The SIGNAL

Collins Collectors Association

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Coupler Alignment / Calibration - 302C-3 & 312B4/5

by Rod Blocksome, K0DAS

The Collins instruction books for this equipment are silent on the procedures for alignment and calibration. The information in this technical note is based on the factory test procedures and should allow the amateur to repair these units.

Required test equipment

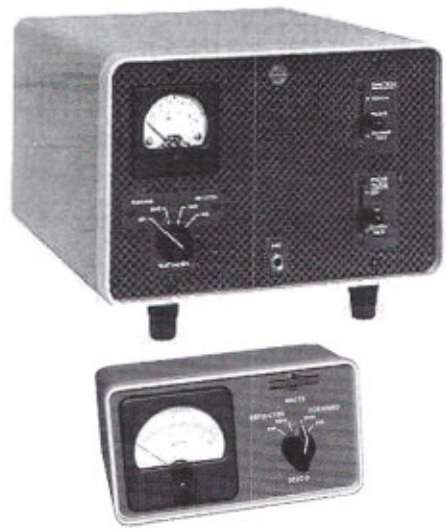
1. A 1kW dummy load of 50 ohms +/-2%
2. Independent means to measure RF power to +/-2% accuracy [Note 1]
3. DC meter, 200 micro-amp full scale +/-0.5%, internal resistance 1000 ohms +/-0.5% (needed only if the directional coupler is aligned and calibrated independently of the associated equipment meter)
4. RF power source with very low harmonic/spurious output (less than –40 dBc)

Balance adjustment

1. Connect the RF source and load in the normal direction — RF to the input and dummy load on the output. Connect the meter "+" to C10 (200 Reflected terminal) and meter "–" to ground. Temporarily short out R6 to obtain maximum sensitivity.
2. Apply RF power at 29.5 MHz and adjust trimmer C2 for minimum meter indication. As the null is approached, increase RF power to at least 500 watts and not more than 1,000 watts to do the final adjustment of C2.
3. Remove RF power and reverse the connections of the RF source and load. RF will now be flowing in the reverse direction through the directional coupler. Connect the meter to C& (200 Forward terminal). Temporarily short out R5 to obtain maximum sensitivity.
4. Apply RF power at 29.5 MHz and adjust trimmer C1 for minimum meter indication. As the null is approached, increase RF power to at least 500 watts and not more than 1,000 watts to do the final adjustment of C1.

Calibration

1. Connect the RF source and dummy load in the normal direction. Apply 100 watts +/-2% at 14.0 MHz. Test select (use a pot or resistance decade box) R5 until the meter reads 100 watts in the 200 Forward position.
2. Apply 500 watts +/-2% at 14.0 MHz. Test select (use a pot or resistance decade box) R3 until the meter reads 500 watts in the 2000 Forward position.
3. Connect the RF source and dummy load in the reverse direction. Apply 100 watts +/-2% at 14.0 MHz. Test select (use a pot or resistance decade box) R6 until the meter reads 100 watts in the 200 Reflected position.
4. Apply 500 watts +/-2% at 14.0 MHz. Test select (use a pot or resistance decade box) R4 until the meter reads 500 watts in the 2000 Reflected position.



Note 1: The common standard in many ham shacks is the Bird Model 43 wattmeter with a specified accuracy of 5% of full scale.

Frequency Response

1. Connect the RF source and dummy load in accordance with the direction given in the following table. Meter readings should fall within the ranges given in the table.

RF Direction	Frequency	Meter Position	Applied RF	Meter Reading
Normal	3.5 MHz	200W Forward	80 Watts	74 to 86 W
Normal	14.0 MHz	200W Forward	80 Watts	74 to 86 W
Normal	29.5 MHz	200W Forward	80 Watts	74 to 86 W
Normal	3.5 MHz	2000W Forward	500 Watts	465 to 535 W
Normal	14.0 MHz	2000W Forward	500 Watts	465 to 535 W
Normal	29.5 MHz	2000W Forward	500 Watts	465 to 535 W
Reverse	3.5 MHz	200W Reflected	80 Watts	74 to 86 W
Reverse	14.0 MHz	200W Reflected	80 Watts	74 to 86 W
Reverse	29.5 MHz	200W Reflected	80 Watts	74 to 86 W
Reverse	3.5 MHz	2000W Reflected	500 Watts	465 to 535 W
Reverse	14.0 MHz	2000W Reflected	500 Watts	465 to 535 W
Reverse	29.5 MHz	2000W Reflected	500 Watts	465 to 535 W

Amplitude Response

1. Connect the RF source and dummy load in accordance with the direction given in the following table. Meter readings should fall within the ranges given in the table.

RF Direction	Frequency	Meter Position	Applied RF	Meter Reading
Normal	14.0 MHz	200W Forward	100 Watts	93 to 107 W
Normal	14.0 MHz	200W Forward	100 Watts	93 to 107 W
Normal	14.0 MHz	2000W Forward	500 Watts	465 to 535 W
Normal	14.0 MHz	2000W Forward	500 Watts	465 to 535 W
Reverse	14.0 MHz	200W Reflected	100 Watts	93 to 107 W
Reverse	14.0 MHz	200W Reflected	100 Watts	93 to 107 W
Reverse	14.0 MHz	2000W Reflected	500 Watts	465 to 535 W
Reverse	14.0 MHz	2000W Reflected	500 Watts	465 to 535 W

In this issue...

Hamvention 2005

by Tony Sokol W9JXN - CCA Dayton Chair

The CCA Booth at the Dayton Hamvention

Our annual pilgrimage to Dayton, Ohio for the Hamvention is rapidly approaching, and this is your last chance to make reservations to attend.

The CCA annual awards banquet is Friday night, May 20th at the Holiday Inn Fairborn. This year's speaker will take us from the early days before radio even existed, to the trials and tribulations that Marconi endured and that led up to his famous QSO across the Atlantic. You will hear "the real story," one which earned our presenter first prize from the Rochester Antique Wireless Association. Have you ever seen a working spark gap transmitter? You will at the banquet this year, along with a matching working receiver. Of course, there will also be a nice array of goodies offered as door prizes and in a raffle.

The CCA will also be hosting hospitality rooms on Thursday night, May 19th and again on Saturday night the 21st at the Holiday Inn.

If you would like to stay "where the action is," you can make reservations by calling 937-426-7800. Be sure to tell them you are a CCA member to get the $99 per night special rate, which is quite good for a hotel of this quality during the Hamvention.

Daytime action at the Hara Arena will be at the CCA booth, #459. The booth provides a great gathering place to meet up with members and sit a spell.

A banquet reservation form is included as an insert with this issue of the Signal. Time is running out, please make your reservations NOW! Check the CCA web site and the CCA Collins Reflector for the latest up to date information. You can also check out www.hamvention.com for general Hamvention information. Get those reservations in now and don't miss out on the fun! See you in Dayton!

Spring 2005

NET NEWS

Fred Holmes W1SKU Net Manager

Well, a lot has happened since the last "Net News." First of all, as I am sure you all are aware, I resigned as Net Manager effective Febuary 28, 2005. The CCA is searching for a volunteer to replace me as Net Manager, but so far no one has stepped up to the plate. Isn't there someone out there who would give it a try? It is really an enjoyable endeavor, with the reward that you help to make the nets, the mainstream of the CCA, happen.

The second important change is that we have a new Assistant Net Manager on board. He is John, W2VTV. Thank you, John, for stepping up and agreeing to take over the position. Please join me in welcoming him. John had helped the CCA find NCOs and had taken nets even before being named an NCO. John is a credit to the CCA and its membership. Third, we are still looking for a person to take over the 10 Meter AM Net Manager position. Pete, K5PZ, has been continuing on as the manager, waiting for someone to step up and replace him. These are YOUR nets, and we need people to be the managers and the NCOs if the nets are to continue.

As for the nets themselves, I haven't been involved as much as I used to be since resigning, but there is a significant change in the Thursday night 75 Meter Net. The time is the same, 9:00 Eastern, 8:00 Central, but the frequency has been changed. Because of problems with the 3875 group, we made arrangements to use the Marconi Net frequency of 3872 kHz from 9:00 to 11:00 PM Thursday nights. This change has worked out well and will now be made permanent. We wish to thank Fred, KB2IXT; Brendan, AB2QB; and Dick, WB8HNX, along with all the other participants in the Marconi Net, for agreeing to share the frequency with us. Please make them feel welcome should they check into our net.

Remember to check into the CCA nets. It's a great chance to put those rigs on the air and to meet and talk with other Collins users. See everyone at Dayton.

In the Shack

Scott Freeberg, WA9WFA

I first saw Collins equipment as a young 14-year-old Novice in the mid-1960s. At the time, I thought Collins equipment must be the most wonderful equipment in the world. Now, 40 years later, I'm sure of it. The next time I saw Collins equipment was during Viet Nam, when I served in the US Navy as a Radioman. In 1997 I bought my first Collins radio, a 75A-2, and my Collins radio love affair quietly began.

After a year of listening to the discussions about the mysterious Gold Dust Twins on the CCA nets and reflector, I bought the KWS-1, the 75A-4, and a 270G-3 speaker. What a classic station with an incredible history behind it. I use that station as my daily driver. I also have a 32V-2 and 75A-1 station, which yields the most wonderful sounding CW and AM. All of my Collins radios are in use (no wall flowers), and they are a real pleasure to use on SSB, AM, and CW. There is a particular pride when using this equipment on the air. I also have a 75A-2, which competes against the 75A-1 for the best-sounding CW ever heard.

I heard about the CCA from a buddy and joined in 1998. I was simply amazed at the camaraderie of the folks in the CCA, the willingness to help and share historical and repair information, the generosity, and the incredible amount of knowledge. It was unlike any ham group I've ever encountered. I've been a member going on eight years now, and I'm grateful for all the assistance and help that I've received from the group. I'm trying to pass along to the newer members whatever scraps of Collins knowledge I possess or learn. I know it's important to share this information.

My station photo shows the Gold Dust Twins on the left. In front of me on the bottom shelf are the KWM-2A, 312B-5, and 30L-1. On the upper shelf are the 32V-2 and 75A-1. The top shelf holds a 270G-3 speaker for the 75A-4.

What's in my Collins future? I am learning how to troubleshoot, repair, and align my Collins radios, so there is a lot to learn and there are a lot of challenges. I'd also like to find and buy a KWM-1 and station monitor, and the matching 312A-1 speaker for my Gold Dust Twins.

At The Mic

by Floyd Soo, W8RO - President CCA
floyd@hi-rescom.com

Well, spring has officially arrived and you all know what that means. Dayton! We will have our usual get-together again this year at the Holiday Inn Fairborn. We will also have our usual Great Time together there, too! Tony Sokol, W9JXN, our Dayton Chairman, again has done a fabulous job of putting together another wonderful banquet! This year's presentation will be a historical account of Marconi's work leading up to his famous transatlantic contact. There will also be a demonstration of a home-built replica of Marconi's spark-gap transmitter and receiver. Rumor has it that the gentleman giving this presentation received an award for his work from the Rochester, NY historical society and that the award was presented to him by Marconi's daughter. This will be just a small part of the festivities during our annual Dayton Banquet. We'll have our usual hospitality suite on Thursday and Saturday evenings, too. Stop by for an informal gathering and some fun discussion about things Collins. Don't miss it!

On the HF net front, we are still looking for someone to take on the Net Manager's position now that Fred Holmes, W1SKU, has stepped down. Anyone who may be interested in filling those shoes, please contact me. I also want to congratulate John Wyatt, W2VTV, on his appointment to the Assistant Net Manager position. Thank you for stepping up to the plate, John. I also want to thank outgoing Net Manager Fred, W1SKU, for a job well done. Thanks also go to Dean Prull, KA6BGW, for his work as Assistant Net Manager. Without volunteers such as these the CCA would not be the wonderful organization that it is today. Thanks to all of you!

So what does the future hold for the CCA? What other activities will the CCA be sponsoring? I am asked these questions fairly regularly. The answer is, quite honestly, up to You, the CCA members! The members drive this organization by informing the Board of Directors (and other officers) what their preferences and ideas are. The membership asked for a nice newsletter, and then came "The Signal." The membership asked for a get-together at Dayton, and then came the annual Dayton meetings and banquet. The membership asked for an e-mail reflector, and then came the CCA List. The membership asked for more HF nets, and then came the 75-meter nets. The membership asked for a website, and then came the CCA website. I hope my point is clear! It is the CCA members who give this organization purpose and direction. We, the CCA BoD, need to hear from You. We need your ideas, input, and assistance. Please get involved! Please become more active! Please communicate with us! It is the only way we will know what you want!

Speaking of the CCA website, in the very near future we hope that all of you will notice a subtle change there. The CCA BoD has decided to officially get some help for Sandy, KW6KW, the CCA's Web Master. Sandy has done yeoman's duty working on the website by himself for all these years. Well, the BoD has decided to appoint several Assistant Web Masters to assist Sandy with his website responsibilities. The aim is to lessen the workload for Sandy and to build some backup and overlap for our website. Another goal here is to keep the website fresh and up to date, without undue hardship on Sandy's work schedule. We are presently interviewing prospective candidates for these positions. More details will be available at Dayton.

Last, but certainly not least, stay "radioactive" and check into our HF nets! Toss out ideas for Collins-related discussion topics. Our NCOs are always looking for a good topic of discussion for the nets, so give them some help if you have ideas. Also, if you or anyone you know has a story to tell for the "Collins Radios at Work" column, a technical tip/article, an "In The Shack" photo, or anything else you think the membership would enjoy reading in "The Signal," Gail, K2RED, our Editor, would like to hear from you (e-mail: K2REDCCA@aol.com). Tell your story! We need to keep things fresh and exciting, but we cannot do that without Your input and participation. Have a great summer!

Letters to the Editor

My dad became a Silent Key on July 14, 1992. He had been a ham since 1956. His call was K5TJG and later W5OAK, the latter callsign while he was in Mobile, Alabama. Sometime in the mid- to late sixties, he purchased the transmitter and receiver of the Collins S-line. When he passed away, I inherited his ham equipment, minus the transmitter. I have gotten the SB-200 linear amp refurbished and now have it on the air. I have the matching Collins receiver, the 75S-3B. He last had the Collins equipment in the Mobile area. I checked with one of my dad's buddies in Mobile, and he said that the last he had seen of the Collins transmitter, it was not working and he wasn't sure whom Dad left it with for repairs, if it could be fixed.

I do not know the model of the matching transmitter. If anyone could help me locate his transmitter, it would be great. My dad was special to me, and getting back his transmitter would be a long-time ambition fulfilled. If anyone has information, please contact me, Boz, WB5HUF at the address below. Thank you. wb5huf0872@wmconnect.com

Join Us on the Air!

- Sunday 14.263 mHz at 2000Z
- Tuesday 3805 kHz at 8pm CST
- Thursday 3872 kHz at 8pm CST
- Friday (West Coast) 3895 kHz at 10pm CST
- Sunday 10m AM 29.050 mHz at Noon CST
- 1st Wednesday AM 3885 kHz at 8pm CST

Sunday for Technical, Buy, Sell & Swap
Tues., Thurs., Fri., & Sunday for Ragchew

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Collins Radios, Still the Best in Town - Part 2

by Edison Fong, WB6IQN - edison_fong@hotmail.com

Consider the first issue of the RF front end, handling the weakest signals and yet not overloading with strong signals. Certainly one can build a front end with plenty of gain. With today's low-noise transistors, the front-end sensitivity easily can match up to a 6DC6 used by Collins throughout the R390A and S-Line. Contrary to popular belief, sensitivity is usually not a problem. If that were the case, a low-noise preamp would be all that is needed to improve receiver performance. The challenge is in being able to handle the weakest signals and simultaneously handle the 2 KW down the street on the same band. In a low-quality receiver that 2-KW station will overload the front end, swamping out the desired weak signal. This is a problem to which all military radiomen can relate. On board a military ship, there are literally tens of kilowatts of RF energy ranging from DC to daylight. An excellent receiver such as the Collins R390A will not blink an eye at the undesirable signals.

What do the professionals use? Figure 2 (see the first-quarter 2005 "Signal") shows the front end of a Collins R390A receiver. This is also similar to the same front end of the Collins S-Line. It uses a 6DC6 in a pentode configuration. This configuration has virtually endless dynamic range, since the tube plate voltage sits at +140 volts. This circuit is almost impossible to overload and yet delivers sensitivity to 0.3 mv or better. With some careful tuning, my R390A measures to 0.1 mv on selected bands. With minimum AGC, this circuit has a dynamic range exceeding 140 dB. Because AGC is kept to a minimum, SSB signals experience less distortion due to the high linearity of the front end. This also accounts for why tube rigs often have better audio quality.

It's not all simply in the detector and audio circuits. In modern rigs, part of the poor performance is due to the front end contributing distortion due to the AGC and the nonlinearity of the RF section. Compare the Collins front end with the front end of, let's say, an ICOM 735, shown in Figure 3. The good news regarding the ICOM is that it does use FETs as opposed to bipolar transistors, which introduce much more distortion. The ICOM circuit is in a common base configuration. To match the impedance and provide for more gain, ICOM has paralleled two devices. The circuit uses no AGC at all in the front end. Thus, it is prone to overload. Looking at the figure, it appears that the drain is biased at approximately 8 volts. This gives rather poor front-end overload performance, as reported by many IC-735 owners. However, this front end probably is adequate for residential and mobile operation. It would not be usable, though, at ARRL headquarters or aboard the USS Enterprise.

Another interesting front end is in the Drake TR7A. After all, it made me a hero during 2003 Field Day. It is basically passive, as shown in Figure 4. There is no RF front-end amplifier to overload. Following the antenna are the bandpass filters, then a diode ring, passive, double-balanced mixer. What is unique here is the amount of local-oscillator drive that the Drake TR7A provides. The 2N3866 provides almost 1 watt of LO power. It would take on the order of 100 mW or so to even begin to overload this mixer. Thus, this front end certainly is built for a battleship environment. My 2003 Field Day experience proved exactly that. It will perform when all others have failed. However, doesn't this configuration lack sensitivity? It can, if not tuned properly. The key is in the minimum loss of the double-balanced mixer and also the high output of the LO. Certainly the Drake TR7A, when aligned properly, does not lack sensitivity.

In general, FETs are better than bipolars at the front end, but they are no match for tube front ends, which offer lower noise and lower distortion products. Tubes are superior in terms of dynamic range due to the high bias voltages and are virtually impossible to overload if designed properly. For low-voltage receivers (e.g., 12 volts or less), a passive front end and double-balanced mixer should seriously be considered, since they are used in professional receivers.

On another note on front ends, the ICOM, and for that matter all more inexpensive radios (Kenwood, Yaesu, etc.), use standard switching diodes for switching in the various front-end bandpass filters. As mentioned by Ulrich Rhode in the March 1995 issue of QST, conventional switching diodes (such as 1S553's) are notorious for distortion and cause InterModulation (IM) products. The bandpass filters typically are not tunable in the less-expensive radios and thus do not reject in-band signals. Even if the bandpass filters were tunable, the linearity usually is inferior due to the use of nonlinear varactor diodes.

On the other hand, the Collins R390A has no PIN diodes for switching. It uses real, down-to-earth wafer switches. No measurable distortion in these devices. Expensive? Yes, but it is the best way to get the job done. Not only that, the Collins R390A goes one step further, something only found in the most expensive receivers made. It uses CAM gears for Track Tuning. This technique was, and still is, the ultimate in receiver design. As one tunes the main tuning knob, the front end, the mixer, the local oscillator, the second mixer, and all associated circuitry are tracked mechanically. As you tune the main knob, all the other tuned circuits in the radio are retuned mechanically for optimum performance. It does not take a degree in radio design to conclude that the mechanics in an R390A are more complex than a Swiss watch.

(continued in Part 3 - next issue)

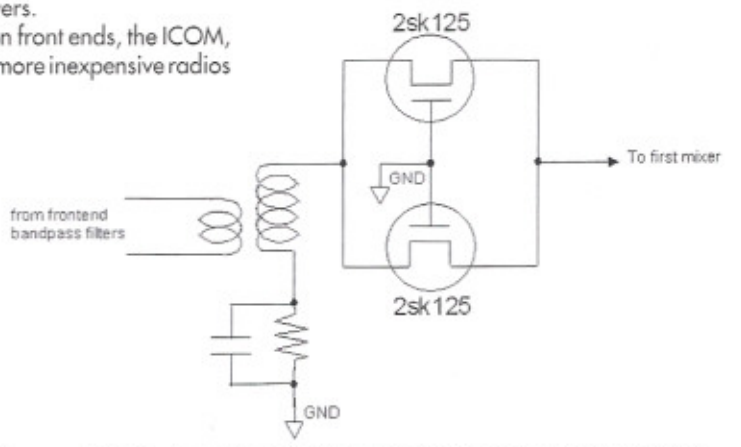

Figure 3. Schematic diagram of the front end of an ICOM IC-735. There is no AGC at this stage.

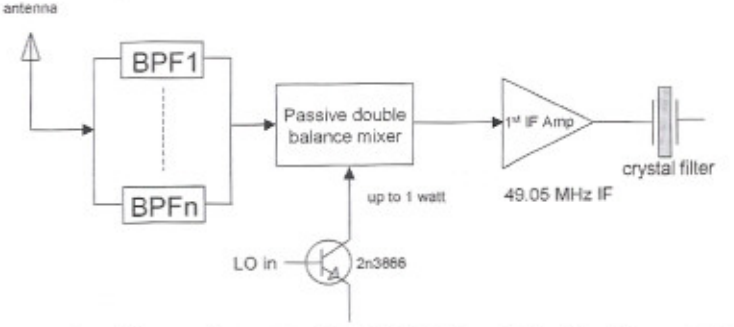

Figure 4. The combined front-end mixer in a Drake TR7A. The output of the LO approaches 1 watt.