

Sangean ATS-909/Radio Shack DX-398 FAQ

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Sangean ATS-909/Radio Shack DX-398 FAQ

Dave Moisan, N1KGH

Updated November 5th, 2003

Welcome! This FAQ is written for users and prospective owners of the Sangean ATS-909 and Radio Shack DX-398 shortwave portable radios.

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FAQ Information & Availability

This FAQ is written and maintained by David Moisan <dmoisan@davidmoisan.org> and can be found at <http://www.davidmoisan.org/radio/sangean/ats909faq.html>. [Feedback](#) is welcomed.

You're reading the HTML version. This FAQ is also available in these formats:

- [Zipped HTML \(ats909faq.zip\)](#), 45k
- [PDF \(ats909faq.PDF\)](#), 142k

The PDF version is generated by [HTMLDOC](#).

General Questions

What is the ATS-909?

What is the DX-398?

The Sangean ATS-909, and the Radio Shack DX-398, is a portable shortwave radio about the size of a large trade paperback. It tunes from 150 kHz to 29,999 kHz and from 88 to 108 MHz in four bands. It can receive single-sideband in true LSB/USB, rather than the simple BFO of most portables of its class, though it doesn't offer synchronous detection. Unlike the Sony 2010, though, the Sangean can tune in 40 Hz steps, though it does *not* display frequencies at that resolution.

It's got a nice, large, backlit LCD display and a large alphanumeric memory, capable of storing up to 308 stations. The radio comes preprogrammed with over 250 frequencies of international broadcasters. As with the Sony SW-77, alphanumeric tags can be used to designate frequencies. The radio has RDS (Radio Data

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System) on FM, which will display the call letters of a station or set the clock.

The radio also has a clock with two settable time zones, a sleep mode, a tape out and remote jack, an external antenna jack and an RF gain control.

In all, it's an intriguing little radio.

Is there a difference between the two?"

The Radio Shack DX-398 is identical to the Sangean ATS-909, except for the nameplate. The Sangean comes with accessories that aren't included in the Radio Shack version, namely an AC adapter and a reel antenna. Both radios come with a vinyl case.

Where do I find one and how much does it cost?

The ATS-909 can be found from [Grove](#) or [C. Crane](#), among other places. It costs around \$260-\$280, and this includes a vinyl case, AC adapter and reel antenna.

The DX-398 has been discontinued by Radio Shack, but you may be able to find one on closeout for \$150. The catalog number is #20-228, this includes the radio and its case; the AC adapter and reel antenna are *not* included.

Radio Shack's recommended AC adapter is Cat. #273-1662, \$12.99. You can get a reel antenna (Cat. #278-1374) for \$8.99. The reel antenna is nice to have (I own one) but not essential.

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[N1KGH Radio Page](#)

[Dave Moisan's Home Page](#)

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<http://www.davidmoisan.org/radio/sangean/ats909faq.html>

[About davidmoisan.org](#)

Sangean ATS-909/Radio Shack DX-398 FAQ: Technical Information

Dave Moisan, N1KGH

Updated November 5th, 2003

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How well does it perform compared to...

...The DX-390 (ATS-818)?

NOTE: All these observations are *anecdotal* and may exaggerate some differences and ignore others.

Personal listening time with each radio in YOUR listening conditions is your best determination.

There is an excellent review of small shortwave radios, including the ATS-909, in the August 1997 issue of *QST*.

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The consensus on rec.radio.shortwave seems to be that the 390 is not a particularly sensitive radio. I evaluated the 390 for a friend of mine and was *not* impressed.

...The Grundig Yacht Boy 400?

The Yacht Boy is said to have better sound, but performance is similar. It, like the Sony 7600 discussed in the next question, is a physically smaller radio so if size is a factor, that is something to consider.

...The Sony 7600?

The 7600 does have synchronous detection, but lacks some amenities on the 909, such as a signal strength meter. This FAQ author almost got a 7600 when Nobody Beats the Wiz closed their Massachusetts stores. (Alas, it was gone the next time I went there with money...)

...The Sony 2010?

Reviews are mixed on rec.radio.shortwave. One camp proclaims the 2010 as superior, mostly due to its synchronous detector that the 909 lacks. The other, notably led by Art Bell of fringe-talkshow fame, pushes the 909.

...The GE Superadio?

Mediumwave performance of the '909 is decent, typical of most SW portables. However, like most portables, it can't compare to the Superadio, *unaided*, due to its much smaller mediumwave loopstick.

When the 909 is coupled with an external mediumwave antenna such as the Select-A-Tenna, its performance is very close to the Superadio. I give the Superadio a slight edge, since at my location in Salem, Massachusetts, during the daytime, my Superadio II can *barely* pick up the 720 kHz CHTN, in Charlottetown, P.E.I. (some 600 miles away over water!); my DX-398 cannot do it without the external loop antenna I have (essentially a homemade Select-A-Tenna).

I'm not much of an FM listener, but I *do* prefer the 909's digital display to the horribly inaccurate analog dial on my Superadio.

Is the ATS-909 Y2K compliant?

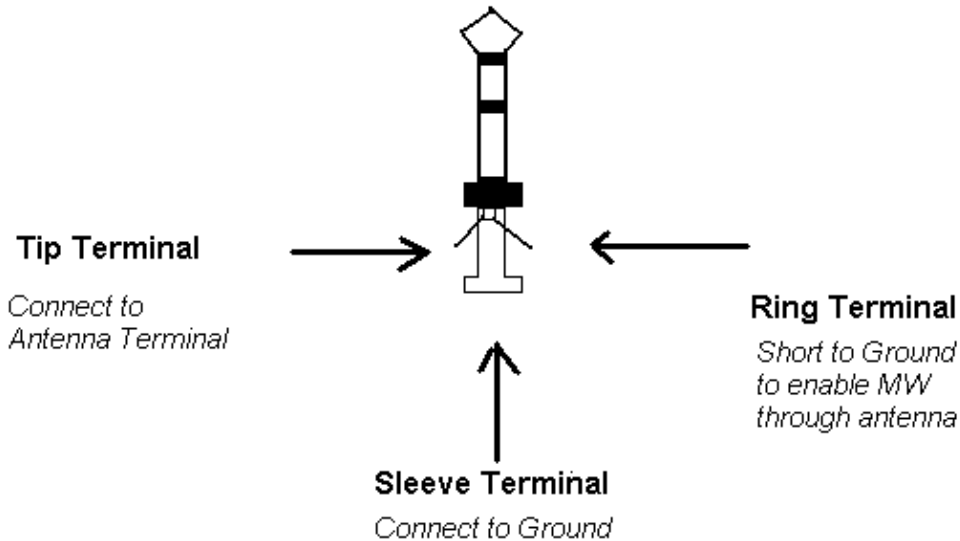
The 909 has two clocks for both a home time zone and a "world" time zone. There is no date function, therefore the radio is Y2K compliant by default.

How do I hook up an external antenna to it?

The radio accepts a 1/8" stereo headphone jack for its external antenna. It's wired a little differently than you think.

1/8" Stereo Jack Wiring Arrangement

viewed from top



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The tip goes to the antenna terminal and the sleeve goes to ground, just as you would expect in this unbalanced antenna input. Shortwave signals are routed from the external antenna jack when a connector is plugged in.

The ring—the terminal in the middle of the plug—has a special purpose. When you ground it, *medium wave* signals are also routed from the external jack instead of the radio's internal loopstick. This is why some people have reported poor MW reception when they use regular 1/8" mono patch cables to connect their antennas.

But for medium wave DXers, this is an opportunity to connect their favorite antennas to the radio; the lack of a *good* MW antenna connection has made some otherwise good radios less than desirable.

If you prefer to use the internal loopstick for MW, simply leave the ring of the plug unconnected.

Ingo Truppel has another approach:

An important note to the MW/LW – external antenna. It is not useful to connect the ring terminal of the antenna plug to ground. Instead of that it should be connected also to the antenna terminal and parallel via a 1 kOhm resistor or an inductance (some mH) to ground – that way you get more sensitivity for MW/LW (look at the scheme for that). I use a self made active antenna (150kHz–30MHz tuned) with an output transformer which grounds the antenna for DC. So I only connect the ring of the antenna plug to the antenna terminal.

[I haven't tried this. The antenna I use is also DC grounded, so Ingo's idea should work for me...DM]

How do I disable the internal MW antenna?

Using a 1/8" stereo connector, ground the ring terminal to the sleeve. Or else use a 1/8" mono connector. The FAQ author much prefers the former method as this can be controlled by a SPST switch to disable and

reenable the internal antenna, thus saving the antenna jack inside the radio from wear.

Does the 909 have birdies (spurious signals)?

Yes. The 909 has two strong birdies at 27.022 MHz and 27.472 MHz, and several others at 17.865 and 18.165 MHz.

Are the station memories really permanent like the manual says?

No. The station memories can be changed.

- Pick the frequency you want to change.
- Enter the new frequency.
- Hit the M key.
- The display will say "MEMOFULL".
- *Hold down the M key.*

The new frequency should now be stored in memory.

How does the priority button work?

The priority function is not well explained in the manual, and it behaves differently depending on what band is involved. On MW, LW and FM, the priority button has its own memory location, so you can store a station to it like any other memory.

On SW, though, the priority button calls up an *already existing* station memory; it does not store a station itself, but only the reference to a station in the memory pages.

To set a priority station in MW, LW or FM bands:

Tune to the station you want. Hit the M key. Hit the PRIORITY key (that key that looks like a "1" and an arrow.) That's it. When you next hit the PRIORITY key, the station you stored will come up.

To set a priority station in the SW band:

First, the station you want to hear must already be stored. Find a empty page (usually page 29) or overwrite a memory location and store your station there. Then hit M and PRIORITY. As long as the station is stored in "regular" memory, the PRIORITY key will call it up.

How do I use the timers?

Rocky, KA7EII@webtv.net, offers this explanation:

First of all, timers 1 and 2 will turn off the radio after one hour and timer 3 will allow the radio to play until you turn it off.

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Turn the radio on and tune to the station that you want the radio to come on to. You can use any frequency and mode on SW or any AM, FM or LW station. Let's say I want to wake up to KNX-1070 at 5:20am.

Now press the MEMO button and the word "MEMO" will flash on the display. Press the TIMER 1 button and the radio will beep. Press TIMER 1 again and the word "timer" will flash on the display. Use the AM MODE button to select radio (you should see the musical notes on the display).

Now use the numbers on the keypad to enter the turn on time. For my example I pushed 5, 2 and 0. Be sure to use 24-hour time. Now press ENTER and "TIMER 1" will show on the display. To check the status of the timer at any time just press the TIMER 1 button and you will see the time and frequency that the radio will turn on to. Press TIMER 1 to go back to regular radio operation. To delete the timer just press the TIMER 1 and CLEAR. To turn the timer back on again just press TIMER 1 button and the "enter" button.

The timers also have a "snooze" function. When my timer 1 comes on at 5:20am and I want to get a little more sleep, just press TIMER 1 button when the radio comes on and it will turn off and turn on again in about 5 minutes. Timers 2 and 3 also have the "snooze" feature.

How do I connect a tape recorder?

Recommended Recorders

According to Radio Shack's help line, there are three tape recorders that work with this radio:

- Optimus CTR-107 (RS #14-1112, \$50)
- Optimus CTR-111 (RS #14-1117, \$30)
- Optimus CTR-117 (RS #14-1123, \$70)

Remote-cable Problems

Chad Vizino:

To control a tape recorder using the radio built-in timer feature and its REC STANDBY jack, it is necessary, for most recorders, to reverse the polarity of the patch cable used to connect the radio REC STANDBY jack to the remote mic (REM) jack of the recorder.

With a patch cord attached to the REC STANDBY jack and measuring the voltage from the other end of the patch cord, the tip of the submini plug is positive and the lower segment is negative.

However, to make a cord that works with my cassette recorder, I had to reverse the polarity, making the tip negative and the lower segment positive.

I bought (and subsequently returned) a GE brand cassette recorder (\$20) from K-Mart just to cross check recorders since all other testing was done with Radio Shack models. It had the same problem (needed the reversed polarity cable.)

My record output is distorted!

Chad Vizino:

Another somewhat related piece of information on connecting a recorder has to do with the REC LINE OUTPUT jack. The DX-398 manual states and I confirmed (but would be worth putting in the FAQ under the question suggested below) that connecting the REC LINE OUTPUT jack to the MIC input jack of a recorder will result in a distorted recording. The recorder must have a line-in jack—the Radio Shack models do have an AUX input jack. I could find no other commonly available recorder with such an input.

I also tried an attenuating patch cord into the MIC jack of the GE recorder mentioned above since it did not have a line-in jack. I had no success with this procedure—the recording was very muted and had lots of hiss. However, the Radio Shack recorder with the AUX input works fine.

[On the other hand, computer sound cards usually have line inputs. These work great, provided that one doesn't have RFI coupled through the cable.]

See also the IF clipping mod.

What RDS information does the radio display?

For those unfamiliar with RDS—Radio Data System—it is a subcarrier sent with FM signals that contains a data stream. This data stream can consist of an ID, a clock signal, traffic advisories and other information. RDS is in wide use in Europe, but less so in North America.

According to a Sangean service rep, "whatever information a radio station is broadcasting through RDS the 398/909 can receive."

North American broadcasters (are there Canadian RDS stations?) usually only send an ID and clock info. (By the way, the clock data is *NOT* guaranteed to be accurate, unlike the similar service that PBS stations send to VCR's.)

Any European listeners who can give a definite answer are most welcome to write.

What's the best AC adapter to use with the radio?

RS now recommends the #273-1758M, a 6V 300mA adapter. This seems much better than the multivoltage adapter they once recommended.

The FAQ author was sold a different adapter when he got his radio, the #273-1454D, a 6V, 150 mA adapter. As the radio draws 300 mA, the adapter is technically undersized. But this adapter has worked for nearly two years without any trouble.

Bill Bowen writes:

The best adaptor for the 398 (and also the 390/392) that is commonly available is the Radio Shack 273-1663. This adaptor is 3/6V switchable, it is regulated, and puts out 700 MA.

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When connected to my DX-398 and the radio set for normal listening volume, the ripple is less than 25 MV.

I've used one of these on my DX-390 for 4 years and just got another one for the 398. The adaptor costs \$19.99 + tax.

My radio locked up! How do I fix it?

On the bottom edge of the radio, to the right of the keypad, there is a small panel with a hole marked "RESET"; insert a paperclip into the hole and release. The clock display should reappear—you might need to reset it—and you should be able to turn on the radio.

My radio locked up and reloaded completely different memories!

First, some background: Sangean has two versions of the 909. One version for the US (and Canada?) and another version everywhere else. All 909's have a mask ROM that is programmed with the radio's firmware, *and* a set of station memories for listeners in Europe and Asia.

European and Asian consumers get this model. US-bound radios undergo one more step before they're shipped: The radio is programmed with a selection of frequencies for listeners in the US, selected by the famous DXer Glenn Hauser.

Unfortunately, under certain conditions, the radio locks up in a mode where it expects to be programmed at the factory, and since no programming is forthcoming, it resets the memories to the original defaults stored in ROM.

According to one Sangean representative, this is a very common tech support issue with the radio, for which a few radios are actually returned for reprogramming.

Barring development of a third-party 909 reprogrammer, you'll have to either reenter your favorite frequencies manually or send it back to Sangean.

More information on the 909's [memory system](#) is available.

(The FAQ author has had his radio lock up on him no less than *three* times! But the radio still has all the memory presets it was purchased with. So it goes.)

What stations are already programmed into the 909?

There are two different versions of the 909 with different presets depending on whether it's an American model or a European/Asian model. Here are the respective lists:

- [America](#)
- [Europe/Asia](#)

My radio won't turn on!

My radio won't turn off!

My radio's locked on a single station!

This is a scary problem with a simple solution: Check the keypad for any stuck buttons. The radio doesn't support any kind of n-key rollover such as you find on computer keyboards, so if any key is stuck, the keyboard won't respond. It's *very* annoying when the priority key is stuck so that you can't turn the radio off *or* change the station!

People who use their own stand to hold the radio may have this problem if the stand makes contact with the keypad, as it likely will if you're using one of those collector's plate stands with the protrusions on the front.

If none of these remedies works, see the next question.

I checked the keypad, and my radio still doesn't respond!"

Some users have noted that after the radio has been stored for a long time with batteries installed, the radio will lock up and the reset button will not work. Removing the batteries doesn't help, since the radio is still powered by a memory capacitor that takes a long time to discharge by design.

In that case, remove *all* batteries from the radio and let it sit for at least a few hours, perhaps as long as six days (as reported by one user on the DX398 list at Yahoo! Groups.)

According to Sangean, this is a known issue. Radios powered on AC have not exhibited this problem. (My radio is AC powered and I note that it has locked up on power-on approximately once every month or so, though I have always been able to reset the radio so far.)

In any case, you shouldn't need to take a hammer to it, though I sympathize, having owned radios that malfunctioned at full volume!

The AGC's *slow!*

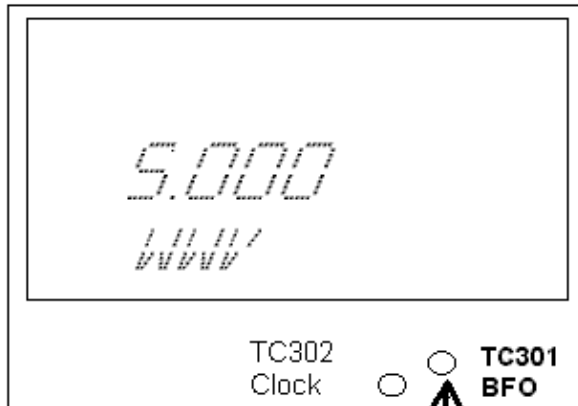
The AGC on the Sangean *is* slow. This is especially noticeable when you turn on the radio or switch to MW, LW or SW from FM. Ingo Truppel has a fix for this in the mods section of the FAQ.

How do I adjust the LSB/USB offset?"

You should only need to adjust the BFO if it is noticeably out of adjustment.

The BFO can be adjusted as follows: *The radio should be at normal room temperature, not in the sun nor out in the cold. Let it sit there for about 30 minutes.*

ATS-909 BFO Adjustment Diagram



©2000 DCM

Adjust this for BFO

1. Tune to WWV, CHU, or an equivalent frequency standard. If none is available at your location, a local MW station will do.
2. Remove the plastic LCD cover with a thin metal or plastic object.
3. There are two adjustment pots under the display, they may be gray or orange. The pot to adjust is TC301, on the *right* side.
4. Switch from LSB to AM to USB and compare the beat note. If you don't notice a difference in the beat notes, don't bother changing it.
5. If the beat note is low on LSB, turn the pot *slightly* clockwise.
6. If the beat note is high on LSB, turn the pot *slightly* counterclockwise.
7. Repeat step #4 until the beat notes sound the same.

Note that TC302 adjusts the *clock*. If you find your SSB unchanged and your clock very fast (or slow), you adjusted the wrong pot!

This is at best only a rough adjustment. You'll need a frequency counter and the service manual if you want to do it right.

I live in Saudi Arabia. My radio doesn't have SSB capability. Can I add it?

It would be a challenge. Not only are there parts missing, such as the BFO and detector, but it's likely the microprocessor would need to be changed out. It's possible, in theory, to change out the processor and collect all the other pieces, but it would cost you. Sangean's not very likely to send a kit of parts for this.

What are the A and B inputs on the bottom of the radio?

They are for reprogramming the radio's memory at the factory. The A and B inputs are an interface known as

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I2C, Philip's standard for inter-IC communication (hence the name). Think of it as a miniature LAN for embedded microprocessors, memory and support chips (which the Sangean certainly has!)

The 909's factory interface and memory system has a page all its own.

Where can I get a service manual?

Radio Shack has a manual available. The part number is #11965753 and you can get it from RS National Parts at 800-241-8742 and it costs \$17.69 +tax and S&H. If you're not in the US, try emailing Tandy Support, or write

National Parts
900 Terminal Road
Fort Worth, TX 76106
USA
Attn: Hazel Pointer
Voice: (817) 624 - 1196 [Canadians can call 1-800-223-8344]
fax: (817) 740 - 0834

Where can I get replacement parts?

Radio Shack has some parts available. See the DX-398 Detailed Parts List online at Radio Shack.

...like the display window I broke?

Radio Shack doesn't have a part number for this. Sangean's part number is #3058601. C. Crane will sell you a replacement for \$10.

A note on the LCD window: If you need to remove it for cleaning—it seems to easily get dust underneath it—use a *thin* screwdriver or metal nail file and pry it from the top, working around the edges until it pops free. Do it *gently*, lest you crack the LCD itself!

...or the flipstand?

There is a rite of passage for ATS-909 owners: They break the flipstand at the bottom of the radio. Your FAQ author has passed by that measure and is now without the original stand!

Universal Radio sells lucite radio stands. Or you can simply get a decorative easel (for the Mr. Spock commemorative plates the Franklin Mint sells, for example) from K-Mart, Wal-Mart or the like. Cost is under \$5. (The easel, should be 8" long when extended—too short, and the radio will fall over. Not that this happened to me...)

I now have a better stand, a white wire plate stand from A.C. Moore that holds the radio up unconditionally, with a little bending. Any crafts or housewares store will have one.

Sangean America has replacement stands, which they will reportedly send out at no charge. So has Radio Shack—;their part number is RSU# 12090718, though they will charge for those.

Where can I get a service manual?

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To fit the new stand into place—or to fit a stand that's popped off—run the stand under warm water to soften the plastic. Then carefully bend the stand until the studs on both sides pop into the matching holes on the back of the radio. Let the stand cool off, and you're ready to go again. (Thanks to James Marshall for this tip.)

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David Moisan

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Last updated on November 5th, 2003

<http://www.davidmoisan.org/radio/sangean/909tech.html>

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Sangean ATS-909/Radio Shack DX-398 FAQ: Modifications

Dave Moisan, N1KGH

Updated April 3rd, 2003

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Taking it apart

The following modifications are courtesy of Rick, [<rickw999@aol.com>](mailto:rickw999@aol.com) and are reproduced with permission from his web site.

1. Unplug the power, antenna, headphone and tape connections.
2. Remove the volume, manual tuning and RF gain knobs by pulling them straight off away from the radio. Be careful not to bend the shafts.
3. Move the whip antenna out of the clipped holding position so that the small screw can be removed from the antenna compartment. Use a *small* Phillips head screwdriver for this.
4. On the back of the radio, there are five holes with arrows pointing towards each screw. Remove these with a medium tip Phillips screwdriver. Put the whip antenna back in its holding slot.
5. Now is the sticky part: apply pressure to the two radio halves at the top and the bottom so that the tabs inside will unlock. If a tab does not unlock, a small piece of plastic holding the tab will break; it can be glued back in place but the radio can be reassembled without it. Lift up and pull the back of the radio up and toward the top of the radio as you work pulling the bottom half away going left toward the volume knob. This is somewhat awkward but can be done right, if done slowly.
6. Now, if you push in between the volume and tuning control with light pressure the left side should come loose at the next tab. Now push the back up toward the top of the radio a tab in the top left should come free as well as a tab at the top right of the radio. The last tab is at the center of the external connections for power, headphone, rec and antenna jacks and hinges at this plate.
7. The back can now be separated from the radio but be careful—the antenna is connected to the back with about 2-1/2" of white wire. The antenna may be disconnected by removing the radio assemble from the front cover and pulling the antenna connector from the board, but be careful with the red and white speaker wires.

Anti-chuffing Modification

1. Once the back is off, look down on the left side of the board under the tuning knob. Use a magnifier

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to locate from top to bottom, the surface-mount parts, 224, 334 and 474 and 103 (the 474 and 103 are side by side). Directly below 474 and 103 is a "round" surface mount diode, orange with a black band at the top, soldered vertically onto the board. Next to that diode to the right are 2 leads with solder.

The leads are between the round diode and the single leg of a surface mount transistor to the right of the leads.

2. After the leads have been located, carefully power up the radio using the external power supply. Push the up and down tuning and see if the mute goes away when shorting these 2 leads with a screwdriver and see that the correct leads have been located. If this is correct, solder the 2 leads together to disable the muting. You could also install a micro SPST switch if you like. It's surface-mount, so be careful not to overheat when you solder it.

Be advised that this allows *all* PLL tuning noises to come through while using the radio; to many, this is preferable to the chuff noises. When the freewheel tuning knob mod is also performed, it works much like an old analog radio and greatly enhances the enjoyment and usability of the radio.

Removing the beep

1. With the radio still disassembled, carefully pull the radio assembly out of the front half of the radio by pulling it up and out. There are no more tabs or screws in the top half. The speaker wires are red and white and only 3" long, so be careful when you lay the front section of the radio aside.
2. Now with a *small* Phillips screwdriver remove 2 small black screws from the display board. 1 screw is near the time set switch and the other is near the speaker cavity. Now, there are 3 tabs on the bottom under the keypad and 2 on top of the display board just above the LCD. Carefully pull the top and bottom tabs back one at a time, lifting the board with each tab gently until the board is free.
3. The wires to the "beep speaker" are a fine gauge red and black wire soldered to the display near the left side of the LCD. To disable the beep, disconnect the wires or remove the speaker completely, which is held by one small screw.

Removing the detent on the tuning knob

1. There are 6 solder pads on the tuning knob near the LCD display light at the left and just below the power button. Using solder wick or a desoldering tool, remove all the solder from the 4 inside pads first. Then remove all of the solder, from the 2 outside pads with the "ears", or ground of the tuning control. If the solder has been removed, then the control can now be removed from the board.
2. With a fine flat blade screwdriver or knife blade, carefully lift the four tabs on the back of the tuning control. Use a pair of needle nose pliers to straighten them up. When taking the control apart, note how it's assembled.
3. Carefully remove the plastic control housing and post from the metal shell at the same time. Inside the metal shell with "ears" is a copper ring. Remove the ring, after noting how it's assembled. The copper ring has 2 bends and a notch that sticks up on one side on the center of a bend. This, along with the plastic post is what causes the tuning knob to be *detented*, working in a clicking motion.
4. Using needle nose pliers, gently flatten the notch that sticks up on one side of the ring without smashing the curves in the ring flat. Then re-assemble the control and try turning it in your fingers, holding the assembly together. Make any necessary adjustments to the control before you re-solder it back into the board. If you need to, check it with the tuning knob on the control first. The stiffness of the control is somewhat controlled by how the knob is pushed up to the surface of the radio.
5. After the control has been put back together gently flatten the 4 tabs back into place using the needle nose pliers. Re-solder the control into place on the display board. Check your work and power up the radio to check the manual tuning. You should now be able to tune much easily, possibly with only one finger on the tuning knob. This mod works great!

Finer tuning for single sideband signals

This mod adds a much finer tuning resolution for the slow setting on sideband. I can pretty much zero beat every signal. You will lose the tuning range, but will gain a finer resolution.

Referring to the schematic, attach a 4.5K resistor across the left/bottom and the right solder posts on SVR5. SVR5 is the 48 Hz tuning for the sideband.

This modification does not work for all side band operation. If a signal is too far off zero-beat, the signal will drop off. If that happens, just switch to the fast setting.

Improving the AGC

This mod provided courtesy of Ingo Truppel <itruppel@atb-potsdam.de>. Contact him if you have any questions.

Big capacitors are responsible for the slow AGC and they used big capacitors because of the high slope gain of the AGC control circuit.

Now to the changes:

1. C57 on Pin15 of IC1 (TA7758P) should be changed from 22F to 10F
2. An additional resistor with a value of 18kOhm has to be placed between Pin15 and Pin17 of IC1 (TA7758P)
3. C11 should be checked—the scheme needs a value of 4.7F—my radio contained a capacitor with 10F. 4.7F is the right value
4. the upper trace to the + terminal of C11 should be cut, so that it is isolated from the circuit. An additional resistor with a value of 4.7 kOhms has to be inserted connecting the + terminal of C11 to the base of Q53. In other words, use a serial connection of 4.7kOhm and 4.7μF instead of 4.7F for C11

A further change that should be done is to shunt the resistor R7 (68 Ohm) from the lower point of the Gain poti VR1 to be zero. That gives you a control of the input sensitivity down to zero. This is very helpful to receive strong signals especially if you use an external antenna.

Putting it Back Together

1. Carefully re-install the LCD display board into the tabs, they should snap into place when the board is lined up. Remember to put the 2 small black screws back that hold the display board. If the speaker wires were removed, reconnect them with the correct polarity and check the antenna connector. Make sure the LCD screen and plastic faceplate inside the front cover are clean.
2. Lay the radio assembly back into the front cover checking the speaker wires for pinching and the alignment of the time-set and MW step buttons, along with the battery compartment ribbon. When putting the back cover on, the switch covers should line up with the switches and the connector holes should line up with the connectors on the radio before dropping the cover in place as well as all the connectors at the side of the radio. Remember to pull the battery ribbon up through the hole.
3. Put the four long screws at the back of the radio in place. Then move the antenna out of the clipped holding position so that the small screw can be replaced back into the antenna compartment. Put the antenna back and reinstall the batteries if used.
4. Check that all the buttons and switches are functioning properly. Reinstall the volume, manual tuning

and AM-RF gain knobs. Reposition the tuning knob in or out of the case to adjust the tension to the control. That's it! You now have a new radio.

Restoring 76 MHz FM band

This modification extends the lower end of FM reception to 76 MHz.

PROS: Useful if you are planning a trip to Japan or if you want to pick up the audio of TV channels 5 and 6. Or if you just want to see what's down there.

CONS: There are many image signals below 88 MHz (this could be why the extended FM is not the factory default). Most of the image signals are from broadcasts 21.4 MHz higher. For example a broadcast at 100 MHz will also be picked up at 78.6 MHz.

TOOLS: You will need a small phillips screwdriver, a soldering iron and solder wick (or a desoldering tool).

PARTS: One 1N4148 signal diode (a 1N914 should work as well).

Procedure:

Open up the case

Remove the five phillips head screws from the back of the unit (including the one hidden under the antenna) and pry the two halves of the case apart. See the [previous section on disassembly](#) for details and warnings. You don't need to remove the batteries if you can remove the front part of the case from the rest of the unit. Be careful of the speaker leads and the leads to the buzzer. You may want to mark these and remove them temporarily.

Remove the smaller Control printed circuit board

Remove the two small phillips head screws holding the board. Release the five plastic hooks at the top and bottom edges of the board. Lift the board out. I found it to be easiest to disconnect the the two coax wires via the connector at the main PCB. This allows the control PCB to "hinge" on the remaining wires and lie flat in front of the rest of the unit. With the back of the control PCB facing upward.

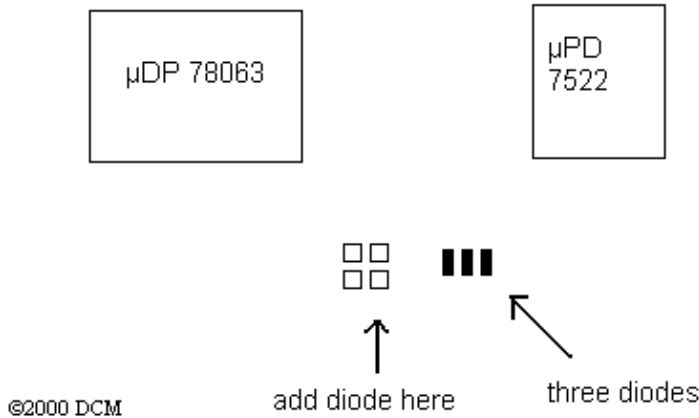
Remove the metal shield

Most of the back of the control PCB is covered by a metal shield. If the shield has a bunch of holes in it, you are on the wrong side. It is soldered to the PCB at about 10 locations spaced around its edges. Remove the tape that holds some wires to the shield. Unsolder all the connections on the edge of the shield. Make sure you don't melt any plastic or wires during this process, especially when working on the edge that is closest to the body of the unit. After the connections are unsoldered the shield lifts right out. There is no bending of metal needed.

Install the diode

The diode to install is called D310 but there are no markings on this side of the PCB. For orientation, the multi-wire connectors are at the bottom of the board, and the large uP chip is up near the top of the board. Look for three diodes lined up side by side halfway down the board, and then look for four empty solder pads just to the left of the diodes and down slightly:

ATS-909 Diode Mods PC Board View



Add the new diode as indicated. It should be mounted in the same direction and orientation as the three nearby diodes. It is a surface mount connection, but I had no trouble using a regular diode by making its leads short and bending them to fit the pads.

Test

Before closing up the unit you can hold the control PCB board vertically and reattach the connector that has the two coax wires going to the main PCB. Power the unit up and see if your FM range now goes down to 76 MHz.

Reassemble

Solder the shield back in place. Retape the coax wires to the shield.

Insert the control PCB back into the unit. Be sure that the wires between the two PCBs don't prevent the board from seating properly. Snap the five plastic hooks in place. Remember to put back the two small screws that hold the control PCB. Reattach the buzzer and speaker if you have disconnected them. Carefully put the two halves of the case together. Make sure all the slide switches are working properly. Put the five screws that hold the halves together back in.

That's it. Again, check out <http://members.aol.com/rickw999/> for more details regarding opening up and closing up the case.

— Jim Bowlin April 10, 1998

Other Diode Mods

There are a total of six extra diodes that can be installed, according to a small note on the schematic.

D322 FM down heterodyne
D316 FM step 50 KHz
D310 FM 76-108 MHz
D314 FM 64-74, 87.5-108 MHz

Procedure:

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D311 and D312 are used to control the AM coverage. The factory default is both diodes absent which gives the widest coverage:

LW	MW	SW
153-519	520-1710	1.711-29.999

The only other configuration that gives almost full AM coverage is adding diode D311 which changes this to:

LW	MW	SW
153-519	530-1602	1.603-29.999

So adding diode D311 will shift some freqs from MW into SW. And chop off the lowest 10 kHz of MW coverage. other diode configurations reduce the AM coverage even more.

-- Jim Bowlin

Using a Sony 7600 Speaker

Peter writes, on the 909's speaker:

One thing I noticed when I was pulling apart the 398, though, was that they'd clearly intended to use a much better speaker than the one they ended up using. The 7600 speaker turns out to be (likely) what they were planning – they left enough knockout in the circuit boards for a speaker with a 1 3/4" magnet, which just *happens* to be the 7600 magnet.

I called sony after figuring that one out and mailordered a replacement speaker for a 7600g; it fits *perfectly* into the case, and sounds a bit better to my ear than the old one. Later this week, I'll actually take the radio down and listen to it side-by-side against an unmodified radio.

Oh, why'd I mailorder a speaker? try finding *anyone* who's actually selling a 3" round speaker these days that's thin enough to fit into the case, and yet has a better magnet than the 398....

Call Sony Parts at (800) 488-7669 or (941) 768-7669 (voice). Their fax number is (941) 768-7790.

[Just be careful of the magnetic field. A speaker with a too-large magnet may desensitize the radio, just like with the GE Superadio--DM]

Jim Bowlin's 909/398 amp/speaker match modification

This might be useful to some people and/or aliens:

Locate the power amp ICs: IC4 and IC5, they are pin SIPS located on the main PCB between the speaker hole and the batteries. Then find the combination of C188 and R204, C188 is a small beige surface mount square and R204 is a black surface mount rectangle with "333" on it. They are located next to each other vertically almost between the two ICs and horizontal just to the knob-ward side of the ICs. If the battery compartment is at the "top" then these two components are mounted vertically. The bottom connection is to a wide PC run which is at ground. The other side of the components go to a land that has a nice fat wire sticking out if

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it which is good for soldering to. If you touch this land with a finger or small wire, you will hear a LOUD 60 Hz hum. Solder a 2.2k resistor between this land and ground. The wide pc runs in this area are grounds. Don't do any soldering with the power on!!!

Next find C148 and R179. They look just like the other two. They are between the first pair and the ICs. But they are not right next to each other.

Again one side of each goes to ground and the other side goes to a land that causes a LOUD hum when touched. This land also has a fat wire sticking out of it that is good to solder to. Another 2.2k resistor goes between this land and ground.

You may want to roll off the high frequency response. To do this add a cap in parallel with each resistor. A value of 0.005 uF will start the rolloff at about 15KHz. If you use polarized caps, make sure the negative side goes to ground.

IF Clipping Mod

Rick:

I have noticed clipping distortion on both of my 398's, particularly on certain MW stations. I have tried the main amp. & pre-amp reduction mods, but they didn't cure the clipping distortion. (It sounds like the speaker is breaking up.)

Last night I found a simple solution. Connect a 1K ohm resistor between IC1 pin #9? and ground. (I will try to confirm the pin# tonight when I have time to look at it more closely) It's the left side, 2nd from the bottom. IC1 is located up and a little right from the negative battery terminal. It also cured the distortion present when plugging in headphones in the line out jack. I'm not exactly sure what it reduced. I think it has something to do with the IF. Any users out there who could confirm?

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Last Updated on April 4th, 2003

<http://www.davidmoisan.org/radio/sangean/909mods.html>

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Hacker's Guide to the Sangean ATS-909/Radio Shack DX-398 Memory System

Dave Moisan, N1KGH

Updated April 4th, 2003

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The ATS-909 Memory Circuit

The following is courtesy of Jim Bowlin:

As has been suggested in this group in the past, the "Data In" connections on the bottom of the DX-398/AT-909 are indeed connected to a nonvolatile memory chip that holds all the preset information.

The diagram below shows the relevant circuit details. The X24164 is a 2048 x 8 serial EEPROM from Xicor. The uPD78063 is a microcontroller made by NEC. Both chips are powered by +3 volts. The two lines are used to both read and write data in the EEPROM.

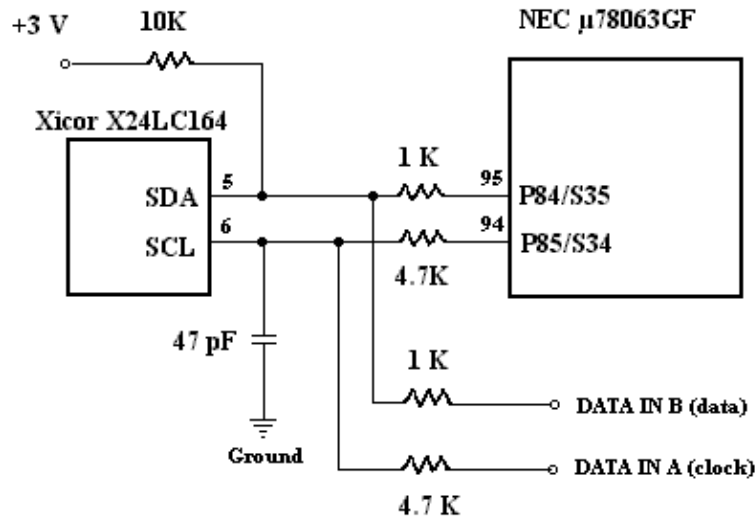
It appears that if the NEC chip puts pins 94 and 95 into a high impedance state when they are not being used then it would be possible to read and write the preset information via the "Data In" connections on the bottom of the unit.

There are application notes on the Xicor site that explain how to interface their EEPROM chips to a PC via either an RS-232 port or the parallel printer port. Software source code is provided as well. Some modification to their interface circuit will be needed in order to connect to the radio without blowing it up.

I will be looking into this further. If anyone is successful in implementing a PC interface to these radios then all of presets could be stored and loaded from files on the PC. Also, these files could be shared and exchanged with others.

-- Jim Bowlin

Partial Schematic of ATS-909 Memory Circuit and Data A/B Port



©2000 DCM

About the I2C Bus

The I2C (for *Inter-IC-Connection*) is a two-wire serial protocol for connecting IC's within a circuit, sort of like a miniature LAN. It can handle speeds up to 1-2 KBPS. I2C has come into very wide use in TVs, radios, communications receivers, cable boxes and many other devices. It's not surprising that the Sangean 909 would use this interface.

Special power-up key sequences

There are several special key sequences that put the radio in various modes to download memory, upload it or do self-tests. Most of these involve holding down the LIGHT key plus one of the band keys, though the display test requires the RESET button on the bottom of the radio. Key sequences provided by Lindsay rabbit5@azstarnet.com

RESET-LIGHT

Display test—all segments of the LCD light up.

FM-LIGHT

Select FM band. Press FM and LIGHT simultaneously; "DATA OUT" is displayed.

You have two seconds to hit ENTER.

Display flashes and then reads "VERIFY"

Display reads "FAILED" (without an interface connected)

It's assumed that the radio will read out memory from the EEPROM when the appropriate I2C commands are given from the external interface.

LW-LIGHT

"DATA IN" displayed;

Power on and set band to LW

Hit LW and LIGHT at the same time; radio displays "DATA IN"

You have two seconds to hit ENTER

display flashes, then displays "VERIFY"

then "OK"

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then "ROM DUMP"
then "VERIFY"
then "ROM OK"

then radio powers down. Powering up the radio will show the memory defaults. Apparently, this is *the* method for programming the radios at the factory.

There have been reports of a certain key combination displaying "SANGEANA" in the FM band, where SANGEANA may represent a ROM revision, but so far, this has been unreproducible. Write me, if you figure this out.

Resetting the radio's memories

The LW-LIGHT key sequence, without an interface connected, will wipe out the memories. *North American users should note that this will erase the American frequencies from the radio and load the European set. Be warned!*

Another method is to take a short piece of wire and short out the A and B port terminals while hitting reset. This forces a reset on the I2C bus which clears the EEPROM. The former "software" method is preferred to avoid any (slight) possibility of damage to the I/O port.

Default ROM presets for Europe/Asia

Here's a list of memory page descriptions that differ between the European/Asian models and the American.

Before	After
1.Australa	DW
2.Austria	SWF3
3.Canada	BR
4.China	DLF
5.Cst Rica	Rad. Ropa
6.Cuba	BBC --D--
7.Ecuador	BBC --UK--
8.England	RFI --D--
9.England	RFI
10.France	Radio NL
11.Germany	R. Vlaand
12.Holland	Schweden
13.Israel	Finnland
14.Japan	Roi Wien
15.Korea N	SRI Bern
16.Korea S	RAI Rom
17.N Zealnd	REE Madr
18.Norway	Vatikan
19.Russia	R Slowak
20.S Africa	R Polen
21.Sweeden	Budapest
22.Switzlnd	Russland
23.Taiwan	Russland
24.U.S.A.	R Kairo
25.U.S.A.	R China
26.U.S.A.	R Japan
27.U.S.A.	R Brasil
28.U.S.A.	Voice AM
29. (blank)	Voice AM

Further References

[Data sheets for the NEC uDP78063](#)

This covers the microcontroller used in the 909

[X24164 information sheet](#)

[X24256 datasheet \[PDF\]](#)

The X24256 superseded the X24128 & X24164 serial memory chips. The X24164 datasheet is no longer available.

[The I2C Zone](#)

[The I2C FAQ](#)

Vincent Himpe's big I2C page and FAQ. Drivers, interfaces, all you need for I2C.

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Last updated on April 4th, 2003

<http://www.davidmoisan.org/radio/sangean/909memory.html>

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Sangean ATS-909/Radio Shack DX-398 FAQ: Resources

Dave Moisan, N1KGH

Updated December 2nd, 2003

Dealers & Manufacturers

Sangean America, Inc.
2651 Troy Ave
South El Monte, CA 91733 U.S.A.
Tel: 1-888-SANGEAN
Email: sangean@earthlink.net
WWW: <http://www.sangean.com/>

Manufactures the ATS-909 and resells it to Radio Shack under the DX-398 nameplate. Also offers service.

Radio Shack
Product Support Center
200 Taylor Street
Suite 600
Fort Worth, TX 76102
Tel: 1-800-THE-SHACK
Computer Fax: 817-415-6804
Consumer Fax: 817-415-6880
Email: support@tandy.com
WWW: <http://www.radioshack.com>

Though Radio Shack no longer sells the DX-398, they still offer service.

C. Crane Company
1001 Main Street
Fortuna, California 95540 U.S.A.
Tel: 707-725-9000
Fax 707-725-9060
800-522-8863
<http://www.ccrane.com/>

C. Crane Company sells the ATS-909 and replacement parts such as the LCD window and the flipstand.

Universal Radio
Universal Radio, Inc.
6830 Americana Pkwy.
Reynoldsburg, OH 43068-4113 U.S.A.
Tel: 1 800 431-3939 (Orders & Prices)
1 614 866-4267 (Technical Information)
WWW: <http://www.universal-radio.com/>
Email: dx@universal-radio.com

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Sells the ATS-909, antennas and accessories, including lucite radio stands.

Grove Enterprises
7540 Highway 64 West
Brasstown, NC 28902
Tel: (800)-438-8155 (US & Canada)
(828)-837-9200
email: order@grove.net
WWW: <http://www.grove-ent.com/>

Sells the ATS-909, antennas and accessories.

Radiolabs
WWW: <http://www.radiolabs.com/products/radio/super909.html>

Radiolabs sells a modified 909 with a *blue* display among other enhancements.

Kiwa Electronics
612 South 14th Avenue
Yakima, WA 98902 USA
509.453.5492
800.398.1146 (orders)
Email: kiwa@wolfenet.com
WWW: <http://www.kiwa.com/>

Kiwa offers audio and tuning mods for the 909 as well as its famous MW loop antennas.

Other Resources

DX-398 Online User's Manual

Radio Shack has the DX-398 user's manual in English *and* Spanish, including frequencies and a parts list.

Yaesu FRG-7 and Sangean ATS-909 Users Notice Board

Ingo Truppel's message board, which replaces the old Insidetheweb.com board, now defunct.

DX-398 Mailing List on Yahoo Groups"

Active mail list on the DX-398.

Rick's Modster Madness

This site has mods to the 909 and other Sangean radios

Credits

This FAQ would not have been possible without the help of Rick Whitehouse, who published the first mods on this radio and graciously allowed me to reproduce them here. If a third-party programmer is ever developed, Jim Bowlin will deserve much of the credit for his work in confirming what kind of memory is in the radio and how it's programmed, and Sean Mc. provided the European/Asian memory list. "Rocky" (KA7EII) provided a neat timer tutorial. Thanks also to Bill Bowen, Lindsey (for the special key sequences), Glenn Mitchell, James Marshall, Mildred Pierce and all the dedicated owners in rec.radio.shortwave for their collective comments and experiences.

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