

Modifications for the Yaesu FT-290

Modification of tuning range

There are 4 possible jumpers in the FT-290R close to the CPU on the second small board from the rear.

Numbers are 1 - 4 from the bottom (the most hidden one).

The indicated combination is perhaps the most usable in Europe because the repeater shift is 600 kHz, the steps on FM tunes to X00, X25, X50 and X75 standard frequencies and at the same time it gives a larger tuning range.

But please note that it is not legal to transmit on frequencies outside the ham band. Even by mistake.

In some countries it is not legal to have a receiver that can be tuned outside the ham bands. Please check local regulations.

Frequency	Repeater	Step	1	2	3	4	
Not usable			0	0	0	0	
144 - 148	600	25 12.5	0	0	0	1	
140 - 150	1.600	100 25	0	0	1	0	
144 - 146	600	10 10	0	0	1	1	
Not usable			0	1	0	0	
144 - 148	600	10 5	0	1	0	1	
140 - 150	8.000	100 10	0	1	1	0	
144 - 148	600	10 5	0	1	1	1	
Not usable			1	0	0	0	
144 - 146	600	25 12.5	1	0	0	1	Standard in Europe
140 - 150	5.000	100 25	1	0	1	0	
143.5 - 148.5	600	10 5	1	0	1	1	Probably most usable
140 - 150	7.600	100 25	1	1	0	0	
140 - 150	600	20 10	1	1	0	1	
140 - 144	1.000	20 10	1	1	1	1	

Yaesu FT290R for TXV use

Once in a while I see questions about the use of an FT290R for transverter use.

I have an Yaesu FT-290R, about 12 years old. The look-alike rig for 70 cm is the FT-790R. If I'm correct, the PLL-system was exactly the same (except for the X-tal for mixing up). It could well be that the mark II versions still use the same processor type.

The information was printed in the VERON DX-press/VHF-bulletin abt 11 years ago. I don't know the author or the exact year. The primary intention of the publication was using an FT-290 as transverter for 70 cm.

The information concerns the microprocessor chip 'HMCS45C' probably noted as Q01. On the pins 38, 39, 40 and 41 jumpers to ground specify the frequency-range, preset and step. With 4 pins there should be 16 different combinations. The factory set position determines the version for European or US-market.

In the table below you find the known combinations for the FT-290R. 'X' means jumper to ground. My guess is that removing the jumper at pin 39, the PLL is transformed to a wider frequency range used in the FT-790R. Once you are able to reach the print-board, you could try to (de)solder the jumpers and determine the results.

These modifications are best made with power and battery backup switched off.

band	144-146	144-148	143.5-148.5	144-148	145-146	144-148
preset	145	145	146	147	145	145
step	12.5/25	12.5/25	5/10	5/10	10/20	5/10
41	X		X			
40			X	X		X
39				X	X	
38	X	X	X	X	X	X

I hope this information is of some use.

FT-290 Bulb-Replacement

FT 290 MK1. Bulb replacement instructions.

1. Remove speaker wires (white & black -)
2. Remove aerial to tag.
3. Remove yellow wire to meter, left hand side (viewed from rear)
4. Remove black wire to meter, right hand side (viewed from rear)
5. Remove earth connection to pc board on front end of unit (thin braid approximately 1/2 inch, 12MM in length)
6. Remove 2 screws from pc board.
7. Remove both support pillars.
8. Take off front.
9. Remove screw (second front panel)
10. Remove meter.
11. Remove led display screws.
12. Remove post.
13. Remove black and red wires.
14. Now test new bulb.
15. Remove unit & fit new bulb, solder bulb wires.
16. Replace items in reverse order.
17. Grab a bottle of your favourite tippie and pour a glass or two from it. You have just saved over 30.00 pounds sterling. Mine has today gone for the second time, that's why i made these notes first time round.

Following a few hints about problems which I had during the work and which might save somebodies time.

(Because of that I had to disassemble my rig three times!)

There might be minor changes during the series of which I am not aware !

- REMEMBER THAT STATIC ELECTRICITY IS POISON FOR YOUR RIG ! YOUR CONTROLLER IS CMOS-TECHNOLOGY !!!
- Ground-connections to front pcb-block has to be unsoldered (at my rig on TWO places: to antenne-ground-tube and to metal box in the center (top view !)
- Unsolder black ground wire to antenne-ground-tube
- Hot wire and ground to antenna coax-cable at the antenna-filter (to get space for handling)
- The bulb size is about 3mm diameter and 6..7 mm long (without wires, hi) I added a resistor of 100 ohms/0.15 watts in series, so the 12 V-bulb can withstand up to 15 volts without trouble, a car battery has about 14 volts which means continuous overload without resistor. This killed my bulb.
- (If your rig's bulb is still ok it might be advisable to add such a resistor on a suitable place of the rear switch-board BEFORE the bulb burns out. This board is much better accessible (remove the battery-case....) This saves a lot of time for your hobbies ! For the lamp change you should calculate half a day if you do it for the first time !)
- The frequency display is only CLAMPED onto the display-pcb which carries the bulb to replace by means of the mounting frame (under which is the bulb). Removing the frame causes the display to fall down or at least result in its displacement.
- Change bulb as mentioned by Ian, add 100 ohms-resistor if desired (If you want to use an extra bright LED 3mm use a 680 ohms-resistor with 0.33 watts for 20 mA current. I have not tested the illumination effect of such a LED. Problem also: The light is not going to both sides for the illumination, meter and LCD.) The resistor should be in series to the red wire, isolation with insulating tape or equivalent.
- Fix the above mentioned frame together with the metal support by means of the two screws. If you want you can remount it to the front plate.
- Now THE IMPORTANT STEP which saves a lot of time in case of display-displacement.
 - **Make sure that you have connected all boards together and that none of the unsoldered wires come to ground !!! REMIND YOU MAKE THIS TEST ON YOUR OWN RISK AND RESPONSIBILITY !!! *** Switch off your FT 290. Connect a dummy-load (because of the unsoldered antenna) to the rear antenna- connector or a frequency counter via a 20 dB-attenuator. Connect the microphone as usual. Switch your FT 290R to LOW power and apply 10..12 V to the DC extern from a current LIMITED supply (Limit 1 A, NO Car-Battery ! Center to MINUS!) Switch the Lamp-Switch to ON. Last chance: No short-circuits ? Switch on your FT 290. The new lamp should be on and the display show a frequency. If not: Check current consumption (Be careful, to make no short-circuits in this test-setup !) Try to transmit and check if you can change the transmit-frequency at counter. (With dummy use a second receiver and see if receive-frequency changes Check if the measured transmitted frequency corresponds with the displayed one in the range of tolerances. If all is ok, goto step a10. If you don't have a display on the LCD but can change the frequency with the knob, you might have the same problem like me: 'Display-Displacement' or bad contact of the LCD. (Try to press slightly against the display, if now figures are announced, it's a big progress.) Switch off the power . Just disassemble the frontpanel with the display again and re-assemble it more accurate. Start again at a8. vy 55 for the second time ! (I had the complete rig together, when I had this fault !)
- Now re-assemble your rig and before resoldering all meter-cables and the antenna you can repeat this test, if you want.
- Check that you didn't forget any screws for fixing the boards together ! (My third partly disassembly !)
- Resolder all wires.

FT-290R (first version) Extensions

I hve nothing about the second version. Perhaps later...
73's of Ludovic.

The pins no 38,39,40,41 near HMCS45C are used for extensions.

PIN No		BAND	STEP	FM/SSB	SHIFT		
38	39	40	41	MHz	KHz	Hz	
*	*			140-150	25 100	1000 100	7.6MHz
*	*	*		140-144	10 20	1000 100	1MHz
*	*	*	*	140-150	5 10	1000 100	no shift possible
*			*	144-146	12.5 25	1000 100	600KHz (European version)
*	*		*	144-149	10 20	1000 100	600KHz
*		*		140-150	25 100	1000 100	5MHz
	*	*		140-150	25 100	1000 100	5MHz
	*	*	*	144-148	5 10	1000 100	600KHz
	*		*	144-148	5 10	1000 100	600KHz
		*		140-150	25 100	1000 100	1.6MHz (FB for 70 cm transverter)
		*	*	144-146	10 20	1000 100	600KHz
			*	144-148	12.5 25	1000 100	600KHz
*		*	*	143.5-148.5	5 10	1000 100	600KHz

Problem width packet

There is a very "hard" de-emphasis in FT-290R. This can cause serious problems copying packet signals with some demodulator chips, eg. like the XR2211. By a common request, here is a modification of this popular TCVR for packet radio. It was made after a RADIO-REF article in several copies, by HA5OB, HA5DI, HA3MA and others. Increasing the intelligibility in noisy environment, this modification is also useful in FM voice communications.

You'll have to add only a serial RC unit, the R being 4.7 kOhm, and C being a 1uF tantalum capacitor. Put them between the pin 9 of IC Q1019 and the collector of transistor Q1021, with the positive leg of the tantalum capacitor to the collector of the transistor. These points can be found as test points, near to IC Q1019. Solder the components together, wrap some insulation around them, then solder to the test points mentioned. That's all you have to do! With this modification, FM reception will sound somewhat noisy, but much louder.

How to prevent the touch-tone pad from automatically keying up your rig

Rigs involved: This mic. comes with the Yaesu FT 290 MK II (2 Meter rig), the FT 690 MK II (6 Meter rig), or the FT 490 MK II (UHF rig), and possibly others.

1. Take the three (3) back screws off.
2. Take the two (2) screws off the circuit board to free it from the case.
3. Find the red wire going to the micro-switch, ie, the ptt line.
4. Follow that red wire to the circuit board. At that place on the circuit board another red wire will join the first one.
5. Un-solder both red wires from the circuit board and clean up the solder mess, otherwise hum will occur.
6. Solder the two red wires together and cover with tape or shrink tubing.
7. Put the circuit board in place and screw it down.
8. Put the "lock" slide switch back in place.
9. Put the rest of the case on.
10. Put the outside screws in.
11. You are now ready to try it out, so go ahead and re-attach it to your rig!
12. All should work:
 - o PTT works and releases,
 - o Mic passes audio,
 - o touch tones work when ptt button held,
 - o touch-tone red "LED" still lights up when touch-tone pad keys are depressed, even if ptt button is not held down,
 - o no hum noticed.

Some small mods for FT-290 MK I

AUDIO DECOUPLING

It seems important to fit a 0.1uF cap into the receive audio line to the TNC. Fit it inside the five pin plug. The FT290R has no decoupling capacitor in the audio output (See wiring Diag. IC No.Q1027 (uPC575C2) off pin 7.

CAP CRUNCH

Many people have problems getting the Mk1 working on packet. This is due to the receiver filtering attenuating frequencies above 2kHz, thus the 2.2kHz tone is attenuated by 10-15dB. The standard capacitor crunch mod, originally designed to give more "sparkle" to the audio cures this. To do the mod, remove the case and turn the rig so the control knobs face away and the SO239 antenna socket is nearest you. At the back of the PCB is a relay (a box shaped component made of semi-clear plastic). Just above the relay are two green capacitors.

Using small pliers, grip the capacitor nearest the relay (C110) and crush it, removing all the debris.

DE-EMPHASIS - 1

There is a very "hard" de-emphasis in FT290R. This can cause serious problems copying packet signals with some demodulator chips, e.g. like the XR2211. This modification increases the intelligibility in noisy environments, and is also useful in FM voice communications.

Add a serial RC unit, R = 4.7k, C = 1uF tantalum capacitor between pin 9 of IC Q1019 and the collector of transistor Q1021. The positive leg of the capacitor goes to the transistor collector. These can be found as test points near to IC Q1019. Solder the components together, insulate them, then solder to the test points mentioned.

With this modification, FM reception will sound somewhat noisy, but louder.

DE-EMPHASIS - 2

Yaesu seem to have goofed on both the FM de-emphasis and the audio filter. A computer analysis of the audio circuit suggests:

1. Reduce C125 from 10n to 4.7n in filter
2. Reduce C124 from 2.2n to 1.5n (near Q1026)

This isn't perfect but it a lot better - the tones now seem nearly equal. There appears to be plain FM (cf phase) with no pre-emphasis on Tx!

RESET TO 145MHz

This mod resets the CPU to 145MHz and sounds a bleep to tell you it's been done. Remove top and bottom covers, locate the hole in the case near the SO239 socket covered by a stick-on aluminium label. Make a hole in the label and install a push to make, non-latching switch. Connect one side of the switch to ground and the other to pin 4 of J5003 which connects the keyboard and control units. A 1nF capacitor should also be connected from pin 4 to ground for decoupling. Replace the covers, dial up any frequency, press the button and the set should reset to 145MHz and bleep.

LISTEN ON INPUT

Place the set with controls towards you, remove the bottom cover and locate the black/white wire on SK1. It's the tenth one from the left.

Cut this wire at the socket and insulate the free end. Locate the green/white wire on SK1 and solder the anode of a 1N4148 diode to it.

Connect the cathode of the diode to the red/white wire on the PCB adjacent to the mic. socket. Insulate the diode leads to prevent shorts. When the call button is pressed, it allows listen on input on both +shift and -shift. When you want the rig to transmit a tone burst you must close the PTT at the same time as pressing the call button.

CURING SYNTHESISER WHINE

Early 290s suffered from a high level of whine. Try moving the wiring harnesses around inside the rig whilst monitoring the whine on another rig. The real cure, if you have a delicate hand for soldering, is locate LO6 in the synthesiser and solder a 15pF capacitor in parallel with it. This can usually be soldered between the hot ends of C24 & C25 which are at the rear of the IC in the synthesiser unit.

MODIFIED SQUELCH

This mod reduces the difference in level between the opening and closing points and speeds up the operation of the squelch enabling the scanner to work better. Reduce C94 from 4.7uF to 1uF, increase R79 from 270K to 330K and add a 10uF tantalum or subminiature electrolytic between the leg of R78 (4.7K) and the body of the transistor T1007.

OPENING UP TO 148MHz

Remove the battery compartment and slide out the power board to allow access to the microprocessor board. Two tinned copper wire jumpers are visible on this board, next to the microprocessor. One is easy to see and the other is not because it is next to the main board.

Cut the jumper which is difficult to see. If the wrong jumper is cut then the frequency display will not be correct when the unit is powered up.

FT-290R Mk1 - mod for 1kc and 100hz steps on FM for satellite working

I asked around for details of this Mod but no-one had attempted it.
I decided to take the bit between my teeth and sort it out. Here goes.

1. Remove the covers of the rig and locate the mode select switch on the front panel. (you only need remove the covers...nothing else)
2. Locate the wafer of the switch nearest to the front of the rig and identify the green and yellow wires. Arrange a suitable method of switching the wires around. With the wires transposed the rig will now step 1kc and 100hz on FM. Note though that SSB will be 25/12kc, simply flick the switch to tune SSB normally. (I used an external switch, but I am sure that the noise blanker switch could be used or replaced with a suitable DPDT switch). You will find that the rig will tune on TX making it much more suitable for satellite working.

If you want any more info please give me a call.

Joe. G4XRZ @ GB7WRC.#16.GBR.EU

Common faults found on the FT-290R

NO RF O/P : PA

If it is not PA (the most likely cause) then check diode D24 in aerial switching, check for L2012 physically shorting to copper screen, and check driver Q2021 and R69.

OFF FREQUENCY RX + TX

If this is just a couple of KHz then realign PLL local osc. If it is several KHz (possibly 10-12) off frequency then suspect PLL local osc xtal X02 (18.7414MHz).

OFF FREQUENCY FM TX

Realign L1002 (FM TX osc coil). If frequency error is significant then suspect xtal X1001.

ERRATIC FREQUENCY JUMPS

Check X02 as above.

DRIFTING

Check -6.8v. rail, and check Q05 on REG unit if this is missing.

POOR SQUELCH OPERATION

Check Q1019 (MC3357P) and D32 in squelch circuitry.

POOR QUALITY FM RX

Xtal X1003 (11.265MHz).

ERRATIC TUNING

The tuning step switch.

TUNING JUMPS

The tuning step switch.

INTERMITTENT TX+RX

Check TX/RX relay. Check alignment of VCO in PLL.

NO AUDIO O/P

Check audio IC Q1027. Also check to see if the reverse polarity diode is blown, as reverse polarity causes failure of this IC.

CONTINUOUS CW OR NO CW TX

Check Q2010 (MC14001B). Also check the wire to the key socket is not s/c or broken, as this can happen when the battery compartment is taken in and out.

LOW SENSITIVITY RX

Check T1001 Ae. i/p coil, D25 in aerial switching and RF amp.

LOW SENSITIVITY ON A UNIT WITH A MUTEK BOARD

Check for loose strands from the braid of the Mutek board's coax shorting out the connecting pins

on the Mutek board. Then check BF980 in Mutek board.

FADING LCD DISPLAY

Dismantle LCD display unit and clean the rubber connecting strip and the PCB it makes contact to.

CRACKLING NOISE ON TX AUDIO (FM ONLY)

Q2004 mic amp IC.

CRACKLING NOISE ON TX+RX

Check X3001 (5.76MHz) in PLL.

MELTED NICADS

Replace DC i/p socket (and nicads). This fault can also occur as a result of using a DC input plug which is not quite the correct diameter or length, because the batteries are then not disconnected when DC is plugged in.

POOR SSB TX (NON-LINEAR)

If the PA has gone non-linear, then replace the PA and change R70 from 390R to 270R.

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