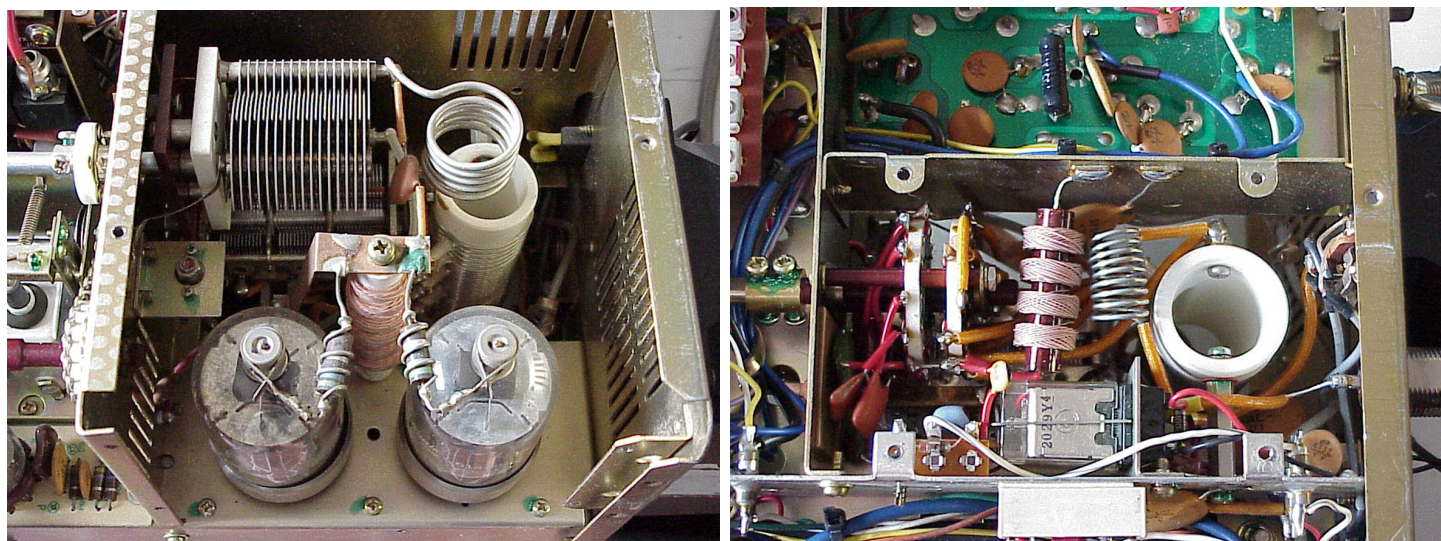
The trimmer boards (MK0/1/2)



The inductive tuning unit



The Driver board position



The Power Amplifier PB-1715A

The Power Amplifier, consists of two 6146B heavy duty transmitting tubes, the input filter and the output filter. The output filter delivers the RF signal to a suitable antenna. The impedance from the antenna has to be between 50 and 75 ohms unbalanced. A Antenna with a different impedance at the feedpoint can be used, but there must be a matching device between the transceiver and this feedpoint. The same goes for other antennas with a lower impedance such as magnetic loops and others.

The 6146B PA tubes are very rugged, and can deliver around 100 -120 Watts output depending on the band of operation, by a input of 180W in the SSB and CW mode. In AM mode the maximum input power is 45 Watt. This is due the fact that the SSB signal has just one sideband, which has only 25% of the power factor of a AM signal, so the tubes can deliver in SSB 4x the power of a AM signal, at the same dissipation.

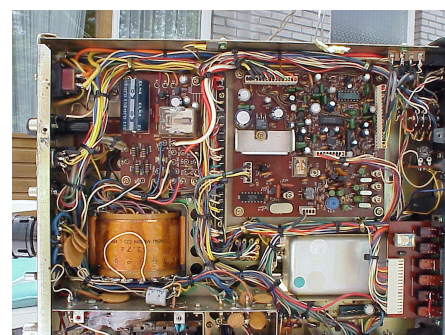
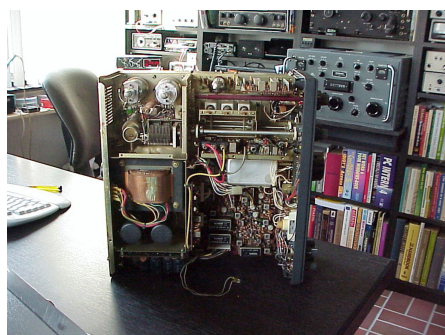
It is never a good idea to push the PA to the limit, it is much better to run the PA with powers around 150W input in SSB/CW, the tubes will last much longer, and the difference at the receiving station is minimal. You will be surprised how many DX stations can be worked with low power. It all depends on an effective antenna, band conditions and operating skill, and not only big power: you have to double your power output to make a S-point difference at the receiving station!

6146 series tubes:

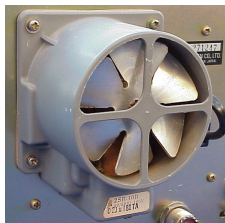
There are several different types of 6146 tubes, and, now tubes are getting scarce is it good to know what possibilities there are for replacing the tubes with others. The FT-101ZD uses the 6146B type, which has the biggest dissipation, thus the biggest output, but has a bad reputation for VHF oscillation and TVI as result. They must be very good neutralized, otherwise the PA destroys itself. The basic 6146 and 6146A (same tube, with a sturdier heater) is still around in great numbers and can be used if there are no 6146B's available. The only drawback is the lower power capacity: the anode dissipation is 25% lower and they need a new neutralization and a correction of the bias voltage.

Another tube is the 6146W, a military designation, used as a remplace for 6146, 6146A and 6146B in the forces. This tube has a rugged construction, similar to the 6146B, but the saying goes that the input power on this tube should also be reduced to ca 75% of the nominal output of the 6146B. 6146 and 6146A may be mixed, but never mix a 6146(A) with a 6146B, because you are in for very strange effects, and some fireworks.

There are other tube designations, they are put together in a small table at one of the next pages.

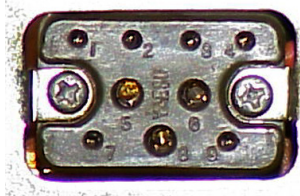


Accessories:



Cooler Fan

The optional cooling fan can easily be installed on the FT-101ZD. If you use another fan than the original Yaesu fan, see to it that the voltage is 110 Volt ac.



DC-DC Converter

The DC-Dc converter allows the mobile use of the FT-101ZD, on a 13.8 Vdc source. The unit is installed on the back of the transceiver and uses the internal transformer to obtain the proper voltages. The power connection is made by a special DC cord, delivered together with the DC-DC converter.



FV-101Z external VFO

This is a compact remote VFO for the FT-101ZD. The VFO has a analog frequency display. If you use it with a FT-101ZD, the frequency is displayed on the digital display from the FT-101ZD. The VFO has a precision tuning mechanism with a silky-smooth operation. Clarifier for transmit, receive or transceive frequency is included. The VFO shift range is +/- 8khz. Up to 6 crystal-controlled channels may be installed. The necessary crystals have to be in the 5 - 5.5 Mhz range.



FV-101DM external VFO

This VFO has twelve memories, up/down scanning, keyboard frequency entry and receiver offset tuning in 10hz steps. This provides smooth and precise tuning for SSB and CW. Either the keyboard, main tuning knob or up/down scanning buttons can be used for quick QSY to your preferred operation frequency. Up to four of your most used memory channels can be protected from overwriting, when you store frequencies. The two-loop PLL circuit is designed to produce a crisp, clean output signal for a spurious-free receiver and transmitter.

This VFO can only be used with the FT-101ZD MK3, serial numbers above 240001



FL2100Z Linear Amplifier

The FL-2100 is specially designed for the FT-101ZD transceiver. It uses two rugged 572B/T160 transmitting triodes in a class AB2 grounded grid configuration. Power input is 1200 watts PEP on SSB and 1KW on CW, on all bands, including the WARC bands 10, 18 and 24 Mhz. The linear has 2 fans for cooling the final tubes, and special protection circuits for the output tubes and the tank circuit. During standby the antenna is switched to the transceiver and the built-in SWR meter allows monitoring of the feedline during either amplifier or exciter-only operation. The heavy-duty powersupply requires no warm-up time and has excellent regulation.

FT-901DM accessoires on the FT-101ZD

The FT-101ZD can use accessories of the FT-901DM, but there are some restrictions at their use.

FV-901DM external VFO

This is a external VFO that provide a synthesized control system for your FT-101ZD. It has a 3-speed scanner, which will take you instantly everywhere in the band, and the auto-scan feature sweeps the band until it finds a signal. The synthesizer has a stepsize of 100 hz and is coupled to a 40-memory bank for storing the frequency. Fine tune is done with the TX/RX clarifier.

Because there is no frequency display on the FV-901DM, use of this VFO in combination with the analog FT-101Z is not possible, as the operating frequency cannot be determined.

FTV-901R transverter

The FTV-901R is a 3-band VHF/UHF transverter, all in one compact case. The basic FTV-901R comes equipped for 144 – 148 Mhz. 6 meter and 70 centimeter modules may be added.

The satellite 1-3 bands provide operation on OSCAR modes A/B/J on full duplex, when an external receiver is used. Repeater split is provided on 6 and 2 meters.

YO-901 Multiscope

The YO-901 Multiscope provides superb monitoring capability, with a instant interface to the FT-101ZD and can be used to monitor the output signal with trapezoidal and two-tone tests, general oscilloscope measurements are also possible. A panoramic adapter is a available option for a quick band activity examination. IF rx and tx monitoring is not possible with the FT-101ZD combination.

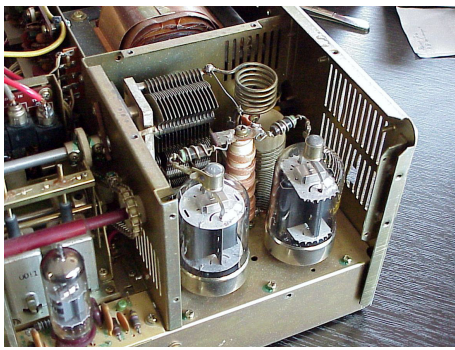
SP-901P speaker/hybrid phone patch

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

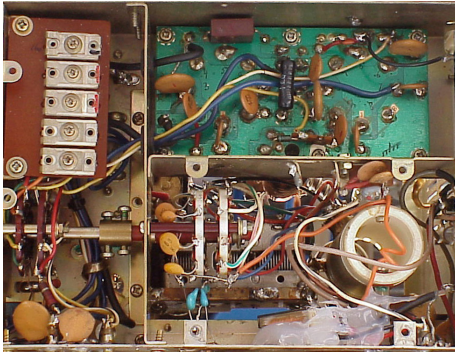
FC-901 Antenne coupler

The FC-901 antenna coupler presents a 50 ohm load to your FT-101ZD transceiver, all across the band. 3 coax-fed and one random-wire antenna may be accommodated. SWR and Power metering allow quick determination of proper matching conditions.

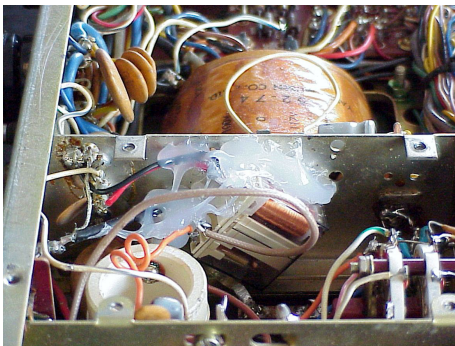




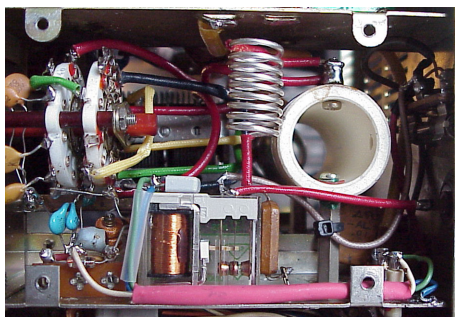
The PA with 6146A and 6146B tube



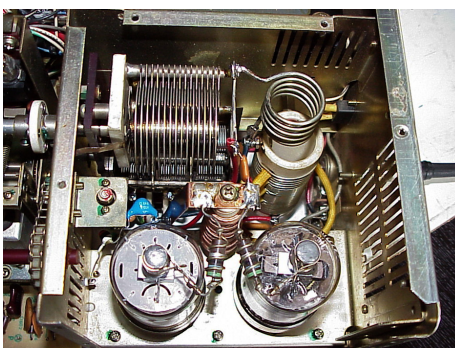
The "skilfully repaired" PA



The creative relay solution and choke



The PA now, after reconstruction



The rebuilt PA with 6146A tubes

A Internet buy

Recently I bought a FT-101Z on the Internet for a reasonable price, intended more or less as spare for my FT-101ZD, that I own for almost 26 years now, obtained new in 1979, one of the first production runs. The normal asking price overhere is around 350 Euro's, depending on condition. The price at 175 Euro (around \$200) was good. The distance to the owner was under 100 Km, making collecting possible. That way I could see what I got, (it is not the first time that the pictures used by the auction have nothing to do with the actual set). Well, the set was also a early version from 1979, so in view of spares for my own transceiver it was ok. It looked nice enough, some scratches on the top and sides, but a nice front. After removing the cover, I saw that the cover of the PA was missing and that the neutralizing condenser was not connected. The receiver worked ok, I could test that with the griddipper that I always take with me for this purpose. The Ham was using it for the reception of weather cards at the time, but had bought a transceiver with a general coverage receiver, for a better coverage. The FT-101Z had of course a analog display, and was with the optional CW filter. The overall sight of the interior was very nice, and at first sight I saw no modifications. The original crystals were there for all amateurbands, the first thing to look for, because many sets are converted to 11 metres and have had a life of hard labour. Only the PA was a mess, it had been repaired, but in a very crummy way, so I had to restore it back to the original form. Some wires were half molten and the original wiring was changed. I could not test the set on the air or at a dummy, because the seller had only a piece of wire as antenne. The tubes were glowing, so I took the set at home. After some cleaning and inspecting, there were no further surprises, only a rewired mike connector, and some scratchy switches and potmeters. The components, including power supply condensers and solder joints were OK. However, when I pulled the PA tubes, I saw to my surprise that they had put in a 6146A along a 6146B tube, one of the most serious mistakes you can make with this tubes. You have to have 2x 6146(A), or 2x 6146B, and preferably a matched pair for optimal use. The input relay was changed in a very crude way, glued to the chassis with a blob of silicone and the output lowpass filter was removed. I have all wiring redone with 0.8mm silvered wire, isolated with the original oil tubing, repaired the coil connections, rewired the neutralizing parts and the output power meter. A new coil for the output lowpass filter was made from 1.2mm silvered wire and I put in a new antenna relay with 16A silver contacts. I think the PA looks a lot better now.

I have used a couple of 6146A tubes in this set, because they are at hand, and to test the possibility for using that kind of tubes in this PA. They work fine. The power output is not important for me, 100 Watts does everything I need, and the output tubes will last forever. In my first FT-101ZD I have still the original General Electric 6146B final tubes, and they look and work as new.

Wim PAØPGA

6146 type tubes and equivalents:



6146	25W = 6293 (heavy duty pulse tube, 5-10x longer lasting)	
6146A	25W = 8298	6883A/8032 (12V heater)
6146B	35W = 8298A YL1370	6883B/8032A (12V heater) YL1372 (12V heater)
6146W	35W = 6146W	(fabricated as 6146B after 1962)
QE-06/40	25W = 6146A	European version by Philips & Mullard
	QE-06/40F = 12V heater, K = 13.8 V heater, H = 26V heater	

Modifications to the FT-101ZD RF board:

RF Board PB 1960A

This board is used in the first series (0-15xxx) and has a RF amplifier, a dual Fet buffer/amplifier and a balanced Fet mixer. Although this board works good and is sensitive as it is, it had for me a big disadvantage: I have in my neighbourhood a very strong "telex?" type station that is operating exact on 8987 khz, right in the middle of the IF of the FT-101ZD and FT-901/902. This signal is so strong that it goes clean trough the mixer, so I had a constant, annoying signal, anywhere I tuned when this station was active. I have already tried to null the signal out with the IF traps in the receiver front-end, it worked to a degree, but now and then this was signal still strong enough to interfere.

In the last versions of the 101ZD and 901/902 Yeasu uses a different board (PB-2154) with a double balanced ringmixer, and I thought that it could be the solution for me, because a DBM has a maximal isolation between in and output that can be as much as 60db. Maybe good enough for getting rid of this very cumbersome 8987khz signal.

After a study of the differences of the boards, I decided to give it a try to wire the 1960 board as the 2154, using a commercial DBM module. I got a PB2154 board for a test, and this test showed that the interfering signal now was so low, it did not bother me anymore. I could have leaved it at that, but decided to change a existing 1960A board with a DBM, as a test and for the benefit of other users with the same problem. First I modified the board of my FT-901D, it uses a PB-1702B board, which is almost the same as the 1960A board. It had the same problems with IF signals getting trough the mixer.

Modification:

As DBM I used a standard CM-1 Double Balanced Mixer from the junkbox, but a SBL-1 or HPF-505 should work also. The only problem was the conversion loss of the mixer, and too low signal level output to the filter. There had to be some amplification after the mixer, as on the 2154 board. I decided to use a J310 as a impedance converter and amplifier, as on the 2154 board.

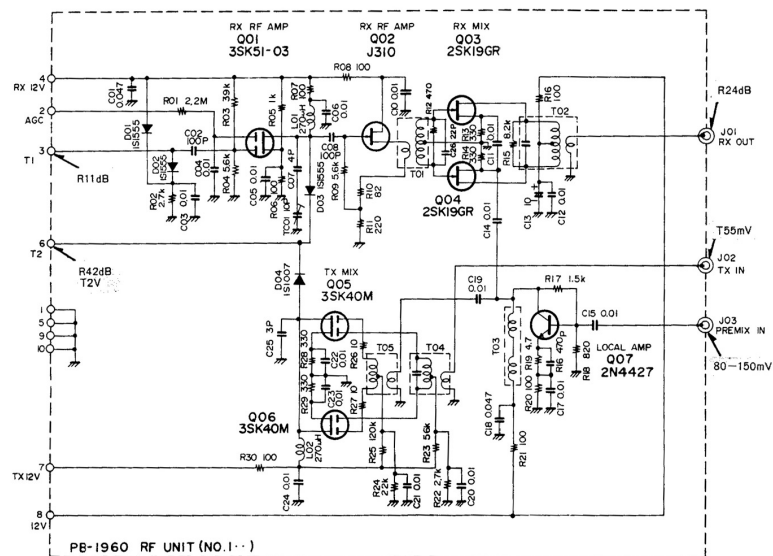
First I removed all unnecessary components on the board: T-101, R111, R112, R114, R-115, C111, C113, C126, Q103 and Q104. Be careful, the print traces are easily lifted. Reconnect R116 from the midtap of T102 to the left pin (bottomside) of T102 and connect C112 direct from the same pin to ground at the foil side of the board. Place J-310 at the right side, source to the middle connection of T102, gate to ground, drain to the previous gate point for connection to the mixer.

Place the mixer as shown in the pictures with a piece of dual sided tape, upside down and wire to the existing print traces:

Before modification

RF UNIT (PB-1960A)

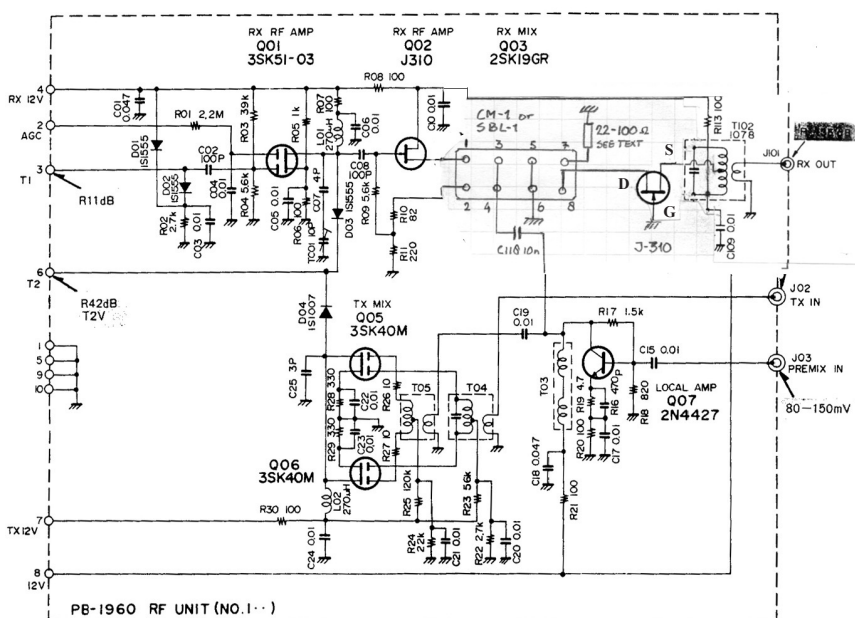
(Early model) Before Prod. #16



After modification

RF UNIT (PB-1960A)

(Early model) Before Prod. #16



1 and 2 are connected to the 2 holes of the removed T101, pins 3 + 4 go to C114 (VCO)
Pins 5 + 6 are grounded (do not ground the case, it is connected to pin 2, and carries some DC).
Pin 8 goes to the drain of the J-310, and a resistor of 22 ohm is connected between pin 7 and ground.

The connections of a DBM is rather standard, the input is at pin 1 and 2, (here it replaces the input coil of T101, which is removed from the board, along with the mixer components).

The output is normally on pin 3+4, but I used them for injection of the VCO signal. That way I could use the low impedance output pins 8+7 for connection to the J310 in grounded gate. Pins 5+6 are grounded. The amplification can be adjusted by the Drain resistor of the output J-310, it should be adjusted to a drain current of maximal 20mA. I have used a 22 ohm resistor.

I first tested several other configurations with the 2SK19 as buffer, but they lacked gain. With the J-310 the signal output level is a somewhat higher than the 2154 board, adjustment is possible with the choice of the drain resistor (18-100 ohm, not lower).

The results:

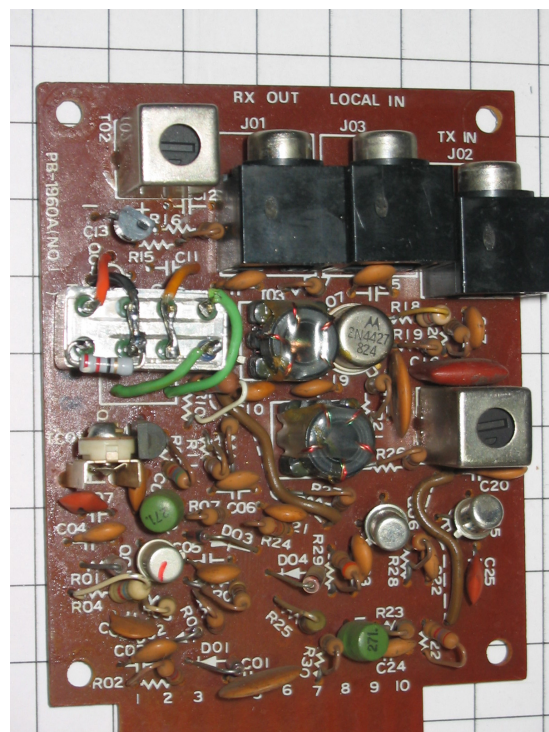
What is immediately apparent is that the noise level is lower than of the unchanged print, lower than the atmospheric noise. A test signal of 0.05uV/50 ohm from my HP606 signal generator is easily heard, a signal of 0.5uV is good for a comfortable QSO, if the QRM is low. I have the luck to live in rather noise-free surroundings, and even on 40 sometimes the noise level is so low that I can hear all stations in a roundtable, with a simple dipole. I measured a sensitivity 0.1uV/50 ohm with both the 1702 and 2154 boards I swapped/tested.

The received signals with the changed board has better audio and there is less "splatter" from other stations, but I think the ringmixer modification on the AF board is responsible for that (see the other mods.)

My greatest satisfaction of this modification is that I now got rid of this "telex" station on 8987khz, I have to peak the preselector now at the IF frequency to find a very faint signal.

Under normal operating conditions that signal is unaudible, even when it was S9 before.

This modification is easely reversable. Save the original components if you feel the need for that.



Questions: Drop me a E-mail or put a posting to the FoxTango group.

Success, 73, Wim PA0PGA

FT-901DM RF board Mod.

Modification of the PB1702B RF Board from the FT-901D goes more or less along the same lines.

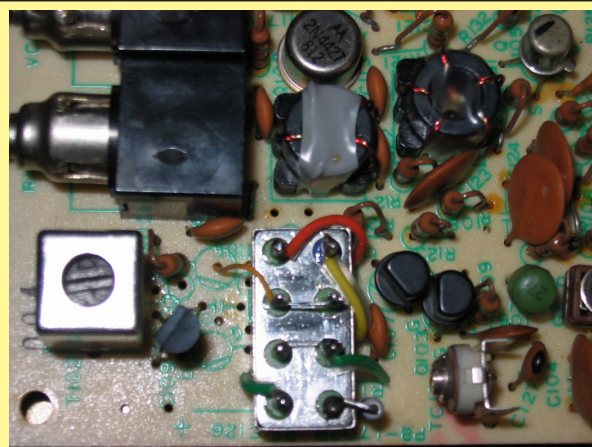
Here a picture of the modified PB-1702 board.

On this I used a HPF-500 DBM from my junkbox, but every other standard DBM will do. Works like a charm.

All in all, a modification that takes only a hour or so to do.

Recommended for European stations that have the same problems as I with this on the IF operating station.

Transceivers that are using a PB-2154 board, have no problem, so there is no modification necessary.



FT-101ZD AF Unit PB1964A

Carrier adjustments: The most complaints for bad audio quality are coming from unadjusted carrier frequencies in your transceiver; after some 25 years they have to be adjusted for optimal audio in receive and transmit.

To calibrate the carrier frequencies: Connect a counter to the middle of pot VR-501

Adjust in receive mode:

USB: 8989.000 khz (trimmer C503)

LSB: 8986.000 khz (trimmer C504)

Adjust in transmit mode (PA heater switch OFF)

CW: 8988.295 khz (trimmer C505)

Repeat several times, until you get the exact values.

Output to the mixer:

USB/LSB: tx/rx about 2Vpp at the middle of VR-501 (measured with a scope)

CW: tx ca. 3Vpp at the middle of VR-501

Modification of the diode ring mixer:

Yaesu used here 4x 1S1007 silicon diodes, in a ring-mixer configuration. They are not bad but the performance can easily be improved, by using Schottky Barrier diodes such as the HP 5082-2800.

If you have the possibility, select them for equal forward current from a batch at the suppliers place, or order a special quad.

Selecting is an easy affair:

Use your multimeter in the diode range and connect to the diodes with a serial resistor of 4.7 K-ohm (value is not important). You now measure the forward current. Select 4 diodes that have the same value on the meter or as close as possible. In a normal batch it is rather easy to find 4 diodes with the same value.

Now, remove diodes D502 to D505 from the board and replace them with the schottky barrier diodes, in the same configuration, the ring end is the cathode.

After replacing, the bridge has to be aligned for maximal carrier suppression with VR-501 and TC-502.

Alignment is done in tx mode (**Heater switch OFF**) because it is most important to have a good carrier null for a clean output SSB signal.

Connect a oscilloscope to pin 2 of the print (SSB out), and null the oscillator signal with VR-501 and TC-502, repeat several times in USB and LSB mode for the lowest output. (I had a value of less than 5mV.)

When you have selected equal diodes, both the pot and potmeter are near the middle of their range.

I measured the old 1S-1007 diodes, they were close but not as equal to each other as the schottkys.

Tests on 40 and 20 meters showed a audible lower noise level and much improved received signals, because the schottky diodes handle bigger signals more easily.

There is also less "splatter" from other stations (except the ones with their overdriven kilowatts and compressors), so it seems that not all splatter is generated on the band but also for a part in the receivers.

Listening on 40 and 20 shows that the average signal levels not much differ from before the mod, but the signals are much cleaner and the noise level is lower, ideal for DXing.

The noise level on the higher bands is lower than the atmospheric noise from the antenna, I can even hear a difference on 80m.

Signal comparisons have been done with another trusty FT-101ZD, on the same antenna and time.

The tx has now a much cleaner signal on the oscilloscope, with no flat topping, even when the mike level is fully up.

I use a standard Yaesu low-impedance hand mike and receive good modulation reports.

All in all it is a easy job, that results in a real improvement on both rx and tx side. I have done this mod too on my FT-901DM, with equally good results.

RF in the audio stage:

Some sets have problems with a distorted audio due the RF that reaches the microphone stage. The real fault here is a bad ground connection or a ground loop. A 10nF condenser between every microphone pin and a common earth is in most cases enough to eliminate this, but proper grounding on one point, preferably at the antennae tuner, if used, is better. Try always to keep the RF out of your shack, It will give some very weird problems with your equipment.

To be continued.....

73, Wim PA0PGA

The 6146 Family of Tubes

by

Glen E. Zook, K9STH

Probably the most used tube of all times in the final amplifier of "boat anchor" transmitters is the 6146. From the early 1950s until at least the 1980s, the 6146 found its way into virtually every manufacturer's line of transmitters. In fact, during the early 1960s RCA had a series of advertisements on the back cover of QST that listed a different manufacturer's equipment that used the 6146 each month.

There are actually three distinctive variants of the basic 6146: The 6146, 6146A, and 6146B. It is unfortunate that the 6146B was called the 6146B for it is really a different tube from the first two. Primarily the difference between the "plain" 6146 and the 6146A is the makeup of the heater ("filament"). The 6146A has what RCA calls the "dark heater". This "dark heater" is supposed to be more resilient to vibration, work well at a larger "range" of voltage, etc. Otherwise, the 6146 and the 6146A are the same tube.

In mid-1964 RCA introduced the 6146B with the "claim" of 33.33 percent higher power input than the 6146 / 6146A. Also, it was "claimed" that the 6146B could be directly substituted for the earlier tubes. The 6146 / 6146A had a maximum rated power input of 90 watts for CW and SSB operation and the 6146B had a rating of 120 watts for the same emissions.

Many amateurs are aware that the military "ruggedized" version was designated the 6146W (I will get to these tubes a bit later). However, RCA also introduced in the early 1960s the 8298 tube for use in commercial mobile equipment. The 8298 is just a "heftier" 6146A. Motorola, General Electric, and quite a number of other commercial FM equipment manufacturers used these tubes in all sorts of FM communications equipment for both low band (30-50 MHz) and high band (150.8 - 172 MHz). When the 6146B was introduced, RCA "announced" the 8298A commercial equivalent of the 6146B. In fact, most of the RCA 6146B tubes were "cross branded" with the 8298A number in addition to the 6146B.

Those companies who were manufacturing 6146 series tubes for the military changed from the "plain" 6146 to the 6146A to the 6146B as the military decreed. However, all of the tubes manufactured under military contracts were known as 6146W and, to my knowledge, nothing was done towards marking the tubes as being equivalents of the 6146, 6146A, or 6146B. The only way of telling is from the "date code" which is printed on each tube. Different manufacturers changed tube types at different times. Also, I know of no "master list" telling on what date a particular manufacturer changed from the 6146 to the 6146A to the 6146B. The only "sure" way to know if a particular 6146W is of either the 6146 or 6146A type is to look for a "code date" of before 1964 since RCA introduced the 6146B in the middle of that year. However, some manufacturers did not start manufacturing 6146B equivalent 6146W tubes for at least a year after RCA introduced the 6146B.

RCA "claimed" that the 6146B was directly interchangeable with the earlier members of the 6146 family. Unfortunately, this did not hold true in most cases. Collins, Heath, and probably other companies, at first issued various documents saying that the use of the 6146B in their equipment was "fine". But, this soon proved otherwise!

For example, when the 6146B was used in the Collins 32S-1, 32S-2, 32S-3, 32S-3A, KWM-2, and KWM-2A it was discovered that the components in the neutralization circuitry "burned up" in a very short amount of time. Thus, Collins had to retract the statement that it was "OK" to use the 6146B. Then, due to the fact that the United States military establishment wanted to "standardize" on the 6146W equivalent of the 6146B, the neutralization components had to be redesigned to allow the 6146B to be used. Fortunately, these changes did not affect the use of the earlier 6146 and 6146A in those transmitters manufactured to use the 6146B. All three types of tubes may be used without any problem in these transmitters.

Replacing the 6146 / 6146A tubes with 6146B types often results in spurious emissions, parasitic oscillations, etc. This is due to the fact that there are different bias requirements, different inter-electrode capacitances, etc. of the 6146B versus the other two. It is often difficult to neutralize 6146B tubes when used in place of the 6146 / 6146A. If neutralization can be achieved, often it lasts for just a few minutes before the tube(s) goes into oscillation.

If one insists on trying the 6146B tubes in place of the 6146 / 6146A types, the very first thing to do is to neutralize the final amplifier. If it will not neutralize, then the 6146B tubes should immediately be replaced with the older type tubes. If it does neutralize, then the neutralization should be "watched" for several hours (even days) of operation. If the neutralization changes, then the 6146B tubes again should be replaced with the 6146 / 6146A series. If the neutralization remains constant after several days, then use of the 6146B is fine in that particular transmitter.



I have, in my shack, a number of transmitters that use the 6146 / 6146A type of tubes. These include Collins 32S-1, 32S-3 (earlier model before the neutralization was changed); Heath Apache, DX-100, DX-35, SB-401, SB-110, Seneca; Johnson Pacemaker; and other transmitters as well. Every one of these is much "happier" with the 6146 / 6146A family of tubes. In addition, I have owned transmitters like the Knight T-150 and T-150A that use the 6146 tubes. Frankly, these transmitters were much happier with the 6146 / 6146A tubes.

There is another 6146 family tube that is "superior" for operation at least through 10 meters. That is the 6293. This tube was designed for "pulse" service and is rated at 1-Kilowatt pulse power input. The primary difference between these and the "normal" 6146 is that the plate is much "heavier" in its construction. Back in the late 1950s and early 1960s we would almost "kill" to get our hands on a pair of these for our DX-100s, etc. The 6293 outlasts the 6146 in "normal" service by at least 5 times and often more than 10 times the life of the tube. These tubes "show up" at hamfests, swap meets, etc., from time-to-time. If you see some of these, definitely "glomp" onto them!

The 12-volt equivalent of the 6146 is the 6883, the equivalent of the 6146A is the 6883A, and the 6146B is the 6883B. Now, there are the tubes that were manufactured for FM commercial service. These series go as follows: 6883, 6883A / 8032, 6883B / 8032A / 8552. Again most of these are "cross branded" with all of the tube numbers that are equivalent.

From 1970 until late 1979 when Motorola went out of the reconditioned equipment business, I owned the Motorola reconditioned equipment center for the south-central United States. We reconditioned Motorola FM equipment for 14 states, everything that Motorola sold reconditioned that was exported, and everything that was sold to the United States Government (this was the height of Viet Nam and the Government did buy reconditioned equipment!).

At that time, the Motrac series of mobile equipment was very popular. Depending on the model, these normally used one, or two, of the 6883A / 8032 tubes. It was only in the very "latest" models (HHT "E" series, LHT series, and MHT series) that Motorola had redesigned the equipment to use the 6883B / 8032A / 8552 tubes. Around late 1976 or early 1977, Motorola decided to eliminate some of the tube types that they were "stocking" at the Schamburg, Illinois, parts depot. Thus, they started shipping 8552 tubes in boxes that were marked as 8032. The Motrac is unique in the fact that you cannot see the tubes when they are in operation (they are enclosed in a metal "heat sink"). In fact, it is difficult to even "tune" a Motrac when the heat sink is not in place.

We went through from 50 to over 100 of the 8032 type tubes per week and within days were "down" to using the 8552 tubes in the 8032 boxes. Within a very few days of starting to use the 8552 tubes we started receiving complaints that virtually every Motrac unit that was received by customers arrived with one, or both, tubes broken. Prior to this we had never had a single complaint. Upon investigation we found that the 8552 tubes had so many parasitic oscillations that they were getting so hot that the glass envelope was being annealed! This was happening within a minute, or two, of tune-up and final quality control. When the radio was subjected to normal vibrations of shipping, the glass envelope of the tubes was being shattered.

This was reported to Motorola. At first they refused to believe us saying that we must have gotten a "bad" shipment of tubes. But, within a couple of weeks they received over 1000 complaints from their service stations about exactly the same problem. It cost Motorola one "heck of a lot" of money to pay the warranty claims because they had tried to "cut costs" by eliminating the earlier type of tube. They had to re-box all of the 8552 tubes that had been put into 8032 boxes and get in a "rush" shipment of 8032 tubes.

The whole problem stemmed from the fact that the "B" series of tubes is not the same as the "plain" and "A" series. The parasitic oscillations were caused by the different bias requirements and by the "fixed" neutralization of the driver and/or amplifier tube in the Motrac. There was no practical way to change the circuitry to handle the "B" series tubes. Also, making such a change would void the "type acceptance" of the units.

In a "practical" sense, it is "OK" to mix 6146 and 6146A tubes since the primary difference is in the design of the heaters. But, NEVER mix 6146 / 6146A tubes with a 6146B! This is really "asking for trouble".

Also, in a number of transmitters and transceivers (especially the Heath SB-Line) the heaters ("filaments") of the pair of 6146 tubes are in series. In these units it is very easy to change the heaters from series to parallel and substitute the 6883 / 6883A / 8032 tubes. The 12-volt equivalent tubes are often available for "pennies" because of the vast number that were used in the commercial FM market. I have done this with my Heath SB-110A and it works "like a champ". If you every want to change back, it is a very simple operation to do so.

I know that there are amateurs who say that they have used the 6146B tubes in place of the 6146 / 6146A without any problems. I can definitely believe that. But, I have seen way too many examples of the 6146B causing problems in relation to the cases in which the substitution has no effect. As I said before, neutralize and keep checking the neutralization for several days if you do replace your 6146 / 6146A tubes with 6146B types. Otherwise, you can find yourself with TVI, "burned out tubes", and other damage to your transmitter.

You must be VERY careful when dealing with the various tubes of the 6146 family, otherwise you just might be in for some very interesting problems. Substitute if you must, but, be aware that you are "treading on thin ice".

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More interesting articles on his website: <http://home.comcast.net/~k9sth/>

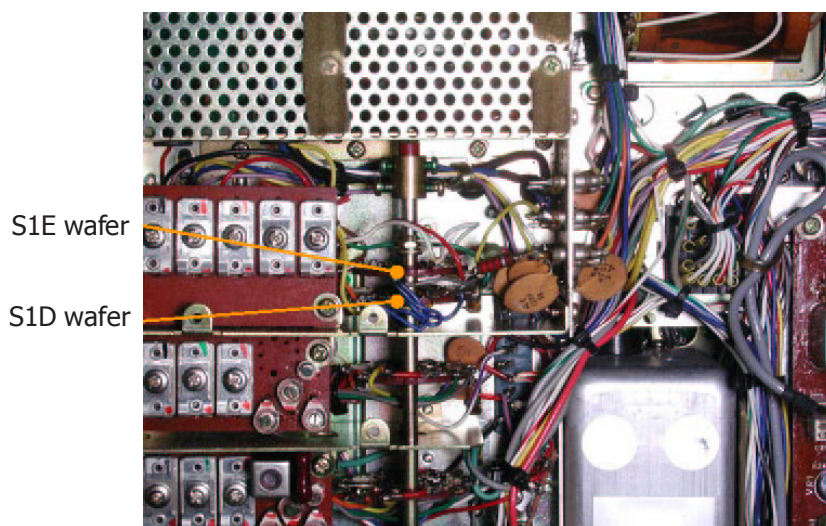
Removing the Yaesu WARC bands TX disabling modification on FT101 ZD MKII.

(N.B. The Yaesu Mod did not disable the RX for the WARC bands)

The Driver mod works by effectively adding extra capacitance from the lower bands across the coil, so that the WARC bands cannot tune to the required frequency, and no drive is therefore produced for the PA. This Mod removes the extra capacitance and the WARC bands can then tune correctly. There are no adjustments to make after the wiring change. Takes about 15 minutes and you get three bands going.

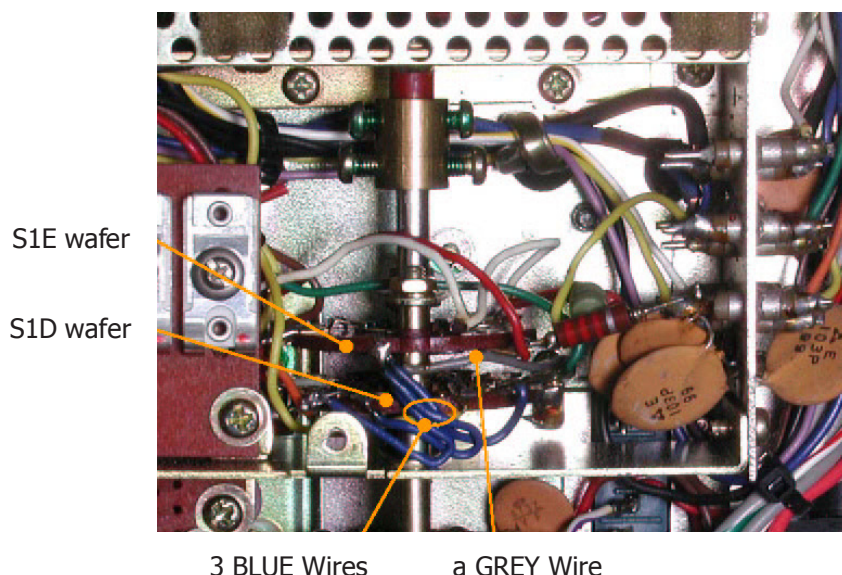
PREPARATION

- Turn the FT101ZD over with the front panel towards you. The Driver section is on your Left hand-side half way up.
- Remove the Driver section metal plate. Two of the lid securing screws will be hidden under some foam.
- The S1E wafer is next to the PA section, which is at the Left hand side rear. The S1D wafer is in front of this one towards the front on the unit.
- Identify the 3 BLUE wires and a GREY wire all joined together on a spare hole at the top of the S1E wafer. The Blue wires are connected to the S1D wafer.

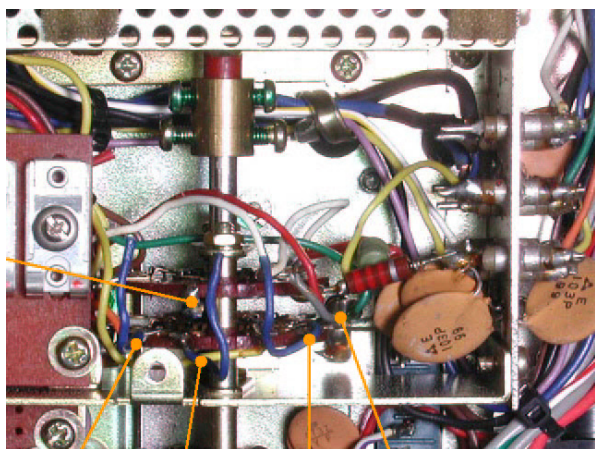


The MODIFICATION

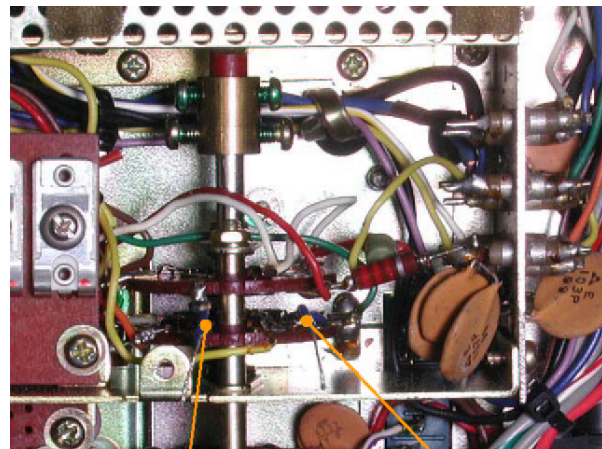
- Cut all the wires off the communing point on switch wafer S1E, 3 blue & 1 Grey wire.
- Remove completely the grey wire to switch wafer S1D position 12 m.(best done by using long nosed pliers and twisting it off)
- Remove completely blue wire off switch wafer S1D position 40 m.



Cut all wires



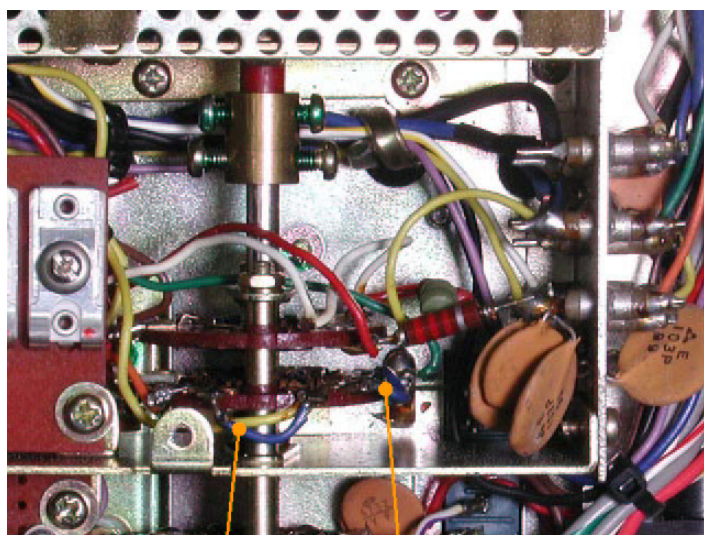
position 40 meter 30m 17m 12m



30 m 17 m

4. Connect as a loop Blue wire on switch wafer S1D position 30 metre to switch wafer S1D position 20 m.

5. Connect as a loop Blue wire on switch wafer S1D position 17 metre to switch wafer S1D position 15 m.

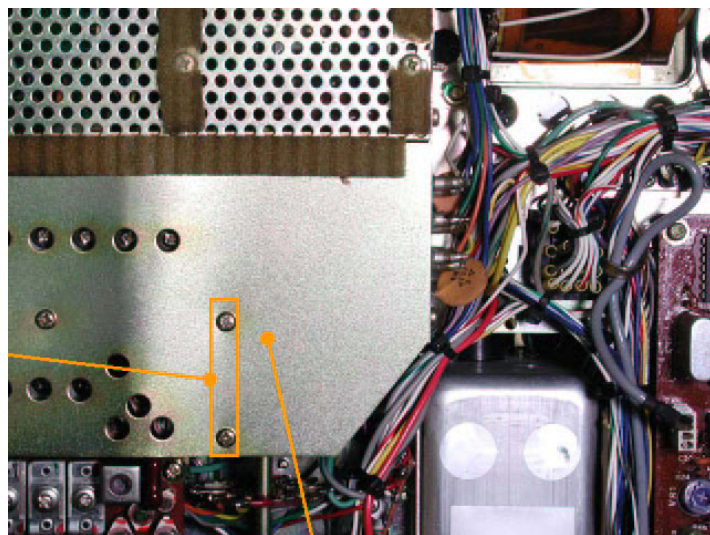


6. End of modification.

30 m connected to 20 m as a loop
17 m connected to 15 m as a loop

Mario Chomicz (G8ODE) & Teruhiko Hayashi (JA2SVZ)

foam tape



Driver section metal plate placed

Counter Replacement Module

Text and explanations by Teruhiko Hayashi (JA2SVZ) http://homepage3.nifty.com/RadioGaGa/COUNTER_e/

For YAESU FT-101Z / FT-107 / Sommerkamp FT-307 / FT-707 / FT-901,902 (later version)

DISPLAY COUNTER UNIT (PB-2086A)

Custom Integrated Circuit (MSM9520RS) Replacement Module

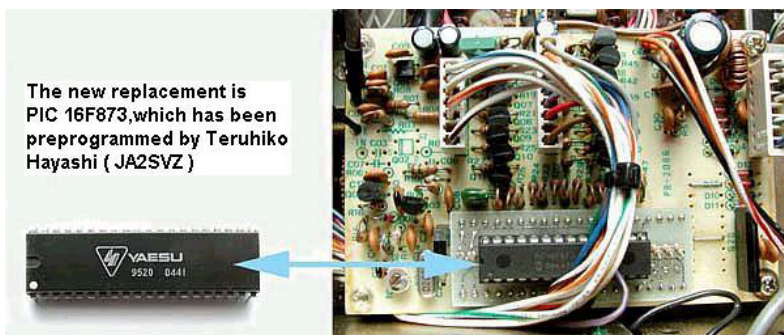
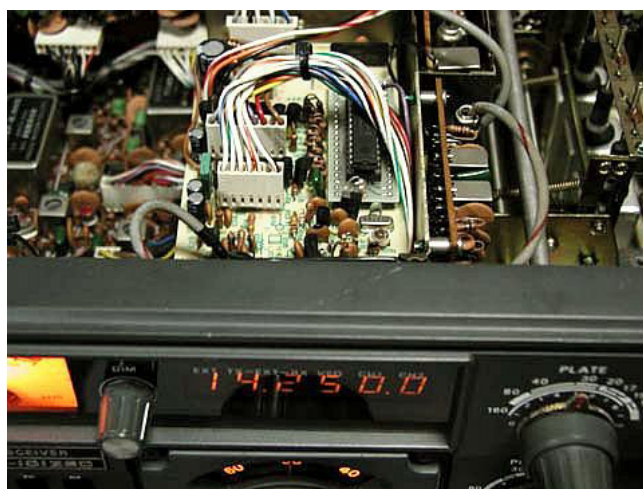
Is your precious, beloved 101ZD still displaying the frequency?

"Pre-DSP/MPU era transceivers" from YAESU often made use of a custom integrated circuit (IC), MSM9520RS in their DISPLAY COUNTER UNIT. The bad news is that MSM9520RS is somewhat prone to failures. Since this particular IC was not a standard product but a custom ordered IC by YAESU and its production has been discontinued for long time, there is very little hope to obtain a replacement part for repair, even at world famous TOKYO AKIHABARA!

This replacement module takes advantages of the flexibilities of PIC microcontroller (PIC 16F873) to "simulate" the exact functionalities of MSM9520RS in the DISPLAY COUNTER UNIT: PB-2086A, equipped in FT-101Z, FT-107, FT-707 and FT-901/902. This module restores their frequency display functionality when MSM9520RS fails.

Those YAESU models were designed and produced at the "supreme" of analogue technologies and can still perform "beautifully" when properly maintained. (and with frequency display, of course!)

My FT-101Z came from one of my friends several years ago and like many others, the frequency display was nonfunctional: MSM9520RS was dead. Since the entire transceiver except its frequency display was functional and in good shape, I decided to develop this PIC replacement module for myself. It did not take too long for me to realize that many people in the world are desperately looking for MSM9520RS and I started thinking I can be of their help.



Applicable Models

Originally this module was designed for and tested in my YAESU FT-101Z but thanks to other enthusiastic volunteers, the applicability of this module to other YAESU models has been verified and tested. So far, the following YAESU models can make use of this replacement module.

FT-101Z FT-107 FT-707
FT-901/902 (later version only)

For FT-901/902, the early versions did not use MSM9520RS for its frequency display; therefore the early version is not applicable. The later version can be distinguished with its brightness control knob: "DIM" located on the left side of the frequency display. Also, the DISPLAY COUNTER UNIT is marked as PB-2086A, with MSM9520RS 40 pin DIP IC.

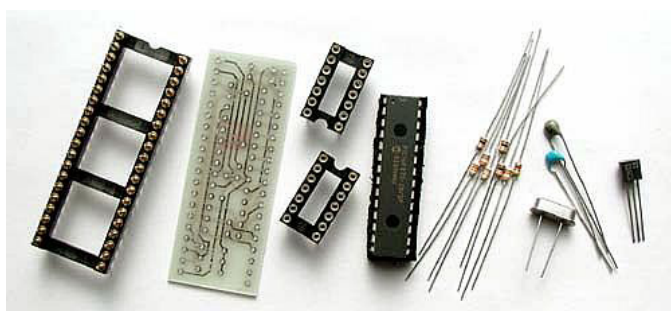
Contents of the KIT

This module is offered as a parts kit form. It contains a custom made, double sided printed circuit board for converting the 28 pin of the PIC microcontroller to 40 pins of MSM9520RS, programmed PIC 16F873, 20.000 MHz crystal (for frequency measurement standard as well as PIC clock generation) and resistors, capacitors and a transistor for modifying the preamplifier circuit on the DISPLAY COUNTER UNIT: PB-2086A.

The Assembly and Installation Manual is available for down load.

Please contact Teruhiko Hayashi (JA2SVZ) by e-mail: thayashi@ta2.so-net.ne.jp for ordering information, S/H cost estimation and for other technical information!

Prerequisite: It is necessary to unsolder 40 pin DIP IC (MSM9520RS) from the board: this may be a little challenging if you are not familiar to. You need to deal with fine foil patterns on the conversion printed circuit board: routing between 1/10 of inch DIP IC pins. Usually it takes a couple of hours for someone who often conducts transistor/ IC projects as a hobbyist to complete the assembly, installation and adjustments.



Hints and Kinks

by **PAØPGA**

In this section I will give facts and thoughts, that I have collected from all over the net.

When sources are known, I will mention them, because to hold your FT-101ZD in an excellent condition is only possible when all real amateurs, share their knowledge and experiences.

That's still the first rule for a Ham in my opinion.

Of course are all tips free to use, but using them is always at your own risk. If you don't have the knowledge or technical skill, then please let the lids of your set closed, it is always better to have a good working transceiver then a perfect heap of junk. Never try to be smarter than the HF engineers of the design Lab, there is almost always a good reason that things are done the way it is.

Most modifications are small, and are additions for a specific reason, not a complete rebuild of the set.

So have said that, we start with a collection of tips:

First of all:

Get the proper user and service manuals for the equipment that you have, and make yourself familiar with the working of the circuits. The manuals for the FT-101Z and ZD, and other Yaesu communication equipment are on the FoxTango site, in PDF format, free to download, **(well, a small donation is very much appreciated, to keep things rolling)**, so there is no reason to start without them.

Special recommended is the very extensive Maintenance Service Manual, with around 200 pages, which is not only very interesting, but gives all information on boards, voltages, trouble shooting lists and in general all information to keep your FT-101ZD in a first class condition.

Switching the fan:

When the rig is mostly used on receive, there is no need to let the PA cooling fan run continuous.

I switch the fan with the heaters On/Off switch:

Pick up the 12V of the heater circuit at the accessory socket at the rear of the transceiver and rectify it with a diode and a suitable elco. Use the DC voltage to switch a small relay. I used a small 12V reed relay with 1 contact. Use a suitable series resistor to limit the current. With the relaycontact you can now switch one 100 Volt connection to the fan socket. I made this modification 25 years ago, and it works still as a charm. There is room enough in the back of the transceiver to mount the relay and the couple of small parts you need in a neat manner.

Source: PAØPGA

Improving second Double Balanced Mixer:

On the AF board is the double balanced mixer, D02 to D05, they are 4x 1S4007.

Replace these with 4x Motorola MBD-702 diodes and the adjust VR01 and TC02 for the best carrier balance. It should be possible to null the carrier almost completely.

Source: G3TJP

First mixer overload

(only FT-101ZD MK2 and MK3, board PB-2154, used after run 17xxxx,)

RF board: Improve the dynamic range of the first mixer by modifying the T-Pad attenuator on the input as follows:

Change R8 (120R) to 36R, change R9 and R10 (10R) to 27R.

Reset overall gain on IF board using VR02, which is the source load of Q15.

Source: G3TJP

Improved Fine-tuning:

Shunt the clarifier control with a 4k7 or 5k6 resistor, then recentre its action by adjusting VR01.

This mod reduces the control's range.

Source: G3TJP

Tips from Kiwi land

On 10 meters the transmitter **takes off** on HF or with the transverter being used. The problem is dry joints or earthing points around the 12BY7. Resolder all connections on and around the 12BY7 board.

Source: ZL3MH

Fault blows main fuse every 0.5 to up to 6 hours and is not the 6146's flashing over.

There are vertical type caps in PB-1968 and the internal fluid runs down and arc across the narrow gap in the caps (300 Volt screen supply, a common problem in TV sets).

Replace caps C1001, C1002, C1003 and C1004, they are all 10uF/450 Volts.

Source: ZL3MH

Replace the 1000pf condensor from the plate of the driver tube to the grids of the 6146B's.

This a precautionary measure, as the FT-101 series had problems here.

Source: ZL3MH

The Noise Blanker stops working sometimes.

It appears to be a dry joint on plug pins of the Noise Blanker/ Fixed channel board.

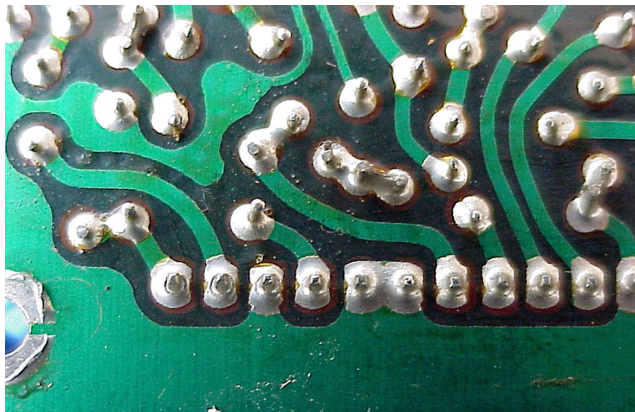
The fix is to solder around the connections of the board.

Source: ZL3MH

I had the same type of dry joints in the cable connectors of the audio board, and the cable connectors of the IF board, there where several pins with craters around. See picture.

This gives all kinds of curious problems. Resoldering is the cure.

Source: PAØPGA



The transmitter stops working:

The band change switch is in two parts. It is joined where it goes to the 6146B compartment from a steel shaft to a fiber shaft. This connection comes loose, and the bands do not line up properly.

It is a good precaution to mark the shafts with a markerpen and tighten the screws on the band switch extension. I heard from a FT-101ZD repairer spending days to track this one down.

Source: ZL3MH

FTV-250 and FTV-650B on the FT-101ZD.

The FT-101ZD is designed for the FTV-901 series of transverter via the 11-pin accessory socket.

The Plate, screen and bias voltages are not always wired to the accessory socket. This is needed if you want to run the FTV-650B 6-meter transverter that is designed for the earlier FT-101 series.

Especially the MK3 model did not have the above wiring.

Both the FTV-250 and FTV-650B can be used with this mod on all FT-101ZD's.

Source: ZL3MH

Help notes on the FT101Z/FT101ZD **Collected tips from everywhere, sources unknown.**

**** there are several versions of the FT-101ZD, and some of these faults do not apply to all versions. ****

Blowing mains input fuse :

Disconnect PA anode clips to see if one of the PA valves is short circuited. If not, then some of the diodes in the main bridge rectifier are probably short circuited.

Intermittent blowing of mains input fuse :

If the fuse blows every now and again, then suspect that one of the PA valves is flashing over once in a while.

Fluctuations in power output :

Check the PA valves. Check the PA anode choke.

Sizzling/arcing from PA :

Check the PA anode choke.

Low power output on some bands :

Check the PA anode choke and also the coupling capacitor from the PA to the output tank circuitry.

PA unstable on higher frequency bands :

If the neutralisation is OK, then check if the 12BY7A driver is glowing blue on transmit - replace if it is.

Low sensitivity rx :

If the marker can be received at the normal level then suspect the aerial fuse. If the marker signal is low as well then suspect the PA driver 12BY7A - this shares a signal frequency tuned circuit with the RF stage. Q8 on the IF board also causes this problem sometimes.

PA tuning incorrect :

If the PA won't tune correctly on some of the bands then check for short circuits on the output tank coil and the nearby wiring.

No rx :

Check the width control is not set at one end (surprisingly common).

No tx and no bias :

Check accessory plug is in octal socket at back. Check the PA screen grid voltage - if it is missing check D1002, D1012, and R1006 on Rect.B unit.

No CW tx :

Check Q1003 on Rect.B unit (possibly Q1001 and Q1002 as well). I have had failure of the CW carrier osc xtal on a couple of occasions.

No tx 28-30mhz only :

Check R8 which is mounted on the band switch assembly near the driver.

RF feedback on 21/28mhz :

Some units had a four way tag strip near the mic. i/p socket - the two centre earth connections should be connected together.

Incorrect frequency display on one band only : Suspect the local osc xtal for that band.

Poor rx/tx on one band only : Local osc xtal as above.

11m reconversion :

These rigs were sometimes converted for illegal CB use. This usually involved replacing 28.5-30 MHz with 26.5 to 28 MHz. A few rigs are still around in this state, and will require re-converting back to 10 metres. This will require the replacement of the local oscillator crystals, and re-alignment. Realignment should not be omitted, as the rigs may intermittently fail to operate correctly if it is. Change required local osc xtals for the original types and the local osc **must** be re-aligned to ensure continued reliable operation.

Hum on rx when volume control at min :

This is usually caused by a hum loop. If there are two earth braids connected to the v/c then cut one of these.

Hum on tx :

Same as above but on mic gain control.

One segment of display does not light :

LED U/S. Note these are usually in sockets and are easily swapped for checking.

Incorrect segment illumination on one digit :

Digit driver IC U/S.

Intermittent incorrect frequency display :

If on one band only, suspect the local osc xtal on that band - check alignment of osc before ordering crystal, especially if fault is on 10m (because it may have been used for illegal CB and not realigned). If on all bands suspect Q04 or Q05 in the counter (later models) - note that Q04 must be the S version.

Intermittent rolling frequency/panel lights dim :

Suspect a dry joint on the LT smoothing cap. Also suspect the cap itself.

Lumpy VFO :

This is caused by wear of the VFO tuning mechanism. I have tried a number of times to repair and lubricate this, but always without success, although it may last a short while.

To be continued.....



Buyers Beware

Be careful by buying any FT-101ZD transceiver with AM/FM and previously used on 27 Mhz by good buddy's, they have all been heavily overloaded by users that had no real knowledge what they are doing, so suspect the worst. They liked special the tube-type final sets, because they are not so easily destroyed by misuse as the more modern sets with transistor PA's.

When you buy such a transceiver, it will cost at least a couple of final tubes, at a additional cost of around \$ 100.-, if not the total repair of the Power Amplifier. It is better to pay something more for a good-looking, not over-used set from a known source. The same goes for the FT-901DM, even more popular with the CB folks because they had the AM and FM boards installed.

If the price is too good to be true, it usually is. Cheap sets are usually problem sets.

If you can repair everything yourself and have the time, there is nothing wrong with buying cheap, but usually the sets are otherwise misused too, so you always end up with a lesser set than the one in good condition, carefully used by a fellow ham. Of course this sets can also have some problems, but have at least the potential to be restored to a first class piece of equipment. Use your common sense.

Always try to collect the set yourself, that way you can see what you are in for. Sometimes to meet the vendor can give you a clue how the set was used.

Buying at Internet is a good source, if you take some precautions:

If the seller uses the internet much, he has usually a quality marking to his name, wich gives a clue to his reliability, but this means also that he buys and sells very often, and is more interested in a quick buck, than in the equipment itself. So please beware, and be careful. You see often the same pictures of very nice equipment in ads, but when you receive it, is it a box full of junk, scratched and mostly with a lot of internal problems. See the FT-901DM page for a sample.

The best buys come from local hams, or hams who want to upgrade to a newer ricebox with more menu's and knobs to fiddle with. To obtain the new toy, they sell the old, reliable sets often for a modest price. Another source can be the usual swapfest or estate sell fom a deceased Ham.

Of course you have to inform yourself on the market value of the set you are looking for.

Actual prices change with general condition, the available options or accessoires, and are often negotiable. Take your time, and keep an eye at ads, sometimes you have to act fast if your dreamset is at an auction for the right price. If you are in a hurry, you can always place a ad in the asked catagory.

6146 type power tubes:

Try to buy NOS tubes of American brands, I have a special liking for RCA tubes, but other good brands are GE, Eimac, Tungstam, Raytheon or European Philips, Mullard, Siemens or Telefunken. All this firms don't make tubes anymore, but there are still much tubes on the market. Good tubes last practically forever, if you use them properly, special the ruggidized types and SQ types in Europe.

They are in most respects much better than the Chinese and Russian and many other mysterious brands that are on the market today.

A special warning may be worth the brands Haltron and Ultron. They were tube manufacturers in the previous East-European countries and produced low-cost versions of all kind of popular tubes. They still produced tubes when the other brands closed their factories. If you look close to the construction you see skewed electrodes, balloons skewed in the sockets, and a general miss of quality. They never last as long as the others. I prefer anytime a 50% tested secondhand RCA tube to a new Haltron.



73 PAØPGA



Keep them glowing...

