Icom IC-706MkIIG Mods and Tips

Everything for Icom 706 Fans in One Place.

Introduction

Ah, the li'l 706: What can I say? I like it! It performs like big radio, but it's small. It sounds good, and it's well made. You can add the remote kit and put the control head and the radio box where ever you want them. The price is right.

This article is a handy compilation of most of the mods and stuff I have developed or found on the web for the 706MkIIG, plus a chronicle of the little accessory kits that I have built to enhance my enjoyment of the 706.

Disclaimer: The author assumes absolutely no responsibility, under any circumstances, for what the reader may do with this information. Building and connecting circuits, and performing adjustments or modifications, may damage your radio, void your warranty, and/or cause it to operate in violation of FCC rules and Type Acceptance, etc, unless you are VERY CAREFUL.

Brand New 706 Setup

The 706 comes with several factory defaults that you'll want to change. The recommended changes make the radio easier to operate. First, let's set up the power-on defaults.

Go to Initial Set Mode by power off, hold Lock button and power on. Refer to the initial setup items on pages 50-55.

Item 1: You can turn off modes that you don't want the Mode button to select in its rotation: Unless you have an external FSK RTTY system connected, turn off RTTY mode. Most of us on RTTY are now operating AFSK RTTY via a computer, where you'll be running on SSB.

Items 2 and 3: When you get tired of hearing it beep, turn beeps off.

Items 4 and 5: When operating the radio in the house, Low lighting is sufficient. Daytime mobile operation will benefit from High lighting of the display.

Item 7: RF/SQL: This requires some explanation! Set to RF/SQL, the knob will act as RF gain from 7-12-O'clock, and Squelch from 12-7-O'clock. Set item 7 to RF/SQL and set the knob to about 12:30 and you'll never have to mess with it again. If set to Auto, you'll have to crank it around every time you switch from SSB/CW to FM modes. The "RF/SQL" setting is the most convenient.

Item 8: Sub-dial: Set it to RIT if you operate HF. This makes the Memory Channel knob operate as a RIT while in VFO-A/B modes. Regardless of where you set this setting, the knob will still operate as Memory Channel while in the MEMOry mode.

Items 9 and 10: Optional Filters: Set to "No" if you have not purchased optional filters. If you add one filter, I recommend the FL-232 in slot 1, and set the "Opt. Fil 1" setting to FL-223. This will (1) give you an effective CW filter and (2) let you select "N" (narrow) while on SSB, giving you the 350 Hz filter for digital modes like PSK-31. Installing the 232 but selecting the 223 fools the radio, so you can use it on SSB. See the Section below on Filters.

Item 20: Auto Repeater: This should definitely be changed from the default. Set it to "On 2" and the 2 meter band will automatically set the right offset when you are in the range of the usual repeater bands -- 600 negative below 147, and 600 positive when above 147. This will save you a lot of extra offset-setting while you are programming your repeater channels. Also sets the usual +5.00 MHz offset for 440 repeaters.

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Item 24: AM NB: Set to "off" and the Noise Blanker will be disabled on AM reception, where it will otherwise cause distortion to strong AM signals.

Item 30: VSend Sel: Set to "off," the HSend line on the Acc'y jack will key the radio on all bands; Set to "on" (the default), HSend will key the radio on HF/6, while VSend will key it on V/UHF bands. "Off" is useful if you will key the radio from a computer interface for all bands. "On" is useful of you will key the radio with a computer on HF, but with an external TNC for V/UHF. You'll need to study the book and do some fancy wiring on the 13-pin DIN plug...

To operate the computer digital modes, see the interface article, and for software and operating tips, see the digital-modes article.

The rest of the initial settings are usually OK -- by preference, or as-needed.

Now power off, and on, and go to the Q menu, by holding in the Display button.

Set the mike gain to 4-5: i.e., just where it changes from a 4 to a 5.

Notes:

1. The supplied HM-103 hand mike contains a 1-inch broadcast-type condenser element designed by Bob Heil for Icon, and has excellent quality -- better than most HF radios. Never talk flat into the mike -- talk **across** it, about an inch away. This large-diaphragm mike element is too sensitive to use flat against the mouth. The HM-103 hand mike, and the Heil iCM series, are the only mikes you should use with a 706. Do **not** attach other mikes to the 706, or you will be disappointed!

2. The mike gain setting is the same for all bands and modes Mike settings are NOT stored by band, modes, nor memory channel.

3. Setting the mike gain at 4-5 and talking across it is sufficient for all bands and modes.

4. Do not use the processor (CMP) except in extremely marginal conditions! The supplied hand mike is so clear that the added "punch" of the processor is rarely needed. Also, the processor will add substantial bandwidth and splatter on SSB, drawing complaints form nearby QSOs.

5. The output power level is NOT stored in memories. There is one setting for HF and one for V/UHF. Output power will need to be adjusted manually as you move from nearby to distant repeaters, or from strong to weak SSB stations.

6. Icon radios seem to use the ALC circuit to control power output. When you are at high power, you'll see little or no ALC meter indication; when at low power you will see full ALC indication. This is normal operation! Do NOT adjust the mike gain to set ALC levels, as with most other radios. Leave the mike gain at 4-5, set the power as needed, and don't worry about the ALC meter.

7. If you do install a different mike, you'll need to determine a new "best" mike gain setting.

Setting up your memory channels

It is important to set up your memory channels in a table before committing to fully programming the 706. I recommend you:

1. Group all your FM channels together, from 50-99 (or so);

2. Group all your other non-FM channels together, from 1-49 (or so);

3. Use a Word table to develop your channel list; sort it by frequency, then install it.

4. Take your time! The better your list, the less fragmentation will develop over time.

5. If you perform the Frequency Expansion modification (below), it will erase ALL settings and memories and return the radio to factory settings. If you REALLY want to use 60 meters and/or MARS, do it NOW and save the long process of programming everything twice.

Frequency Calibration

Unlike older radios, the 706 uses only one crystal oscillator (called the Master Oscillator). All other frequencies in the radio (L.O., 3-4 I.F. stages, VFO, and CW-offset) are computer-derived from the Master Oscillator. This makes it relatively simple to frequency-align the radio, so that it agrees with the Frequency Display in all modes.

NOTE! Various 706 models use different parts to calibrate the Master Oscillator. Refer to your Instruction Manual. Additionally, the lower diagram on page 63 (11: Internal Views) in my Instruction Manual is wrong:

1. In the position shown as R602 is a trimmer capacitor (coarse adjustment), and

2. Just above it is R602, the variable resistor (fine adjustment), and

3. Adjustment of L623 is not necessary.

It is possible, if you are very careful, to calibrate the radio to +-1 Hz at 15 or 20 MHz (WWV as reference). Use the highest WWV frequency you can receive, usually 20 MHz in the middle of the day. Note: This is not the procedure used by Icon and the Service Manual. I consider this procedure more accurate because it uses WWV directly, bypassing the possible error of the Service Monitor, which is *supposedly* calibrated to WWV.

This procedure only applies to radios without the optional TXCO (high-stability unit CR-282). Also, this procedure is only for radios like mine -- having a trimmer cap and a VR nearly under the 60 MHz gray coax in the lower (front) right-hand (radio inverted) corner. These lie just to the right of the encased (shielded) master oscillator.

You will need:

1. #1 Phillips screwdriver;

2. Jeweler's Screwdriver set;

3. 3.5 X headband magnifier and a bright light;

4. Air Conditioner and/or heater, and digital thermometer to control room temperature;

5. And for greatest precision, a computer running MixW in the PSK mode -- read the audio frequency on the status line with 0.1 Hz resolution.

Not Necessary: Oscilloscope, Service Monitor, or Frequency Counter (thank goodness!).

Procedure:

1. Measure your normal room temperature. The radio (inside) runs about 10 degrees F above ambient, while closed and receiving.

2. Increase your room temperature 10 degrees above normal and stabilize it.

3. Lay the radio upside-down on a pad, front facing you.

4. Connect power and antenna.

5. Remove the bottom cover and set it aside.

6. Verify the room temperature is 10 degrees above normal, and stable.

7. Turn the radio on and let it receive for 30 minutes or so.

8. Set and lock the VFO to the highest WWV signal you can hear -- usually 20.000.000 Hz.

9. Set Mode to CW. You will hear the 600 Hz receiver offset tone beating the WWV carrier.

10. Press and hold (1 second +) the Mode button repeatedly, switching between CW and CW-Reverse.

11. Compare the two tones. If there is any shift in the CW and CW-R tones, you need to calibrate the Master Oscillator.

12. Don the magnifier and adjust the lighting.

13. Get the jeweler's screwdriver that precisely fits the slot in the trimmer capacitor.

14. Wrap a band of electrical tape around the handle of the screwdriver until is it 1/2 to 3/4 inch in diameter, This allows you much more precise control.

15. NOTE: Touch the tiny components with the lightest possible pressure!

16. Set the VR to its mid-point.

17. Adjust the trimmer cap as close as possible (coarse adjustment). Use the lightest possible touch!

18. Remember to remove the screwdriver from the trimmer cap when comparing CW/CW-R tones.

19. DO NOT adjust any of the coils! (L623 or L601).

20. Finally, adjust the VR (fine adjustment) until you hear no frequency shift between CW and CW-R.

High-Precision Adjustment:

1. Connect the radio's audio output to the audio line-in of a computer (set the volume low).

2. Run a program such as MixW that has a continuously averaging audio frequency display in the status line.

3. Repeatedly adjust the VR, very carefully, until no frequency shift is seen on the computer. It is possible to get within 1 Hz.

4. Note: Your computer soundcard clock may not be calibrated, so you may not see 600.0 Hz on the status line frequency readout. Simply adjust the VR until the numbers are equalized between CW and CW-R modes. Afterward, you can adjust your soundcard clock (in MixW) to make it alternate 599.9/600.0 (in AM mode) and then your computer will also be calibrated.

5. When satisfied, replace the cover and return the room to normal temperature.

Testing the Frequency Calibration, Notes:

1. Accuracy increases on lower frequencies and decreases on higher frequencies. For example, if it is off 1 Hz at 20 MHz, it will be off 0.5 at 10, or 0.25 at 5 -- or 10 Hz at 200 MHz and 20 at 400. Hence, Icon Service (and the Service Manual) will tell you to calibrate the radio using a lab-grade Service Monitor or Frequency Counter at 60 MHz or higher. However, even the best lab-grade equipment is calibrated to WWV, the broadcast of the US NIST cesium atomic clock, so I recommend just bypassing the Service Monitor and using WWV directly, at its highest frequency, 20 MHz, and getting the Master Oscillator within 1 Hz in a temperature stabilized room.

2. Many do not know that the modulated audio tones on WWV are also Frequency Reference Standards. The "beep" at the top of each minute is exactly 1000 Hz; the continuous tones (when on) alternate between 500 and 600. Thus, you can listen to WWV on AM and get an exact 500 or 600 Hz tone, then switch to LSB and USB and compare them with the true tone heard on AM. You can also beat a 500 or 600 Hz offset tone against the 500 or 600 Hz modulation, when available, but this beat is hard to hear below a few Hertz.

3. To periodically test the calibration, simply return to 15 or 20 MHz (exactly) and repeatedly switch between CW and CW-R, comparing the tones. You'll see it go off a little when the room temperature is not normal, and when the radio is heated up from lots of transmitting, but it shouldn't be more than 2-3 Hz off, at 20 MHz.

4. You can determine your exact error by connecting to a computer and reading the frequency differential between CW and CW-R. Divide the differential by two and that will be your error (readable to within +- 0.01 Hz using MixW.) If you then QSY down, divide the new frequency by the old (to get the ratio) then divide the error by that. Using this technique, I was able to win the 2004 ARRL FMT award certificate by getting within 0.04 Hz!

5. You can determine the frequency error of other people's radios. Have them set to some exact reading and transmit a carrier for 10 seconds or so. Switch your mode to CW and alternate between CW and CW-R, while adjusting your VFO to equalize the tones (set tuning step TS to 1 Hz resolution). Compare your readout with theirs. The differential will be their radio's display error, plus or minus your own error, which is, hopefully, within 1 Hz, referenced to WWV. I have observed that a high percentage of Hams are running an error of 40-60 Hz... This may be "acceptable" on older, pre-PLL radios, but modern radios with PLL and a Master Oscillator can be calibrated much closer. Also, I have also observed that new, factory-fresh radios are typically off up to 50 Hz. This may not sound like much, but remember if you're off 50 Hz on 40 meters, you'll be off a whopping 1 kHz on 2 meters and 3 kHz on 440! --not acceptable. Since you have the time, you can do much better than the factory.

Locating the Giblets

The best thing about the 706 is being able to put the control head where you want and need it. This is not only handy in mobile installations, but at home as well. In my case, it's essential, as illness forces me to stay in bed most of the time. The head's by the bed and the shack's in the back...

Since I live in a 30-foot trailer, my station must be small - just 2 shelves. The radio and power supply are mounted below the lower shelf. Not shown: MFJ-949E replaced with MFJ-993 IntelliTuner. (Note the crystal radio on the left, and the 25-1300 MHz scanner on the right...)

First position: The control head was mounted on coffee table beside bed.
The 9-inch-high mount is a PanaVise cell phone mount.

My latest bedside operating desk. Middle shelf slides out for use. 706 head
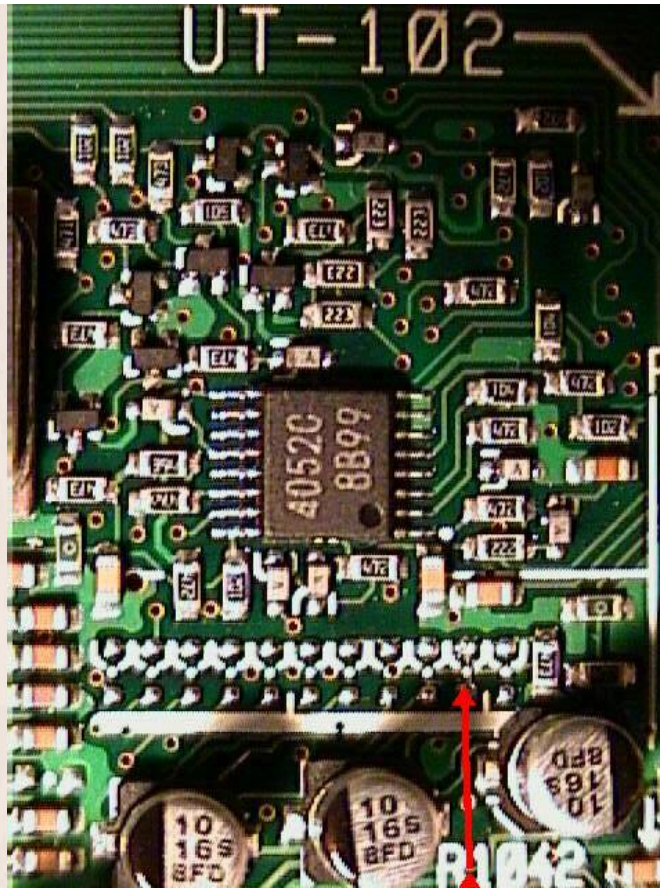mounted underneath top shelf on PanaVise cell phone mount.

Left: Another idea for control head placement.
Right: The radio, and major bird nest, is located under the desk, out of the way. Power supply and computer
interface under there, too. Mounting rear-down enhances cooling and prevents cable strain. Also, it's less than 3
feet from the ground rod!

Frequency Expansion

NOTE: The author does NOT advocate any illegal operation. It is YOUR responsibility to stay within your authorized bands. NOTE: This is for the MkIIG ONLY. Earlier models use an entirely different procedure. NOTE: This procedure WILL RESET the radio to a factory-new condition. All memories and settings will be cleared.

This modification will allow the MkIIG to transmit on most of the frequencies that it receives on.

It is useful for:

1. Accessing the new Amateur 60-meter channels

2. Authorized MARS and/or CAP operation

3. Authorized Maritime and/or Aviation SSB operation

4. Authorized VHF and UHF public service (police, fire, etc) operation

5. Authorized Land Mobile radio operation

6. Authorized VHF marine operation

7. Unauthorized operation on any frequency, only in immanent life/death emergency, only when no other means of communication are possible (legal but still legally risky)

8. NOTE: Amateur Radios are NOT FCC TYPE-ACCEPTED to operate in other services — even if you have the license to do so! Don't goof around in the legal gray area unless your leg is mashed under an 11-ton boulder! Remember that other (non-Amateur) radio services require not only a license, but also a radio that is FCC Type Accepted for that service!

Tools: The 706 uses components that are extremely tiny. You will need at least the following tools:

1. 2.5x to 3.5x headband visor magnifier or jeweler's loupe

2. Bright light

3. 15 watt pencil iron with a clean, lightly tinned, needle sharp point

4. Fine-point tweezers

5. Extremely steady hand

How to remove it (D2030):

(IC-706MkIIG ONLY - Top PCB - Red Arrow Indicates tiny SMT Diode to Remove.)

1. Some people just crush it with needle-nose. I don't like that idea since it might damage the PCB.
2. Take the tip out of your 15-watt iron. Chuck it in a drill. Turn it against a grinding stone, to a needle point.
3. Reinstall the tip. Heat and re-tin it. Tap off the excess solder.
4. Remove power cable from radio. Remove top cover slowly. Carefully unplug speaker.
5. Using visor magnifier and bright light (and a very steady hand), catch one end of the diode with tip of iron (very lightly tinned).
6. Gently pull upward with the iron. The diode will either rotate upward on it's other lead - or it'll break off.
7. If you lift one end just a little, you can leave the diode there in case it ever needs to be reattached.
8. Plug in speaker. Reinstall cover. Power up. Reprogram all your memories and settings.
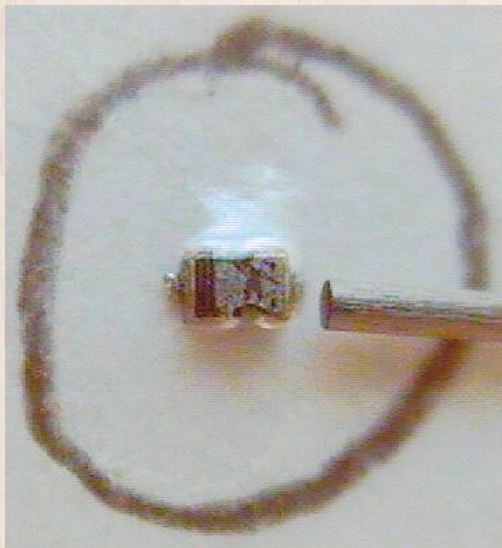
The removed diode. The rod is a 0.5 millimeter mechanical pencil lead.
You can see the diode is about ¾ x 1 millimeter.

Filters

If you run CW or narrowband digital modes like PSK-31, you need a narrow filter. I recommend the FL-232, 350Hz CW-RTTY filter. It is available from all Icom dealers. Look for the best price online. I have seen them as low as $79.95 (Universal Radio), and HRO sold me one for the rock-bottom price of $78. Many vendors sell them for $95-$105. Don't pay too much!

Pop the filter in, then go into setup and tell the radio it's an FL-223 (not 232). This will allow you to select the filter in SSB mode, as well as CW and RTTY. This will allow you to select Narrow on SSB and have about a 450Hz wide bandwidth on your waterfall.

How it acts:

1. 1. In CW and CW-Reverse, it acts as expected, setting itself at 600 Hz. The IF shift will move it around about 600 Hz.
2. 2. In SSB, it'll act like a RTTY filter. In USB, it centers at about 2150 Hz. The IF shift will pull it down to about 1000 Hz for PSK use. But in LSB, it positions itself low. The IF shift will move it down through zero to the other sideband, or up to about 2k.
3. 3. Though called a 350 Hz filter (+-6db), my waterfall shows it to be about 500 Hz wide on moderate signals. Kicking in the attenuator or rolling down the RF gain will narrow it just a bit. As with all narrow filters, it works best when lightly loaded, so keep the signal level fairly low when running digital modes.
4. 4. When running PSK at 1000 Hz with a strong signal, an harmonic image can be seen (barely) at 2000 Hz. It's not a problem at all (it may be generated in my computer, not the radio).

How to use:

1. Run setup (Lock+Power) and select FL-223 for the slot in which the FL-232 is installed. That will make the radio think it's a 223 (a narrow SSB filter) so that you can then select it while in SSB.
2. For the usual computer soundcard digital modes (PSK, FSK, MFSK, etc), set USB, start with no filter, set the

signal at 1000 Hz, select the narrow filter (Fil N), and crank the IF shift all the way right and that'll center it at 1000 Hz in USB..

3. Or, simply leave the IF centered (filter at 2150) and then tune your desired signals there. However, if you set your PSK software to copy at 2150, it will also transmit at 2150 and this may confuse other users who are accustomed to using 1000 Hz only.

4. When a strong signal overloads your receiver, just shift the IF until your desired weak signal is right on the edge and the filter will wipe out the nearby strong signal. If the offending signal is splattering, complain!

Links to Other Great '706 Places

- Icom America - Amateur Radios - IC-706MKIIG Main- they made it

- http://www.rigpix.com/icom/ic706mkiig_service.pdf Download and print the official IC-706MkIIG ServiceManual and Save $25. Shows you how and where to align and tweak everything (advanced users only!)

- Google Search: 706MkIIG OR 706Mk2G- 2100+ hits

- G3VFP's Fantastic List of Schematics, Circuits, and Software- too cool!

- www.mods.dk- Frames: Click 'Icom' then click 'IC-706Mkii' then click 'view all mods' then save it.

- Yahoo! Groups : ic706 Messages- Users discuss all the details

- eHam.net Reviews - ICOM IC-706 - All flavors- read what hundreds of users say about it

- CI-V Information pages by DF4OR- Lots of CI-V radio control software

- Big list of radio control software from QRZ

- How to connect a 706 to an SGC - PDF

- How to connect a 706 to an amp - Web Page or PDF file by K6XX