Mods for the Sony ICF 2010

by John Albert WA9FVP

(NOTE: These modifications are intended to be performed by experienced technicians. Monitoring Times assumes no responsibility for damage or voided warranties resulting from the procedures outlined below.)

I have read several articles on the Sony ICF-2010. Most everyone will comment on the functions or the performance of the radio and a few will hope that Sony will correct these problems in future models. I take a different view; that is, if a radio does not meet my standards I will modify it until it does.

I installed five modifications in my Sony ICF-2010, three of which improve the performance of the SSB mode. Don't do these "mods" if you are not a skilled technician. They Sony 2010 uses the latest "surface mount" technology and you can easily damage the radio. Also, the warranty will be voided if the radio has been altered.

The Sony ICF-2010 Service Manual can be purchased for $12 plus shipping from Joseph Electronics, 8830 N. Milwaukee Ave, Niles, IL 60648. Phone (312) 297-4200 and ask for the "Sony Parts Man."

MOD #1: Rechargeable Nickle-Cadmium Batteries

There are two problems when a radio is converted to rechargeable batteries. First, a NiCad battery will only put out 1.2 volts when fully charged; a regular D-size flashlight battery puts out 1.5 volts. You may think this is a small difference but when several batteries are used, the .3 volt difference adds up.

The ICF-2010 was designed to operate on a 3 volt internal supply and the three D batteries will provide 4.5 volts. Three NiCads will only put out 3.6 volts. The radio starts to loose its performance if the batteries drop below 3.2 volts.

Somehow, four NiCads (4.6 volts) will have to be installed. Radio Shack introduced in their '87 catalog called a "sub C" size slightly smaller than the "C" size and, when two "C" and two sub C batteries are stacked, they are almost the same lengths as three "D" cells.

The batteries can be installed in the 2010 battery compartment by shimming them with a foam rubber material. I used foam carpet padding left over from our newly-carpeted living room floor.

Lay down one long, narrow strip on the bottom of the compartment and use short strips to shim the sides of the "sub C" batteries (the two inner batteries). You can use the Sony power pack when you are near an AC outlet but the NiCads will have to be removed and charged separately. Radio Shack also has the chargers available.

Better Yet, Add a Charger Jack

Another way to charge the batteries is to install a charger jack and circuit in the 2010. You won't have to remove the batteries and the Sony adapter will power the radio while a 120 AC to 9 V DC adapter restores the NiCads. The parts and AC adapter can also be purchased from RADIO SHACK.

Figure 1 shows how to install the jack and where to connect the 47 ohm resistor on the jack board.

PARTS LIST

Radio Shack #		Item
1	237-1651	120V AC to 9V DC adapter
1pkg	274-292	Subminiature phone jack
1pkg	271-009	47 ohm 1/2 Watt resistor
1pkg	23-124	C size NiCad batteries
1pkg	23-190	Sub C size NiCads

Installing the Charger Circuit

Step 1
Write down the frequencies and modes you have stored in memory; when the back of the radio is removed the memory backup batteries will fall out and the radio will lose its memory.

Lay the radio face down on a table or bench using a soft towel to protect the front from scratches. Remove the battery cover and the D batteries, then remove the six screws which hold the rear cover. One of the screws is in the battery compartment.

Remove the back by reaching under the battery compartment and pulling up when the radio is sitting on its face.

Step 2
When the back is removed you will notice two circuit boards, the Main Board and the Jack Board. Look at Figure 1 and then the jack board in the radio. Notice the foils that are shaded in Figure 1. Connect the "mini" jack ground to the "ground foil" and the resistor to the "Battery +" foil. Make sure the wires are long enough for the jack to reach the bottom right of the cabinet (looking at the back of the radio).

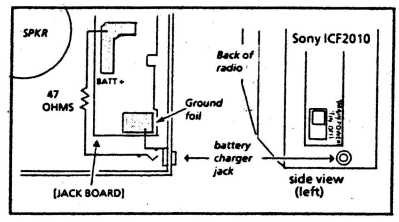
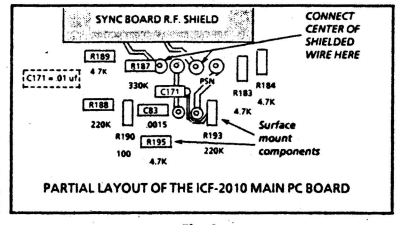


Fig. 1



PARTIAL LAYOUT OF THE ICF-2010 MAIN PC BOARD

Fig. 3

When you solder the wire to the BATT+ foil, make sure the wire will clear the contact finger which is on the inside of the rear cover. This finger touches the BATT+ foil when the back cover is mounted and you will see the scratch marks on the foil.

Step 3
Place the radio on its back (the rear cover is still off). Get your drill ready. You will need the appropriate size drill bit to mount the jack. The plastic case is too thick for the jack so you will have to use a countersink or a 3/8" drill to taper the hole. After you mount the jack make sure the wires won't get pinched when the back is installed.

Step 4
Install the back of the radio (reverse step 1) if you don't want to do the next "mod." Connect the charger to the radio and let it charge overnight. Remember, you can use the radio normally when the Sony power pack is plugged in. This will disconnect the batteries and the charger from the radio and the batteries won't be drained.

MOD #2: The Stereo AM Tuner Modification

The Sony ICF-2010 uses a new chip as a "synchronized detector" for AM shortwave reception. As pointed out in October's issue of *MT*[1] the ICF-2010 can receive AM stereo using two radios.

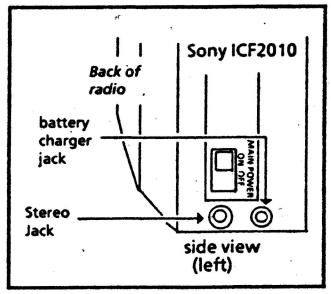


Fig. 2

I have found a way to use the ICF-2010 as a stereo tuner by adding a stereo jack and two pieces of shielded cable. Again, you should be a skilled technician to do any modification on the ICF-2010.

Step 1
With the radio lying face down on the work bench and the radio bottom towards you, carefully examine the main PC board. At the right end of the main board you will see a metal shield. Below the shield you will see a cluster of surface mount components and traces.

By examining Figure 3 and the main board, you will see the two pads to which shielded cable will be connected. Look for the designation "PSN" just below the pads.

Step 2
Prepare two shielded mini-microphone cables with shrink tubing on the braided wire. Connect one end of the cables to the mini stereo jack. Connect the other ends (center conductor) to the points shown in Figure 2. Also solder the braided outer conductor to metal shield which is ground.

Step 3
If you made the battery charger modification, you will have to mount the stereo jack next to the battery charger jack on the left side of the ICF-2010 (Figure 2). Use a 1/4" bit to drill the hole for the stereo jack. Again, a countersink will be needed to taper the hole so the jack will mount on the thick plastic case.

Step 4
Now you can mount the back cover and replace the batteries. Reprogram the memories and tune in a local AM station. Use a mini stereo "Y" adapter (Radio Shack #42-2475) to connect the Sony ICF-2010 to your stereo HiFi amplifier. You will notice that the level is lower than usual; you can compensate for this by using a

[1] "ICF-2010 User Hints," Gary Bourgois. *Monitoring Times*, Vol.5 No.10, p.28.

higher volume setting. If you have a small monophonic amplifier, you can use it on one channel and the radio's audio for the other channel.

Now switch to SYNC mode and tune up or down to select *upper* or *lower sync*. You should hear stereo on one of the SYNC positions. If you cannot hear what sounds like stereo, tune to another AM station and repeat the process. If you are using a stereo amplifier, just switch to SYNC mode and tune until you hear stereo music.

PARTS LIST

	RS #	
1	274-249	Stereo jack
1	278-752	Mini shielded braided wire

MOD #3: Better Single Sideband Reception

One problem with the 2010 is it does not have a "fast attack, slow release AGC (automatic gain control) circuit. A fast AGC is OK for AM reception, but it causes an unpleasant pumping sound when receiving single sideband. My modification adds a 4.7 µf capacitor and transistors which are used for microprocessor control.

The first transistor causes the AGC to rapidly discharge during the first scan cycle. Without it the receiver would miss the weak signals when the scan resumes if the previous signal was very strong. The second transistor disables the slow AGC during the reception of AM or AIR.

Before doing this mod you should purchase the service manual: it will aid you in locating the on-board components. The ICF-2010 is a high-tech receiver using the latest surface mount technology.

Use the proper grounding procedures for static protection. You will be removing some surface mount parts so the proper soldering and desolder removing tools are needed. The tools and parts are listed below.

Step 1
(Same as step 1 in the first mod)

Step 2
Locate surface mount resistor R14 and remove it using a desolder tool. This resistor may break but don't worry, you won't need it anymore. Unsolder diode D6 which is on the component side and let it fall into the radio. Just turn the radio over and shake it until the diode falls out. Diode D6 will be re-used.

Step 3
Prepare a small Vector board and wire it according to the schematic in Figure 4. Diode D6 and all of the components that are marked "NEW" will be mounted on the Vector board.

Make sure the wires going to the Vector board are long enough so that you can tuck the board in a spot just above the speaker. Connect points A, B, C, and D to the main PC board foil side.

You will notice that one end of R15 is not connected and D6 will connect to the other side of R15 (the lead marked "D").

Step 4
Recheck the wiring, assemble the radio and install the batteries. Set the radio to a ham band and receiver a strong SSB signal. You should notice that the noise level increases slowly between transmissions. The SSB reception will also be very clear and pleasant to listen to.

Sometimes you will notice a very strong SSB station on the ham bands will cause a very weak station in the QSO to be even weaker because it will take longer for the AGC to recover. You can force the AGC to discharge rapidly by storing the received frequency and by pushing that memory button whenever the weak SSB signal is received. This activates the "quick discharge circuit" and rapidly increases the sensitivity of the radio.

PARTS

QTY	RS #	Type
2	276-2009	2N2222 transistor
2	271-1330	4.7K resistor
1	271-1335	10K resistor
1	271-1321	1K resistor
1	272-1024	4.7 µf capacitor
1	276-148	Predrilled PCB

TOOLS

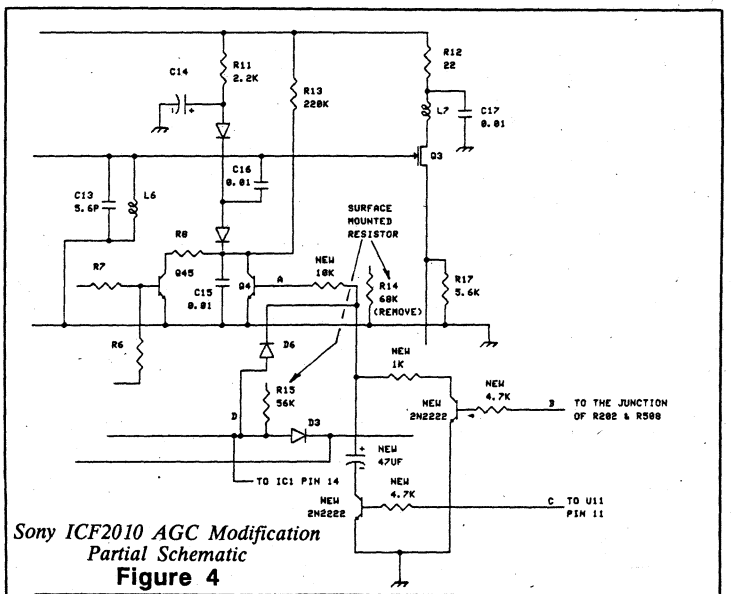
#2 Phillips screw driver

Solder remover tool
(Radio Shack #64-2098)

Controlled heat soldering station (like the Weller WTCP series)

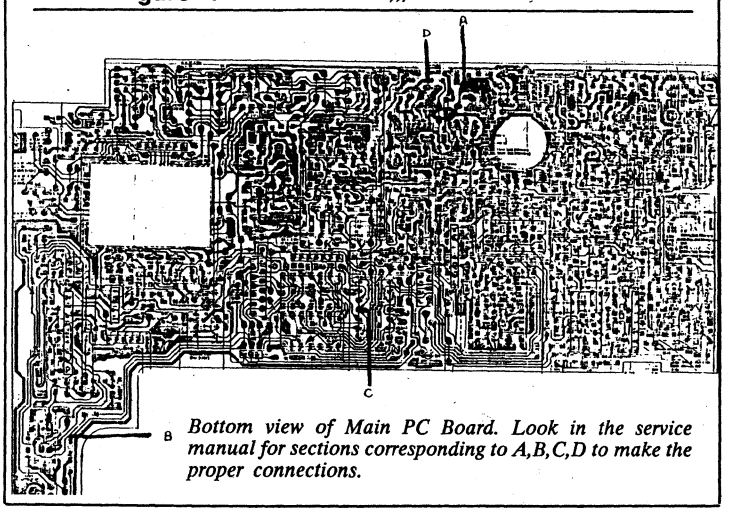
Needle-nose pliers

Wire cutters



Sony ICF2010 AGC Modification Partial Schematic

Figure 4



Bottom view of Main PC Board. Look in the service manual for sections corresponding to A,B,C,D to make the proper connections.

MOD #4: Add a Better Filter

When I received my Sony ICF-2010 as a Christmas gift in 1985 I already owned an Icom R70 receiver. I had purchased the FL-44 filter and I had the stock 455 ceramic filter lying in the parts drawer. I thought that maybe this filter would improved the Sony ICF-2010 by providing a narrower IF band pass. So when I finally received the Sony service manual, I proceeded with the task of modifying the Sony. If you have the Icom FL30 filter as a spare, you would need to purchase the Sony service manual (address given above).

Step 1
Proceed as in the original step 1.

Step 2
Prepare the Icom FL30 filter by adding two mini shielded wires about 6 inches long to the ground andinput/output pins (See the Icom layout sheet which came with the radio). Properly sleeve the shielded wire with shrink tubing. Connect the appropriate leads to the Sony radio on the main PC board. See the layout sheet and schematic in the Sony service manual.

Step 3
Test the radio; you should notice a narrower bandpass with the new filter when tuning the ham bands, for example. Tape the filter so it won't short out to anything and stuff it in a spot where it won't jiggle around in the radio. I found a spot at the left near the rod antenna.

Step 4
Reassemble the back and install the batteries.

If everything checks OK, reprogram the memories and enjoy your new radio!

John Albert (203 York Street, New Lenox, IL 60451), is a Research and Development Technician at Rockwell International. (Please enclose an SASE if a reply is desired.)

Newsgroups: **rec.radio.shortwave**
From: **(John W. Albert)**
Date: **Mon, 19 Apr 1993 12:17:07 GMT**
Local: **Mon, Apr 19 1993 7:17 am**
Subject: **Collins filters and the Sony ICF-2010**

Installing the Collins Torsional filters in a Sony 2010.

About 3 years ago I installed two Collins Torsonal Mechanical filters in a Sony 2010. I selected two filters. One is tuned for LSB (1.2 Khz above 455 kHz) and the other, USB (1.2 kHz below 455).

In order to prevent the other sideband from entering the I.F. bandpass the two filter set was needed. The radio's uP has two data output lines that selects USB and LSB. Using switching diodes, I constructed a "holy" board that used the control lines to select the filters. The board was mounded in a space near the speaker. Shielded wire was used to terminate the filters.

The purpose was to prevent both sidebands from entering the I.F. which caused AGC pumping.

I'LL EXPLAIN!

To select upper or lower sideband the 2010 uses a synchronous detector that is placed at the end of the I.F. chain. The detector chip uses the same PLL technology in radios that receive A.M. stereo or AM synchronous detection. During SSB reception the chip performs very well but, in the crowded Ham bands, strange problems are noticeable

If your copying USB, for example, and another USB station falls within the I F (lets say 6 kHz below the received signal), You won't hear him (the synchronous detector attenuates signals that falls in the other sideband) but his signal can cause an AGC pumping (the signal falls within the I.F and the A.G.C. responds).

In order to reduce the cost, A normal communications receiver uses a single I.F. bandpass filter and changes the BFO freqiency for LSB or USB reception. Because the Sony 2010 uses a crystal controlled B.F.O. (it's enclosed in a shielded compartment along with the synchronous detector), It would have been difficult to modify the circuit. thats why I decided to use the two filter configuration. By the way the 2 filters cost about $300.00

The cost is quite high and I'm sure there arn't too many SWL's that would justify purchasing filters that cost as much as the radio. The filter did improve SSB and CW reception but there's still a problem with image rejection, front end over load and intermodulation distortion.

Newsgroups: **rec.radio.shortwave**
From: **(John Albert)**
Date: **1996/01/29**
Subject: **Sony ICF-2010 AGC Problem**

In order to clear up the Sony ICF-2010 A.G.C. problem, I prepared this file
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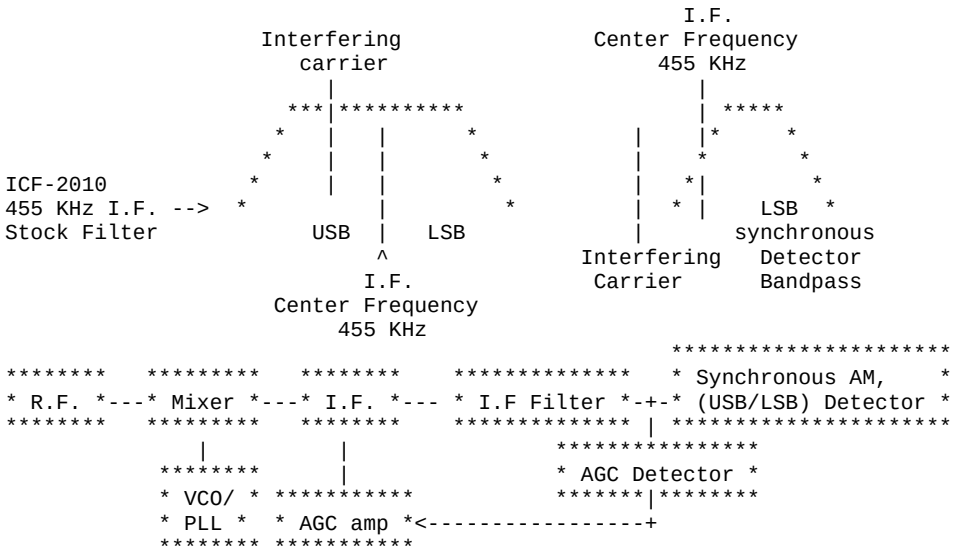
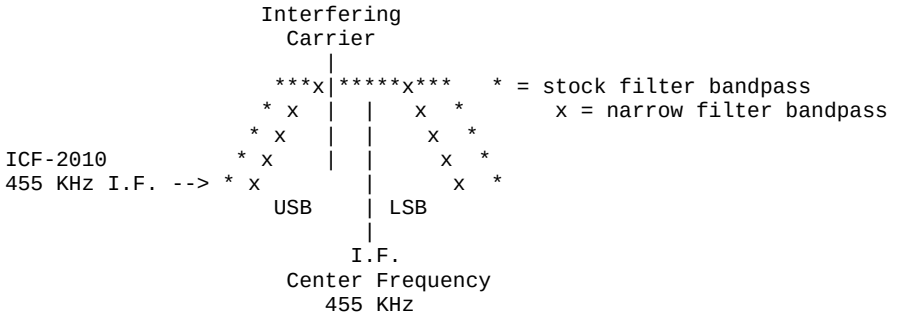
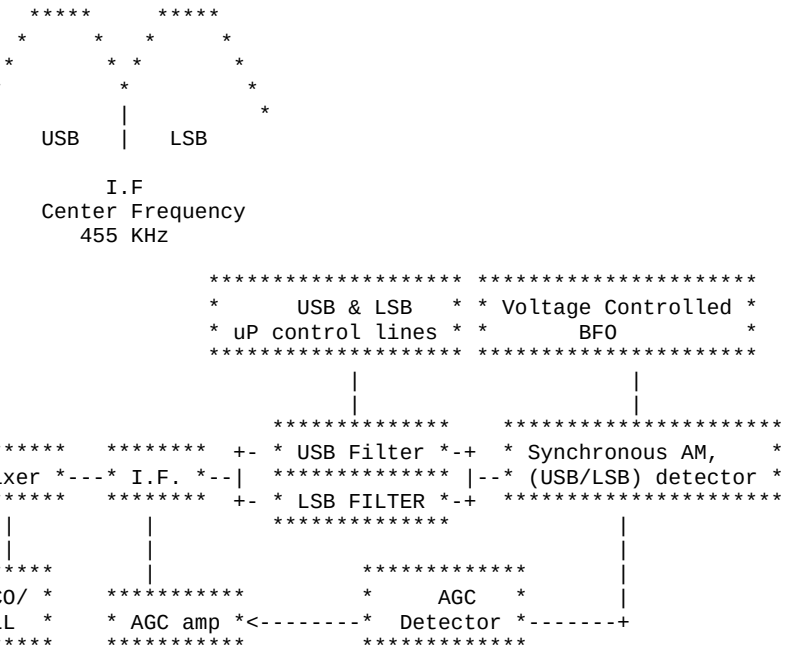
The Agc is in the I.F. stage and that's where the problem originates. The Synchronous detector, following the 2010's I.F., is used for AM synchronous mode and for SSB reception. Using an audio phase shifting technique it rejects the other sideband thus preventing it from entering the speaker. During lower or upper sideband reception, if an interfering signal falls within other sideband frequency the it will pass through the I.F. filter. You won't hear it because it's rejected in the synchronous detector stage. The AGC, on the other hand, will respond to the signal and reduce the sensitivity.



If you install a narrow filter that's center around the I.F. to correct the problem, you will simply reduce bandpass and limit the audio response. The A.G.C. will still respond if an interfering signal falls within the frequency range of the other sideband.



The problem (as shown above) is caused by the Sony ICF-2010 I.F. bandpass filter. It passes signals above and below the I.F. center frequency. An after market filter will not correct the problem.
My scheme uses two I.F. filters that are centered 1.3 KHz above the I.F. frequency (for lower sideband reception) and 1.3 KHz below the I.F. frequency (for upper sideband reception). The filters are selected by the micro-processor using the USB and LSB control lines and PIN diodes. When the LSB filter is selected it only passes the received sideband and rejects the other in the I.F.. If the interference falls within the other sideband, it gets rejected!



The dual I.F. Filters are Collins Radio Torsional Mechanic Filters ($150.00 each). The USB filter is 2.6 KHz wide tuned to 453.7 and the LSB filter is 2.6 KHz wide tuned to 456.3 KHz.

This is not a cost effective way to implement sideband filtering. Most communications receivers use a single SSB filter for upper or lower sideband reception. The BFO frequency is changed by selecting a second BFO crystal. Shifting the BFO frequency on the 2010 would have required the re-designing the phase locked BFO that's used during synchronous detection. The circuit is heavly shielded and there's only enough room for one crystal.
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Jack Albert WA9FVP