

Collins 32S-3: Installing an Inrad SSB Filter

The OEM filter in the Collins 32S-3 has a balanced output which is isolated from ground. The newer Collins filters which Inrad sells have a common ground between input and output and cannot be directly substituted for the OEM.

If the original OEM filter fails, it may be replaced with an Inrad #720 2.0 kHz filter along with some additional modifications.

Note that the OEM filter has a 2.1 kHz bandwidth and some people would like to widen the transmit audio. Inrad has #706 2.5 kHz and #726 2.9 kHz filters available which may be installed with the same additional modifications plus an audio modification.

Figure 1 below shows the overall audio bandwidth of the OEM radio. The low frequency roll-off is caused primarily by the audio amplifier response. Most of the roll-off comes from a 1 uF capacitor, C9, which drives the balanced modulator. (The 32S-1 has a 0.5 uF capacitor driving the balanced modulator.) The horizontal scale is 500 Hz per division and vertical is 5 dB per division. The bandwidth is about 2 kHz with the lower -6 dB at 438 Hz. Also, note the ripple.

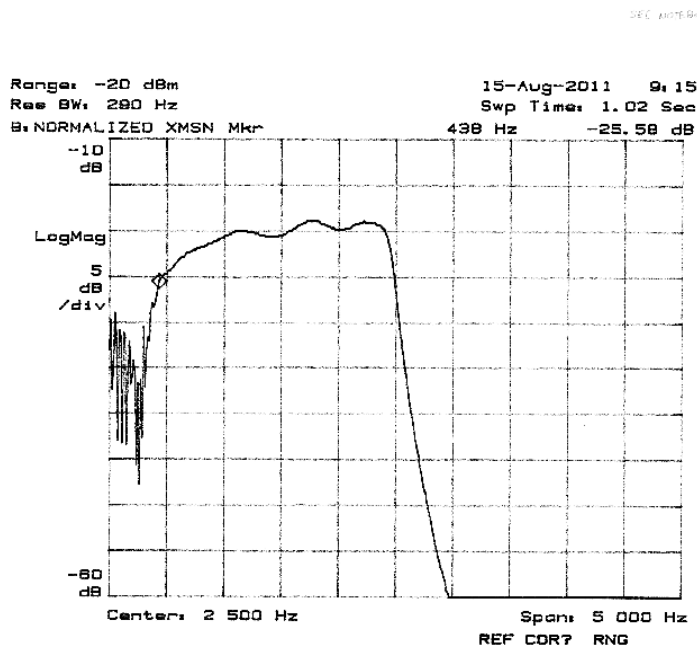


Figure 1- OEM Audio Response

Figure 2 below shows the area where the filter and other components reside. Please read the directions below fully before starting any modifications. Remove all power from the transmitter and make sure all internal components have discharged before beginning work.

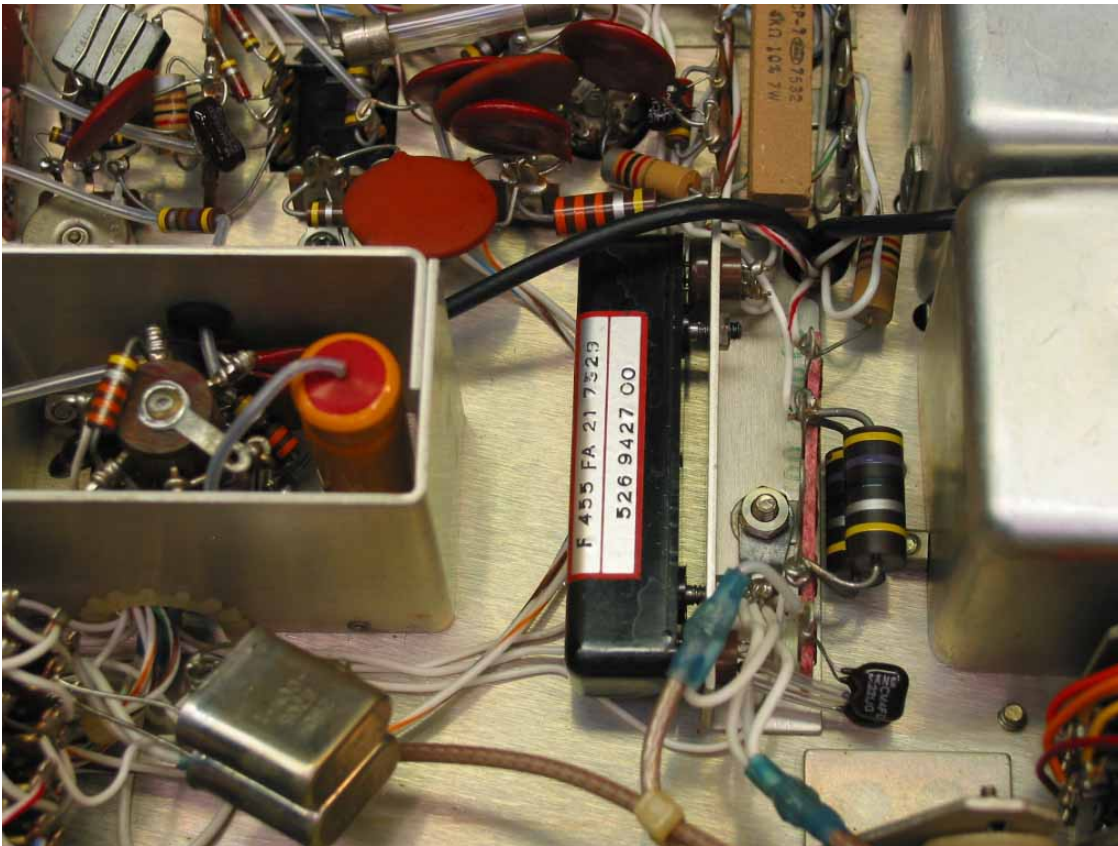


Figure 2 – Location of OEM Filter

Note that the way Collins built the radios evolved over time. In general, all the pertinent parts should be there in an original unit, but the implementation may be somewhat different. For example, earlier radios may not have plug-in connectors for the OEM filter, but the filter may be wired in with wire or coax cable.

The low frequency roll off can be improved by replacing C9 with a larger value capacitor. A 10 μF 250 VDC electrolytic capacitor is included in the kit as a replacement for C9. It is smaller than the OEM capacitor. C9 is inside a shield and mounted on a tube socket turret. It is difficult to reach and changing it is not suggested for a novice at soldering. The time to do this capacitor replacement is approximately 1 hour for an experienced technician.

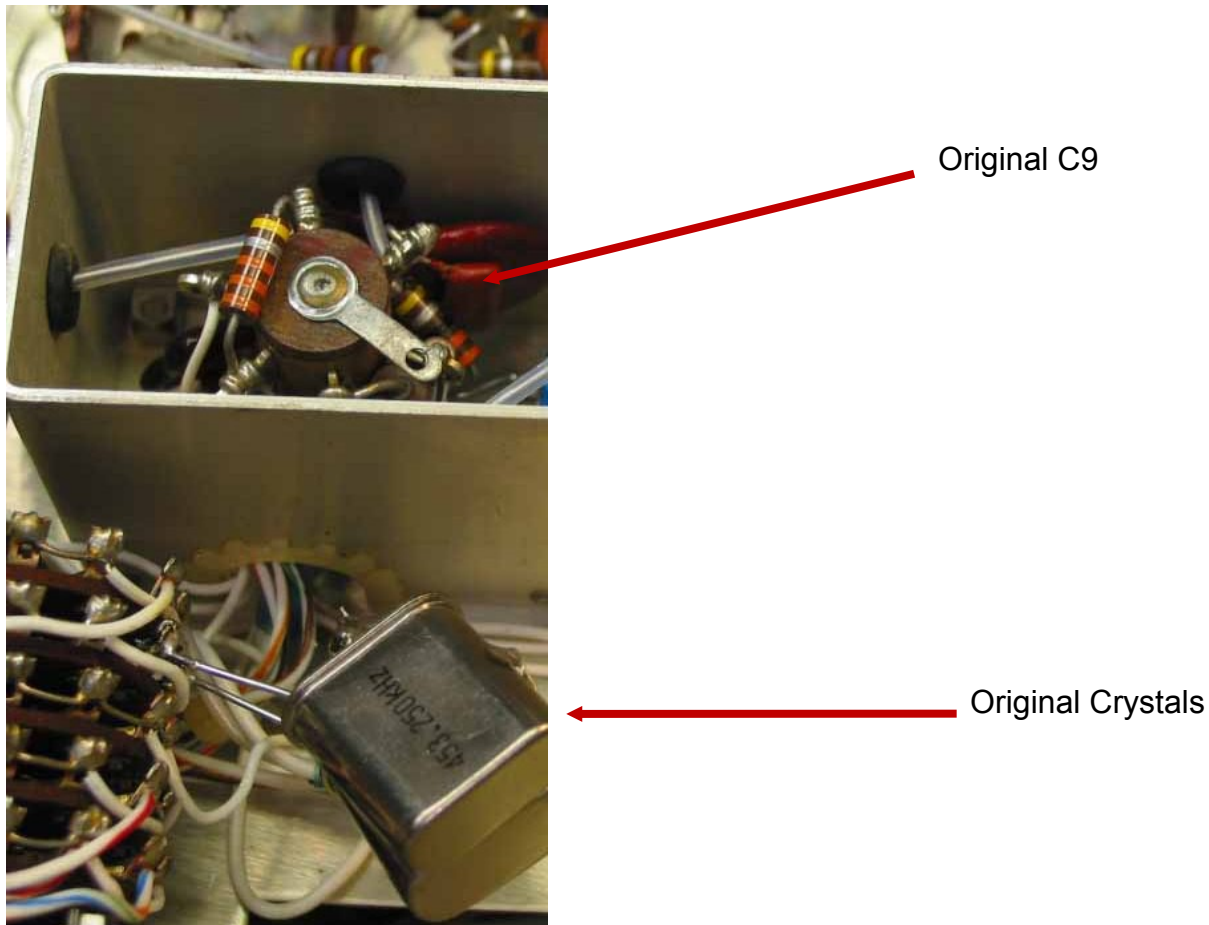


Figure 3 – Location of C9 and Crystals

The OEM BFO crystals are 456.350 kHz USB and 453.650 LSB. If one of the wider filters is installed, the BFO crystals need to be replaced. The combinations are as follows:

- 2000 Hz filter, Inrad #720, use OEM crystals
- 2500 Hz filter, Inrad #706, use 456.550 and 453.450 kHz crystals
- 2900 Hz filter, Inrad #726, use 456.750 and 453.250 kHz crystals

When replacing crystals, be sure to get the USB and LSB in the right place by recording where the OEM crystals came from.

The positive lead of the capacitor goes to pin 8 which is the bottom connection. The negative lead will go the connection closest to the top of the shield. Figure 4 shows the new C9 after replacement.

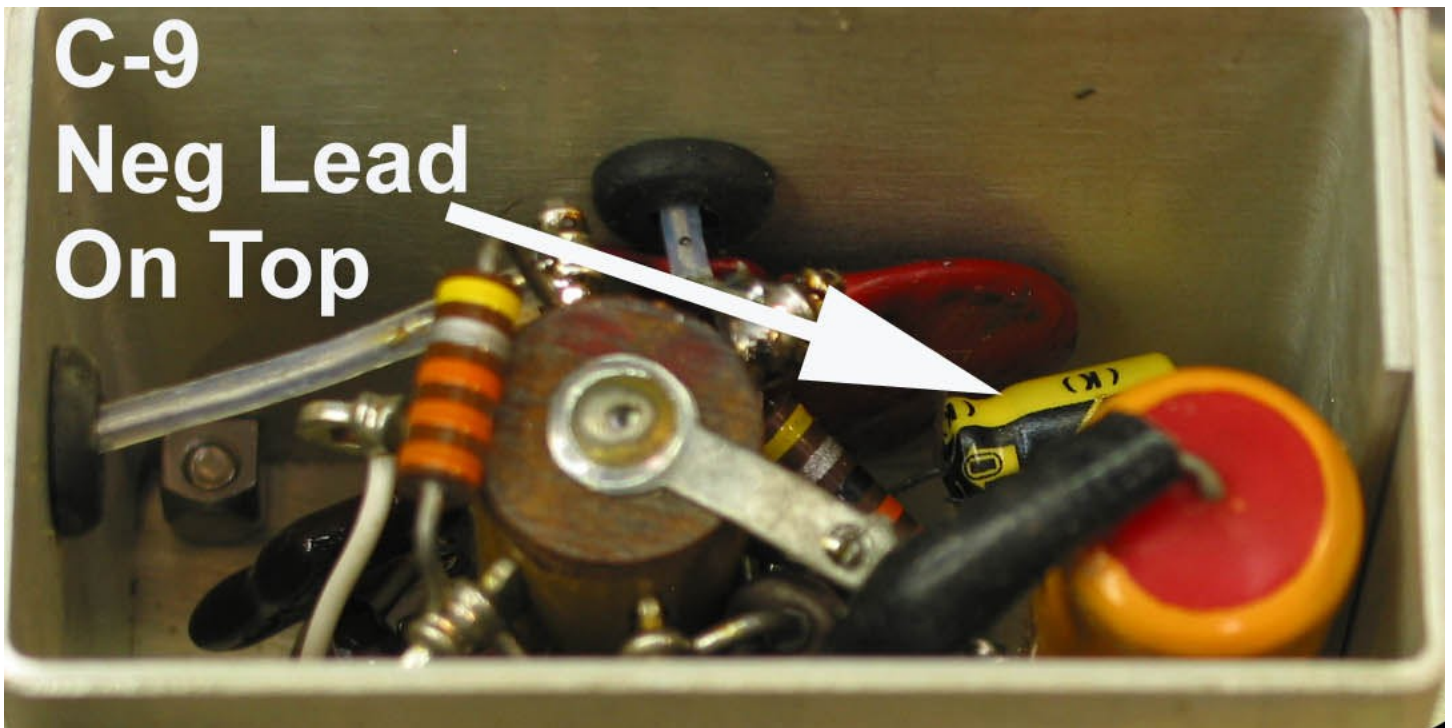


Figure 4 – Updated C9

Remove the OEM filter at this time, noting the locations of the ground lead(s) and signal lead to the filter.

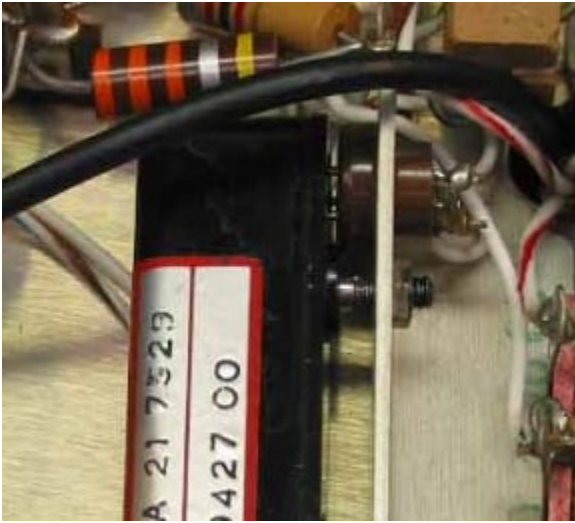


Figure 5 – OEM filter Input

On the output side, note that each filter pin has a silver mica capacitor (capacitors C18 and C19) connected to it. See Figure 6.

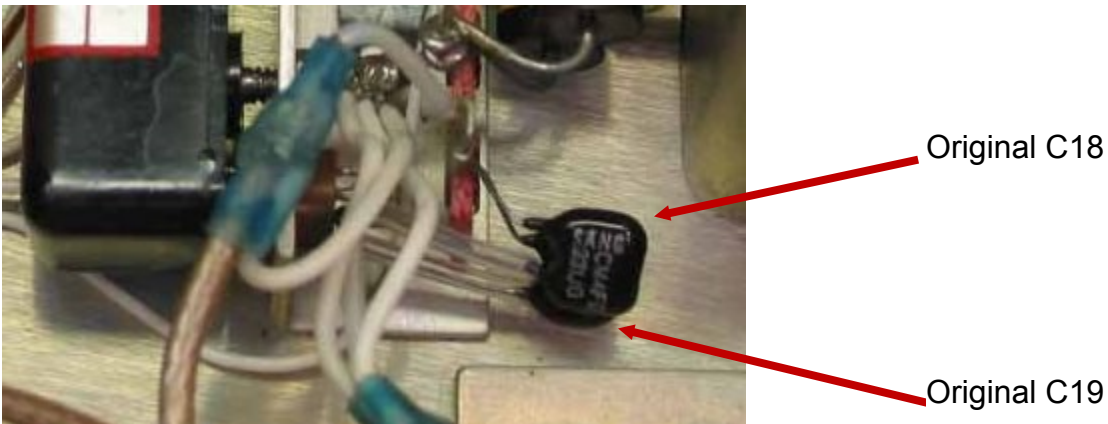


Figure 6 – OEM Filter Output

To change to the new style filter, a transformer must be constructed to balance the filter output. A small ferrite toroid core and bifilar wire is provided to wind this transformer. Figure 7 shows the wound toroid. It has 10 bifilar turns of #28 wire. One winding, the primary, is connected to the Inrad filter between output and ground.

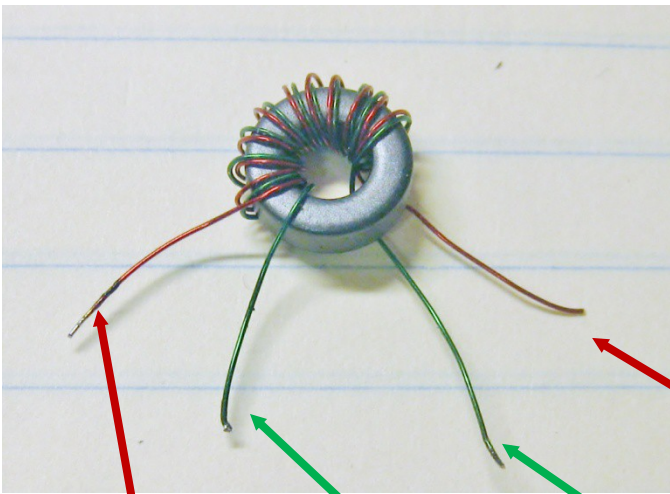


Figure 7 - Xfmr

To Inrad Filter Output

To Inrad Filter Ground

To C18

To C19

Place the new Inrad filter in the same general location as the original OEM filter.

Connect the original signal lead to the new Inrad filter input pin. The ground lead should be connected to the filter common pin located in the middle section of the filter. See Figure 8.

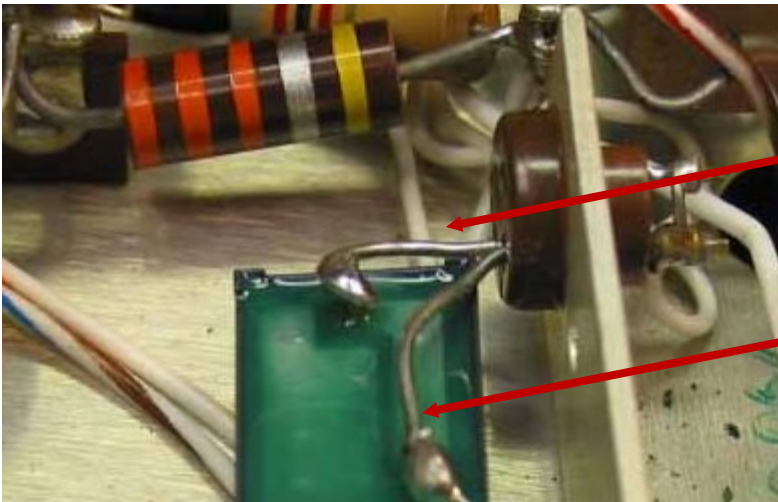
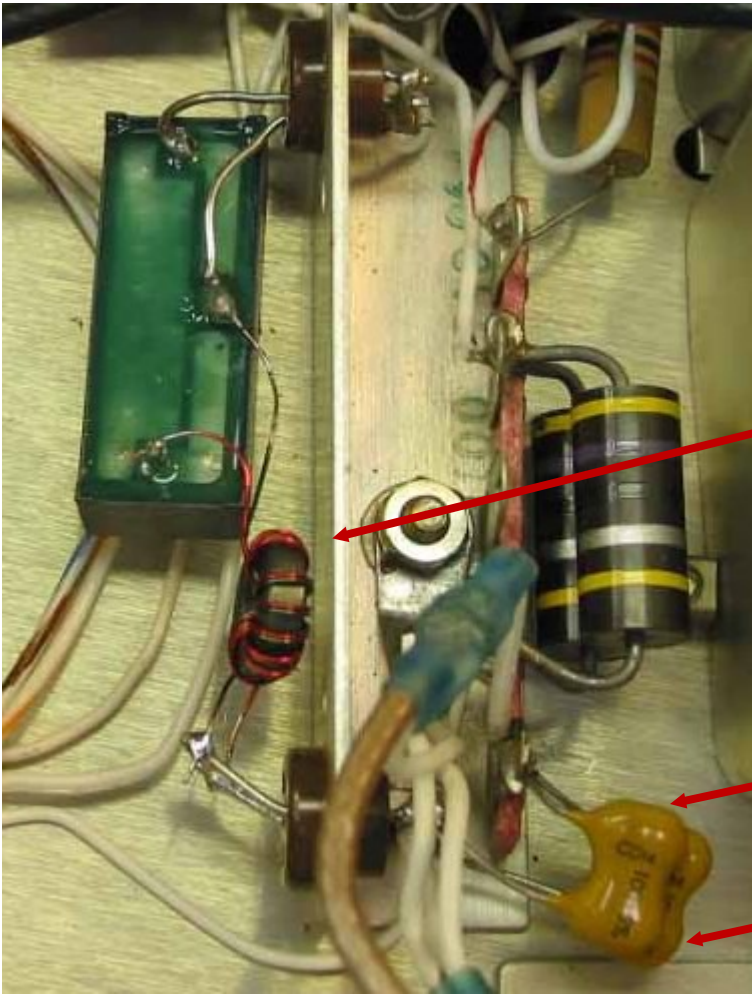


Figure 8 – New Filter Input Connections

To reduce ripple, C18 and C19 should be replaced with lower value capacitors. A pair of 100 pF capacitors are supplied in the kit to accomplish this. The new toroid transformer, along with the new capacitors are seen in Figure 9.



New Toroid Transformer

New C18

New C19

Figure 9 – Completed New Filter connections

The last step in the modification process is to permanently disconnect one side of capacitor C17 and then connect a 75 pF capacitor in parallel with a 2k resistor across the filter input and ground as shown in Figure 10. Note that location of the additional parts is physically not at the filter itself, but near the original C17.

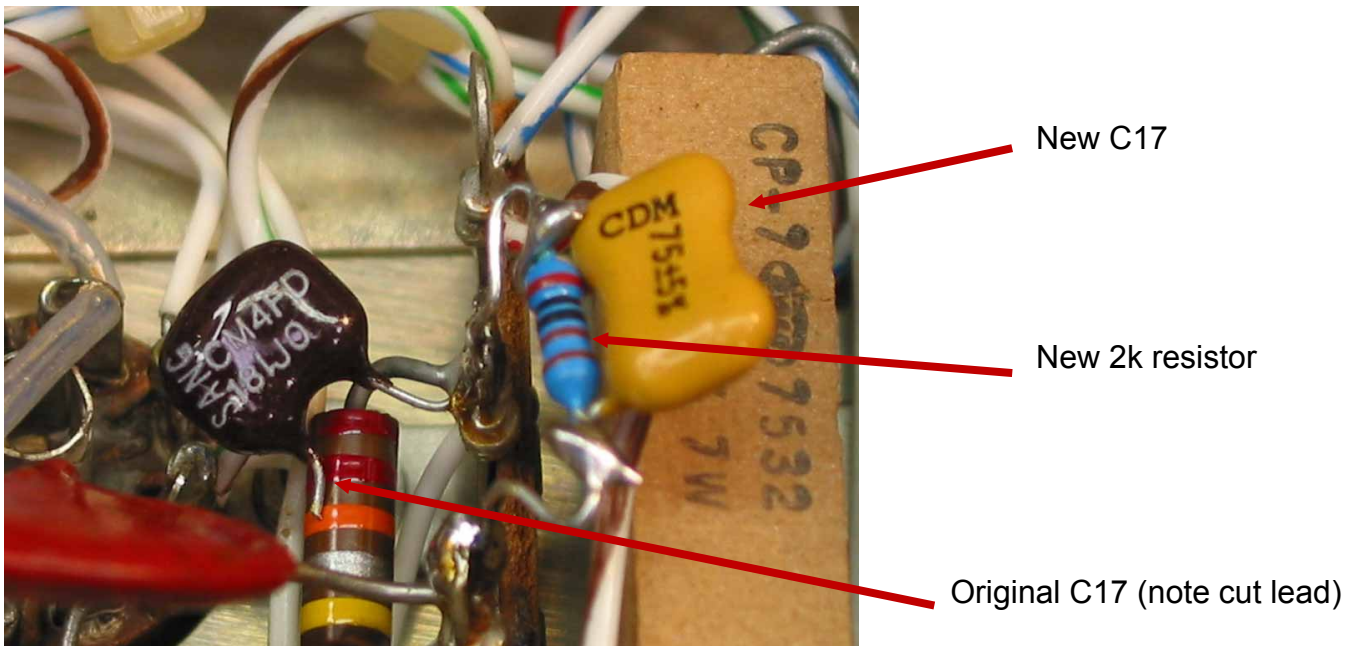


Figure 10 – Update Filter Input Circuitry

Note that when updating the transmitter to the wider filters, the appropriate carrier oscillator crystals must also be changed in the companion 75S-3B/C receiver. Please check your manual to find the crystal locations in your receiver. If the crystals are changed, you will need to align the USB VFO adjustment for carrier shift per the Collins manual for both the receiver and transmitter so they will shift together on USB. There is no adjustment for LSB.

Also note that when using wider filters, you might find that a little more drive power might be necessary.

Inrad provides kits of parts for these mods as follows:

Kit for 2000 Hz filter

- 1 Inrad #720 filter
- 1 toroidal core
- 2 feet of #28 bifilar wire
- 1 75 pF silver mica capacitor
- 1 2 kOhm resistor
- 1 10 uF electrolytic capacitor
- 2 100 pF silver mica capacitors

Kit for 2500 Hz filter

- 1 Inrad #706 filter
- 1 toroidal core
- 2 feet of #28 bifilar wire
- 1 75 pF silver mica capacitor
- 1 2 kOhm resistor
- 1 10 uF electrolytic capacitor
- 2 100 pF silver mica capacitors
- 2 456.550 kHz crystal (one for xmtr, one for rcvr)
- 2 453.450 kHz crystal (one for xmtr, one for rcvr)

Kit for 2900 Hz bandwidth contains

- 1 Inrad #726 filter
- 1 toroidal core
- 2 feet of #28 bifilar wire
- 1 75 pF silver mica capacitor
- 1 2 kOhm resistor
- 1 10 uF electrolytic capacitor
- 2 100 pF silver mica capacitors
- 2 456.750 kHz crystal (one for xmtr, one for rcvr)
- 2 453.250 kHz crystal (one for xmtr, one for rcvr)

If it is desired to have the same bandwidth filter in the receiver, the corresponding matching filter may also be ordered from Inrad as #720 (2000 Hz), #706 (2500 Hz) or #726 (2900 Hz), selecting the version made for the 75S-3B/C.

Inrad would like to thank Rob Sherwood for providing the inspiration to develop and complete the modification and Jeff Covelli for providing important technical feedback and many of the photos used in the installation notes.