SX-28 IF ALIGNMENT PROCEDURE

(Rev A)

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The IF alignment procedure in the SX-28 manual is basically OK but a little confusing, there are a few pitfalls that are not adequately explained. Below is the procedure I found best to align the SX-28 IF. After a few weeks of using the receiver repeat this procedure again, especially after replacing caps and resistor in the IF section.

The procedure and chart for alignment of the noise limiter and RF are straightforward and easy to do when following the RF alignment table.

STEP 1 ROUGH IF ALIGNMENT

I don't like the method in the manual of detecting IF output using audio and the BFO. For me it's much easier to connect a good high impedance DC voltmeter across R25 the audio detector load resistor, I used a Fluke digital meter. This meter will read carrier signal strength by measuring the rectified DC carrier signal voltage easily and not be audio frequency dependent. Collins uses this method for aligning their 75A4 receiver.

First turn off the AVC and set the RF gain at 9, connect a speaker so you can hear if it's working. Connect a good stable signal generator to the stator of C1.1, which is accessible under the RF tube and capacitor cover. I found this is the easiest way to get ae 455kc IF signal to the grid of the mixer tube since its pin 8 is buried under the mixer switch and coils underneath the chassis.

I found there can be IF signal feed through by way of the first AVC and noise limiter system with that can cause a peak in the IF band pass. To avoid this doing initial alignment run the slug on top of the first AVC transformer, T6, in as far as possible to detune this transformer.

The best procedure is to first get the IF aligned and then find the crystal CW filter's resonant frequency. Set the band switch to band one and the tuning dial near 1400kc. Set the selectivity switch in the IF sharp position, not crystal sharp. Introduce a signal at 455kc into the C1.1 capacitor stator. It helps to initially use modulation on the generator to hear the signal in the SX-28's speaker. Watch the voltmeter across R25 and set the signal generator to get around –5 volts on the meter. Adjust the slugs on T1, the first IF transformer, T2, the second IF transformer, and the caps on the top of T3 for maximum reading on the voltmeter. As you do this alignment adjust the generators output to keep the voltmeter's reading around –5 volts to not overload the IF.

The manual says not to adjust the top slug of T2 initially, but I find it's best to get an initial rough adjustment now to better find the crystal's frequency and then do a final adjustment as described below in step 3. Last set the crystal phasing at 0 and adjust C31 also for maximum meter output. In the non-crystal selectivity sharp position the phasing control still has a slight affect on the adjustment of C31.

Also be sure the crystal filters phasing capacitor is near half meshed with the phasing knob set at zero.

STEP 2 - FINDING THE CRYSTAL FILTERS RESONANTE FREQUENCY

Switch the selectivity switch to the crystal sharp position and the phasing control at zero. Turn off the frequency generator's modulation and turn up the receiver's audio volume. Sweep the signal generator's frequency around 455kc and look for a peak on the voltmeter's response. If you have trouble finding this peak go to the crystal mid position and also turn up the signal generator's output. Also readjust the phasing knob around zero for a maximum peak on the voltmeter. On my receiver I found a peak at 452.64kc. If you find two peaks, use the stronger of the two in the following steps.

Leave the signal generator set at this frequency and repeat peaking of the IF transformers and C31 with the selectivity in the non-crystal sharp position using the procedure of step 1. It's also a good idea to record this frequency for future use.

If you are unable to find a peak response in crystal sharp selectivity try to find a peak in mid crystal selectivity and then use this frequency in sharp crystal selectivity to try and get a peak by adjusting C30.

If there is no response peak or a very broad and weak one is found you may have a contaminated crystal. I have corrected in many of these older receivers with crystal holders that can be disassembled by cleaning the crystal. Unsolder and remove the crystal holder, remove the #2 screw and nut holding the holder together and carefully remove the crystal. Clean the crystal along with the holder halves interior surfaces and metal shoes using first mild detergent in water followed by alcohol and then rinse these parts with distilled water. After drying of the parts, assemble the crystal back into the holder being careful to not touch the surfaces of the crystal and holder shoes. To date I've saved the crystals in four receivers using this procedure.

STEP 3 - ADJUSTMENT OF THE UPPER OUTPUT SLUG OF T2

Now this part to adjust the output slug of T2 is a little tricky and not well described in the manual. Switch to the crystal wide selectivity switch position. Turn off the modulation of the signal generator but leave its output level set to the crystals frequency you found in step 2 to get around a –5V reading. Turn up receiver's audio to hear some hiss in the speaker. Keep the phasing set for maximum selectivity in crystal filter sharp. Sweep the signal generator's frequency around the crystals frequency of step 2 while watching the voltmeter. You should see a peak in response on the voltmeter followed by a dip and then a smaller peak. On my second receiver the peak was around –8V at 452.6kc, the dip at 451.9kc followed by a second peak around –1.1V. Now set the signal generator's frequency at the dip frequency and adjust the top slug of T2 for the deepest possible dip while still having two sharp peaks. This will take a little patience in switching back and forth between the dip and two peak frequencies. Be sure both peaks are present since it's easy to adjust too far and loose this peak. It will take very small adjustments of the slug to get the right adjustment. You should also hear a rushing sound in the speaker as the signal generator frequency is swept across the two peaks and the dip between them. This procedure will give a good notch for getting rid heterodynes from interfering signals when receiving an AM signals.

After this procedure for adjusting the top slug of T2, do not adjust this slug unless you repeat this procedure of step 3.

STEP 4 – CRYSTAL FILTER ALIGNMENT

After the procedure of step 3, switch to the crystal sharp selectivity position. With the phasing set for maximum selectivity near zero, sweep the signal generator's frequency to find the crystal frequency as shown by a peak in response on the voltmeter across R25. If there are two peaks select the stronger. Be sure to leave the modulation off on the signal generator because the modulation sidebands may lead to errors in finding the exact frequency. Now adjust C30 for a maximum reading while adjusting the signal generator. Now set the generator for a meter reading around –10V.

Record the level on the meter and switch to the crystal wide position. Record the level of the peak response, which should be near the frequency found for the crystal in the sharp position. Now switch to the mid crystal position and find the peak response, which should also be near the sharp positions frequency. Adjust C29 for a voltmeter reading close to mid way between the levels for the wide and sharp switch positions levels.

After this procedure you will be able to use the mid and sharp crystal positions for CW reception and the wide crystal for notching out interfering heterodynes while receiving phone signals.

STEP 5 – ALIGNMENT OF THE FIRST AVC TRANSFORMER, T6

Connect the voltmeter to the first AVC output going to V1 and V2 and ground. The best place to pick off this signal is across C66, the .02uf AVC filter cap. Set the signal generator to the crystal frequency you found in step 2 and leave it connected to the mixer input capacitor plates as in the above steps. Place the AVC switch in AVC and back out the slug screw on top of T6 while watching the voltmeter. The meter will be a little positive to start with but will go negative as T6 is adjusted. Adjust T6 for a maximum negative voltage and if necessary increase the output from the signal generator for a peak reading around –5V.

STEP 5 – ALIGNMENT OF THE NOISE LIMITER

Align the noise amplifier by connecting the voltmeter across pin 5 of the first IF tube, V5 and chassis ground. Turn the AVC on and set the ANL knob at 9. If you are working on a very early SX-28 with T5 having only one slug adjustment screw skip the following paragraph.

If you have a SX-28 with two slotted adjusting screws on top of noise amps transformer, T5, connect a 47K swamping resistor across the primary winding of T5. Adjust the two capacitor screws for a late SX-28 top of T5 for a maximum voltmeter reading on the voltmeter connected to pin 5 of V5 but keeping it around –5 volts to not overload the IF system. After this adjustment remove the swamping resistor from T5 added in the previous paragraph.

If you are working on an SX-28 with only one adjustment on T5 the noise limiter adjust T5 for a maximum meter reading and then proceed to step 6.

For a later SX-28 you now must adjust the noise limiter 455kc trap capacitor. Unplug the grid connector from V5 and reconnected the voltmeter across audio diode load resistor R25 like done in step 1. Turn the AVC off and set the signal generators input into C1.1 to get around a –5V reading on the meter. Now adjust the trap capacitor, C55, for a minimum reading on the meter. After this adjustment reconnect the grid lead to V5 and proceed to step 6.

STEP 6 – FINAL TESTING AND ALIGNMENT

To test the IF alignment and correct any small interaction from the limiter and first AVC transformer repeat the alignment procedure of step 1 with the frequency generator set at the crystal frequency you found in step 2. **Do not change the adjustment of T2 unless you repeat the procedure of step 3.**

Now test the frequency response of your receivers IF by placing the selectivity switch in sharp non-crystal and leave the voltmeter and signal generator connected and the receiver controls set as in step 1. Set the frequency generators frequency and output for a –10 volt meter response at the center of the sharp band pass. Now tune the generator either side of this center frequency and record the frequencies where the meter reading reduces to –5 volts. Subtract the lower frequency from the higher and record the difference, which is the 6db down bandwidth. Repeat this procedure for the mid and wide non-crystal selectivity positions.

On my early SX-28 I recorded the bandwidths as around 4kc in sharp, 6kc in mid, and 12kc in wide. In sharp the band pass had a smooth peak in the center, in mid it was flat for around 4kc before dropping off, and in wide it was flat except for around 3db peaks about 5kc either side of the center frequency. Also there is a slight change between the center frequency of the band passes that's normal and caused by the increase of IF transformer inductance by switching in the coupling coils to control band width. My later SX-28 had wider bandwidths, about 14kc in wide, than my earlier one most likely caused by design changes to the IF transformers.

For good wide band fidelity on AM broadcast signals it's important that the wide selectivity band pass be as flat as possible and the peaks be nearly the same. If your SX-28 had a sloped band pass and/or uneven peaks first repeat the alignment procedure of steps 1 through 3 to make sure you didn't make a mistake. But if the peaks are still not nearly equal do the following procedure that I had to do on my later SX-28.

Tune the signal generator to the higher of the two peaks in wide selectivity. Make a small adjustment to the capacitor adjustment on the last IF transformer, T3, toward the back of the receiver to slightly reduce the peak. Then tune the signal generator to the other peak and note if it's the same. If it's still lower adjust T3 to slightly raise it. If it's higher adjust T3 to slightly lower it. Then go to the first peak and see if it's equal to the second one. If not, repeat the procedure until both peaks are nearly equal. It took 3 tries to get the peaks on mine where one was 3db and the other 2db above the center frequency response.

This completes the IF alignment procedure that I found worked very well on both my SX-28's. It should also work for the later SX-28A and military GRR-2 receivers. If you are not successful in aligning your SX-28 you most likely will have to replace capacitors in the IF and/or do some trouble shooting.