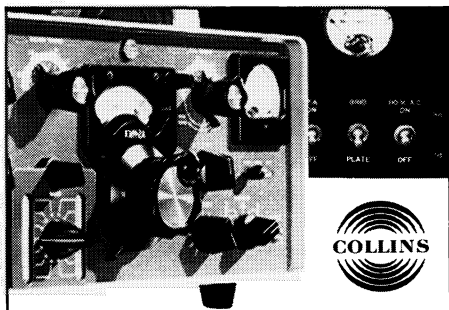


COLLINS S-LINE/KWM2 DIAL ASSEMBLIES - Part 1

by Ed Brooks, W5HTW ed.brooks@worldnet.att.net



This is the first part of a multi-part article by Ed W5HTW. The complete article will eventually be available in the "members-only" section of the CCA web site.

I. PURPOSE

The purpose of this document is to address common dial problems with the Collins S-line and KWM-2 radio equipment. It should be noted, this document is one person's experience with an old 32S1 transmitter, and my not apply equally to all such equipment. In addition, considerable input was received from others on the Collins List Reflector, and, where applicable, is incorporated in this document.

Because many people do not have internet or web access, or have access only to email, this article will initially be in text-only format. Originally I intended to include sketches and photographs. However it was noted several people did not have full internet access, and could not download graphics. I decided to make it far more detailed in text, and eliminate all the references to photos and/or graphics I had put into the original draft. I may undertake

producing it again with graphics, and making it available in PDF format. Also the article was originally written for publication, but with the removal of the graphics, I decided the detailed text would be more valuable for the maximum number of people.

This is my own experience. It is not necessarily the Collins-approved procedures, and is not necessarily procedures those more experienced with these radios might suggest. It results from my tear-down and reassembly of the dial mechanism on my 32S1 transmitter. Input is also derived from the web site at <http://www.angelfire.com/de/vk3kcm/> this will supply specific information about the dial mechanism. Another fine source of information is John, WA5VVT, who can be found on the Collins Reflector, or via email. Look him up in the QRZ on-line database.

I suggest, no matter what area of dial troubleshooting you are considering, you read this through first, then go back and mark the areas that concern you. This way you will not have to search for specific things if you run into trouble.

Finally, I reiterate, this procedure came about from my work on the Collins 32S1 transmitter. There will be several places in here that may not appear to apply to your KWM2, 75S receiver, or 312B5. You will simply have to "adapt" what is here to your particular situation. For example, I say "remove the VOX controls bracket" on the 32S1. Obviously on your 75S3 you are not going to have a VOX controls bracket.

Be advised this is a copyrighted article. If you'd like to reprint it or distribute, I just ask that you seek my permission to do so, in advance.

II. SCOPE

The problems I encountered occurred when I purchased an old (aren't they all?) Collins S-line, consisting of the 32S1 transmitter, 75S3B receiver, 516F2 power supply in a speaker cabinet, and 312B4 Station Control. Copies of manuals were included, although some others on the Collins reflector supplied me with additional materials. The system appeared to be ready to install and operate.

Though no problems were encountered with the receiver, the transmitter exhibited low

output, and a complete realignment was tried. Since I had not performed an alignment on any of these boatanchors for a good many years, I probably made several initial mistakes, in relearning the process. However, after three or four tries, I had the unit up to full power. Several interesting things occurred during this process, but those are for another article.

Initially, as I was currently using other HF transceivers, I operated this S-line in transceiver mode, to put it on the air. I was already aware it was not well suited for my primary mode of operation, CW, so saw no particular reason to go to separate VFOs. When I finally did try that, I learned the transmitter VFO did not turn reliably. Searching my personal memory banks, the gray matter under my gray hair, I recalled extensive servicing of these radios in my government communications service, but could not recall ever getting into the mechanics of the dial assembly. I popped the cover and examined it. It appeared quite straight forward, a project for an evening. I was wrong.

III. DIAL PROBLEMS

The most common complaint on the Collins S-line and KWM2 dial operation is slippage. The dial does not respond, or does not respond reliably, to turns of the tuning knob. In many cases, the dial stops completely at some point, and turning the knob has no effect at all. In my case, the dial would not even go back in the opposite direction more than a few markings. However, when the radio was cold, had been off for several hours, the dial performed much better. Some users find other problem areas concerning the dial. Below are listed a few.

1. Slippage. This is when the dial does not respond to turning the knob (as described above.)
 2. Binding. Since the dial drive system is not a positive system, that is, is not a gear system, any binding of the dial assembly results in slippage of the dial drive.
 3. Numbers not aligning correctly. This is a fairly common problem and though the first place to look is the idler gear, there are other things that can cause this.
 4. Mechanical misalignment of the PTO (Permeability Tuned Oscillator, or VFO) subchassis. There are three possibilities here.
- (continued on page 2)*

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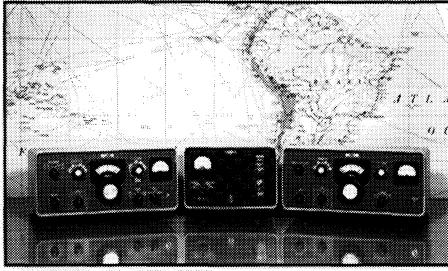
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Send us a picture of your shack, your call sign, and any shack information and we may use it in a future issue of the Signal. Just mail it to the CCA address.

COLLINS S-LINE/KWM2 DIAL ASSEMBLIES

by Ed Brooks, W5HTW

(continued from page 1)



IV. DIAL OPERATION

Before tackling corrective measures on the S-line dial, it is essential to understand the principle of operation. There are two areas, electrical and mechanical, and at times they are interdependent. The electrical part, though, can not be accurately adjusted without the mechanical areas being correct. Rotating the tuning knob turns a shaft that goes through the front dial plate, or escutcheon. On the other end of that shaft there are two spring metal disks, close to each other, which serve as drive disks. I refer to them in this document as "clutch plates." These two clutch plates are used to grip an inner circumference ring, made of nylatron, on the dial assembly. This drive system allows for intentional slippage, such as at the end of travel of the PTO shaft, or if there is binding in some other area. Such slippage would not have been possible with a geared drive.

There are two dial plates. The front one has the panels that shadow out numbers, and the back has the numbers imprinted on it. The front dial plate is directly attached to the PTO shaft, and should rotate with that shaft. The PTO shaft can be rotated through two full revolutions, and slightly beyond, at each end. Operational frequency range of the PTO is 2500 to 2700 Kilohertz, though it should tune above and below that a few KHZ. If the drive clutch is operating correctly, when the knob is turned, the PTO shaft is rotated. This rotates the front dial plate, through the nylatron ring. The diameter of the clutch disks, related to the diameter of the nylatron ring, is such that several revolutions of the tuning knob are required for one revolution of the drive ring.

The back dial plate is not rotated directly by the PTO shaft. Instead, it is driven by the nylon idler gear. Consequently this back dial plate can not be affixed solidly to the PTO shaft, but must be free to turn on the hub. Why is this? Because the two dial plates have different numbers of teeth. This is not readily apparent upon looking at them, but Collins, in order to increase dial resolution, designed the dial mechanism so that the back dial plate rotates at a different rate from the front. If you remove the assembly, you will note there are two sets of numbers on the back dial plate.

During rotation, this dial plate shifts its relative position in regards to the front plate so that both sets of numbers come into play at different points in the rotation.

Proper dial alignment requires that there be a "beginning" point for initial alignment, and we will cover that later in this article, during the alignment process.

The PTO shaft rotates through two complete revolutions from stop to stop. Stop is accomplished by using a slip-ring tab, and different size set screws. I suggest, before you even think of disassembling anything, you rotate that dial through its entire range and study how the stop tab works. It is very simple, but if you remove those set screws you can be in for trouble. One of these set screws will pass under the tab, while the other will catch the tab and rotate it with the shaft, to a fixed stop at either end of the PTO travel. Removing or interchanging these set screws could cause further problems, by shifting the electrical position of the PTO shaft outside of its 2500-2700 KHZ range.

V. REMOVAL FROM RADIO

There has been a lot written about the S-line dial system. In fact, a lot of what is in this article results from some of that writing, especially the web site cited earlier. That web site contains an S-line dial alignment procedure that is an excellent place to start. However, since a lot of the readers of the Signal and owners of Collins radio equipment, either have only email, or no access to the web at all, this article will cover much of what is covered in that web article.

REMOVE POWER!

Of course, the first step in disassembly is removal of main power. Safety is always a consideration. The radio must be removed from its cabinet, which requires disconnecting the power cord, but I realize it is possible to slide the radio forward with the power cord plugged in. That will not do!! Remove ALL connectors from the rear of the radio. For your protection, as well as the protection of hard to find tubes, remove the PTO oscillator tube, and other tubes anywhere around it. Don't risk breaking a tube.

1. If possible, rotate the dial fully counterclockwise (toward zero). If you can not rotate it with the tuning knob, this can be accomplished later in the process.

2. Remove the screws securing the radio inside the cabinet. These are the corner screws on top, and the foot screws on the bottom. Slide the radio completely free of the cabinet.

3. This step applies to the transmitter. Remove the VOX control bracket. There may be similar brackets in the KWM2 or your model of the 75S receiver. Any thing that is blocking

access to the dial assembly from the top must be removed. To remove the VOX bracket, the two top screws on the dial escutcheon must be removed. Then slide the dial lamp bracket off the VOX bracket. Push both of these to their respective sides, out of the way.

4. Remove the nylon idler gear. As you do, note the way this unit is made. There is a bushing inside the nylon gear. My first thought was the bushing was worn out, as it had a lot of "play" or looseness in it, as it is a larger inside diameter than the bolt it rides on. That is not the case. It is designed that way. There is the bolt, a lock washer, and a flat washer. These must go in the correct order during reinstallation, so be sure to note how they are positioned as you remove them.

5. Now, if you were unable to rotate the dial as in step 1 you may rotate it by hand, from beneath the cabinet, to its fully CCW position. You may also rotate it from the top, but the zero set plate is still in position at this time, and makes reaching the dial a little more difficult for big hands. While rotating the dial and PTO, note the tab, the tension spring, and the stop screws on the PTO subchassis that stop the shaft from going past its desired end of travel. Stand the radio on its end on the bench, so you can see underneath and above easily. Note: It is not necessary to remove the zero set knob assembly to remove the dial assembly and/or the PTO. But if it becomes necessary later in the process to remove the zero set assembly, it is quite easy to do, and you need only a number 4 Bristol wrench (I actually used a ground-down Allen wrench, but this is not recommended!) and a small Philips screwdriver. This will be covered later, for in total alignment it may become necessary to remove this.

6. If Slippage and/or numbers alignment is your only problem, you may be able to resolve it without further disassembly. If you feel this is worth a try, skip the remaining steps here, and go to the ALIGNMENT section. If there is binding, rough operation, or other doubtful performance, continue with further disassembly.

7. Remove the tuning knob.

8. Loosen the hex locking nut on the tuning shaft.

9. From the bottom of the radio, rotate the dial assembly so that the access hole gives you a view of the drive clutch disks.

10. Using needlenose pliers on the bushing through the panel (escutcheon plate, the plate marked with the type of radio, such as "KWM2") and observing the drive clutch disks, rotate the bushing to move the disks upward, toward the top of the radio. This will reduce their grip on the drive ring. You can observe

this movement from beneath the radio, by looking through the access hole in the dial hub. The object is to move the clutch disks upward as far as possible.

11. At this point you should decide if you wish to entirely remove the PTO from the radio, or work on it inside the radio. That will depend upon your final goals. If you feel there may be a need to open up the PTO assembly for cleaning, you will find that most easily accomplished by removing the unit entirely. If you do not need to remove it entirely, go to step 12, below. If you need to completely remove the PTO, follow this procedures:

a. There is a wrapped cable from the PTO to a hole in the main chassis. Beneath the chassis this cable will be found to contain the coaxial cable that leads to the mixer, as well as four other wires, color coded, and attached to a nearby terminal strip. To avoid drawing out a diagram I might lose, I simply clipped the wires, leaving one half inch of each wire on the terminal strip. This would allow me to later match color codings. However, if you don't have enough spare wire to do that, you need to draw an accurate diagram of where those wires go before unsoldering them. Remove all of them.

b. Trace the coaxial cable. On the 32S1 this cable runs up through the transmitter chassis to the FREQ CONTROL (And AC power) switch. Unsolder both the shield and the center lead, but be sure you have made notes as to where they go before you do. Carefully pull this cable back down to beneath the chassis.

c. From the top, unscrew the two metal screws holding the PTO subchassis mounting bracket to the main radio chassis.

d. Now you should be able to wiggle the PTO sufficiently to disengage the drive clutch beneath the chassis. Once that is disengaged, you can lift the PTO assembly free, snaking the cable up from beneath as you do so. Try to avoid dragging the coaxial cable across sharp edges and scraping off its outer insulation. Doing so could result in it coming into contact with some undesired area of the radio when reassembled, resulting in a short.

e. If you can not disengage the dial assembly from the clutch disks, (see step 13, below) you may have to loosen the front dial escutcheon plate. To do so, see paragraph 16 below.

12. Remove the two screws holding the PTO mounting bracket to the main chassis (as in step 11{c} above).

13. Rock the PTO somewhat in a gentle attempt to disengage the clutch drive ring from the clutch disks. You can again look through the access hole in the drive hub to see the effect you are having, and how to move the PTO chassis.

14. With the PTO lifted free of the radio (there

is usually enough free cable to allow easy access to the dial assembly) make sure the dial is rotated fully counter clockwise.

15. Further disassembly may not be necessary. However, having gone this far, it would be wise to note how the dials operate internally.

16. Loosening the front escutcheon plate requires removing the zero set dial and the bolt that is hidden under the tuning knob. That bolt goes through the front panel, and to loosen it, you must be able to access the small nut on the back of the front panel, through the access hole in the dial hub. A small pair of angle needlenose will hold the nut while you unscrew the bolt. If you need to loosen, but not remove, the escutcheon plate, you may not need to loosen the two screws holding the zero set dial in place. Or you may wish to loosen them slightly but not remove them. This will allow you some play to complete step 13 above, disengaging the Nylatron ring from the clutch disks. In order to completely remove the escutcheon plate, you must also remove the zero set knob. When you pull the plate forward, it will come off the zero set drive shaft, and you may remove that. Don't forget when reinstalling the escutcheon, you have to put that zero set drive in first!!

(To be continued in next issue)

Please Note: Some of the techniques and technical information discussed in the Signal are controversial and we invite you to share your knowledge and experience with us. Please send your letters and comments to the Editor.

CCA Theme Weeks 2000-2001

Everyone's invited to tune up their favorite Collins radios and check into any of our four weekly CCA nets during the weeks listed below with info on your rig, technical and historical questions and interesting anecdotes. Theme Weeks start on Monday and end on Sunday. Come join the fun!!

November 13th: S-Line Week

December 3rd: Troubleshooting and Restoration Week

January 22nd: KWM-2/2A Week

February 12th: KWS-1/75A-4 Week

March 5th: KWM-380 Week

April 2nd: "A" Series Receivers and "V" Series Transmitters (Wednesday AM Net)

May 15th: Military Gear and Unique

Join Us on the Air!



•Sunday 14.263 mHz
at 2000Z

•Tuesday 3805 kHz
at 8pm CST

•Thursday 3875 kHz
at 8pm CST

•Friday (West Coast) 3895 kHz
at 10pm CST

Sunday for Technical, Buy, Sell and Swap.
Tuesday, Thursday and Friday for Ragchew.

THE COLLINS VIDEO LIBRARY!

- The R-390A Addendum Video
 - The R-390A Video
 - The Collins Amateur Radio Equipment Video Spotter's Guide
 - The Collins 75A-4 Video
 - The Collins KWS-1 Video
 - The Collins KWM-2 Video
 - The Collins 75S-3 / 32S-3 Video
 - The Collins 30S-1 Video
 - The Collins 30L-1 Video
 - '91, '92 & '97 Dayton Videos
- also the PDC-1 kit that converts ANY average reading wattmeter to true PEAK READING even the Bird 43!

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Collins Legacies: 32A And 32B Transmitters

by J.B. Jenkins, W5EU jenkjb@flash.net and Gary Halverson, WA9MZU GHalverson@vpnet.com



Front view of J.B.'s recently restored 32B

Fourth in a series, this article describes two transmitters produced by Collins Radio during the prewar years. If you would like to see more of these prewar articles, please contact J.B. and Gary at the email addresses above and let them know how much you appreciate their efforts.

A Rig for the Times

The Collins 32A CW Transmitter and its radiophone companion, the 32B, were designed to exploit fully the possibilities of the new type 46 tubes. These transmitters followed the general circuit arrangement laid down by George Grammer in the July, 1932, and subsequent issues of QST, although the constructional features were modified to conform to Collins' standard constructional methods. These transmitters are very similar in appearance and construction to other Collins transmitters, such as the 30W and 40B.

For those operators interested in telegraph transmission only or who wished to start with a CW outfit and later change over to phone, the 32A was available. The 32A transmitter is identical to the 32B in every respect, except that the modulation equipment is not supplied, and the 150 milliammeter for modulator current has been omitted.

The Radio Frequency section employs a type 47 crystal oscillator, 46 buffer, and two 46 power amplifiers in the final modulated stage. The speech amplifier and modulator uses a type 57 audio gain, 46 driver and two 46's in push-pull as class "B" modulators.

There are two complete power supplies in this transmitter; one is using an 80 rectifier and the other is an 83 mercury vapor rectifier, operating on 110-120 volts, 50 or 60 cycle A.C. current.

Operation is possible on all frequencies from 1500-15,000 K.C. Provision for operation on higher and lower frequencies were available on special order. Coils for one band were furnished at no extra cost. An extra set (3 to a set) of coils for any other band was available for \$4.50.



Back view of J.B.'s recently restored 32B

The frequency control is by crystal with isolation of the crystal oscillator from the power amplifier by a suitably designed buffer stage.


Amplitude distortion is less than 5% at 100% modulation. The overall frequency response is 70 to 10,000 cycles within 1.5 db. The Collins type 1-A mike input must be used for phone operation. This is a gain control and mike transformer combination which sold for \$10.00.

Three surface type high grade milliammeters are furnished for reading plate and grid currents in the various stages. One of the primary specifications set that was forth for the design of every Collins transmitter is that it must be capable of tuning solely by meter readings and that no flashlight bulbs resonance indicators or other "gadgets" are required to adjust it properly on any desired frequency.

The complete unit has the appearance and construction of a commercial transmitter. The dimensions are 16" high, 19" wide, and 11 1/2" deep. The standard frame furnished with the transmitter is for table mounting. The panels, however, are the correct dimensions to fit a standard 19" rack, and the transmitter could be so supplied on special order. The shipping weight is 90 pounds.

In 1933, the cost of a 32B less tubes and crystal was \$156.00. The purchase price for the 32A, less tubes and crystals was \$106.00.





At the Mic with KW6KW

**Sandy Meltzer
President, CCA**

It's hard to believe another year has come and gone. Just enough room to wish all of you and your families the best for this coming holiday season and my best wishes for a happy and prosperous New Year.

73, Sandy

The Editor's Operating Desk

by H Michael Crestohl, W1RC/VE2XZ
Editor, The CCA Signal

This month CCA President Sandy Meltzer, KW6KW, has written a summary for this newsletter a message outlining the current state of the CCA and some of the short-term plans for the future.


We all owe KW6KW a great deal - during his first term he created and currently maintains our in-depth Collins web site at www.collinsradio.org, produces the CCA quarterly newsletter THE SIGNAL as well as many other accomplishments that we're all very proud of. Sandy is not paid for any of his services...even though he is a professional graphic artist and commercial web designer who is usually well compensated for the same work he does pro bono for the CCA.

Joining Sandy, John Bess WA5VVT and Floyd Soo W8RO will be two new Board of Directors replacing Butch Schartau KOBS and Jim Stitzinger WA3CEX who have chosen not to be candidates for re-election. Both these gentlemen have contributed a great deal to the CCA and deserve our gratitude and thanks for all their efforts over the years. I certainly hope that they will continue to increase our knowledge and understanding of these fine radios as they are both extremely knowledgeable in their own areas of expertise.

In the past 18 months since I have been the SIGNAL editor I have seen two of my goals reached and this gives me a great deal of personal satisfaction. One of these, the DEMIL Project has gone extremely well. In the past year virtually all the Collins Radio equipment formerly marked for destruction has now been reclassified so it will no longer be "demilitarized". In addition, the document scanning project is proceeding well, thanks to Larry Saletsky who is responsible for scanning the majority of the manuals into .pdf format which will soon be available for free downloading from the Members section of the CCA Web site. I'd additionally like to thank Mike Feher, N4FS and Peter Grave who have loaned me some of their rare military manuals covering Collins Amateur equipment for scanning.

Yes indeed, it has been a most productive period for the CCA and there's more to come in 2001! Stay tuned to this frequency to learn more!

My wife Cynthia (VE2QF) and 2-1/2 year-old daughter Yettive join me in wishing a very happy Christmas, Chanukah and New Year 2001 to ALL CCA members.

Hope everyone has a great Holiday Season!
73 to all!  Michael