

# **SIGNAL ONE**

## **TROUBLE GUIDE**

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## PREFACE

The following is a compilation of problems and their solutions applicable to the SIGNAL/ONE CX7 and CX7A transceivers. This transceiver is a complicated piece of equipment and as such requires close attention. This booklet is designed to focus attention on problems that have been common to the CX7 and CX7A transceivers and help their owners keep their units in proper operating condition.

The problems (and solutions) are from my own experiences and those of other owners. In most cases it is assumed that the reader will have in his possession a copy of the complete maintenance manual. It is suggested that repairs not be attempted if this manual is not available.

I wish to thank all those who sent me information regarding their problems and how they solved them. For those of you who sent me problems and no solutions, I hope this booklet will be of help!

I intend to update this booklet from time to time.

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## PREFACE to the final edition

I originally started reconstructing this Trouble Guide with the intent of reproducing the original as closely as possible. After trying to piece together fragments of the various revisions, I realize that this was futile and counter-productive.

As a tribute to the efforts of Bob Sullivan, I felt that it would be in the best interest of Signal/One owners and restorers to continue on with the Trouble Guide.

What you see here is a compilation of all the problems, modifications, and miscellaneous changes that I could find in all the revisions of the original Trouble Guide and the Signal/One Newsletters (also published by Bob Sullivan).

While I believe the document to be complete, there may be items that I have missed. I have made every effort to assure the information contained herein is correct. Errata were corrected where found, but I recommend that the reader validate the information by reference to the Newsletters and manuals, if possible. The definitive reference for modifications remains W8CSX's Modification List.

Bill Turini KA4GAV  
HAManuals

## INTRODUCTION

The following sections will describe various Signal/One problems and their solutions. Remember of course that many times a problem has different solutions! The solutions herein are those of an actual experience of one or more owners. In other words, for some specific problem you may have the solution given here may not solve the problem but would certainly give direction to your troubleshooting!

It is strongly recommended that major repairs not be attempted without the complete maintenance manual at one's disposal.

Normal precautions when troubleshooting transistorized equipment should be observed at all times:

1. Be very careful not to short anything when probing with test leads - a short (for even a brief period) in the wrong place can damage many components!
2. If parts replacement is required be sure the part is an exact replacement or a recommended substitute. See the NOTE at the end of this section.
3. When desoldering and soldering on the printed circuit boards, do not use an iron with a rating greater than 50 watts. Lands will lift from the boards if an iron of higher rating is used.
4. In general voltage measurements should be made with a VTVM rather than a VOM to reduce circuit loading that can disguise proper readings. Keep in mind that some of the new FET type VOM's can not be used to check diodes or transistor junctions by comparing front and back resistances since not enough current is utilized to take the junction beyond its "knee". Check the instruction manual for your instrument.
5. Remove a component as a last resort! Carefully check voltages, resistances, etc. Many adjustments in the Signal/One are critical - make sure all associated adjustments are correct.

\*\*\*\*\*

Many "problems" with the Signal/One can be traced to incorrect front and rear panel adjustments, tune up procedure, and misinterpretation of panel indications. Make sure you have carefully read and understand the operating instructions. This transceiver is NOT a KWM-2 which will operate properly under just about any conditions and/or misadjustments. Make sure you follow the procedures given in the manual. Read the following general comments carefully:

1. The OUTPUT control should never be advanced beyond 10 o'clock. Beyond this point most units will "take off" and cause spurious oscillations. This condition is indicated by very high forward and reverse power indications. With the DRIVE control at or near 9 o'clock output will be nearly 150 watts. This can be confirmed by inserting a tone at the mike jack. (In TUNE indicated power will be a little less)
2. NEVER attempt operation in the broadband mode with SWR's greater than 2:1. The broadband trimmers cannot take it. Remember that the broadband adjustments are made at a certain frequency and wide excursions from this frequency will require tune up in the NORMAL position.
3. If the BLANKER control is set too high, severe distortion will result on received signals.
4. In some cases during normal operation, very little or no movement of the meter selected to DRIVE will be apparent. There is no need for concern here.
5. It is normal for the PRESELECTOR to peak at the extreme CCW end of this control except on 160 meters.
6. Do NOT use ALC when driving the A70 or A77 linears!
7. A key plugged into the KEY jack and depressed when in USB or LSB mode will cause a switch to the TRANSMIT mode but there will be no power output.

\*\*\*\*\*

N O T E

Spare parts for the Signal/One are available through PAYNE RADIO, P. O. Box 525, Springfield, Tennessee, 37172. Don Payne has a complete listing (with prices) of all the spare parts he stocks. He has a minimum \$5.00 order. Remember that parts are in short supply! Most of the semiconductors are available through the mail order electronic supply houses.

The following sections are divided up as noted in the Table of Contents to help the reader get to the section covering his problem. I hope the information herein will be useful. I invite additional comments and suggestions. All contributors to this booklet will receive a free copy.

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## TRANSMITTER SECTION PROBLEMS

**PROBLEM** Apparent excessive power output on one or more bands (both forward and reverse).

**CAUSE** Driver section taking off on some parasitic frequency caused by overdrive.

**SOLUTION** Turn down the DRIVE control! You may not have 150 watts output in TUNE but if you whistle into the microphone or insert a tone you will find the output is very nearly 150 watts even with the DRIVE control as low as 9 o'clock. If turning down the DRIVE control does not solve the problem, replacement of one or more of the driver transistors may help (Q3 or Q4 on the RF driver board, A5).

**PROBLEM** Burned broadband capacitors in final cage

**CAUSE** Operation in broadband position with a high standing wave ratio.

**SOLUTION** Replace the burned capacitor(s). This can be a difficult job. In some cases, however, only the mica spacer that has burned can be replaced - which is an easier job than replacing the whole capacitor. This can be done by removing the adjusting screw and washer, bending the plates back until the burned spacer is located, and replacing that mica spacer. After replacement, readjust the trimmer per the manual.

**PROBLEM** USB/LSB out of balance (that is, audio is normal in one sideband but distorted in the other)

**CAUSE** 8.8 Mhz carrier misadjusted.

**SOLUTION** Adjust R46 located on the BFO board, A4.

**PROBLEM** Spontaneous lock up to transmit mode in USB LSB, and CW positions. Keyer is inoperative.

**CAUSE** Defective transistor in keyer circuit

**SOLUTION** Check transistors associated with keyer on counter board, A7, especially Q3 (2N5183).

**PROBLEM** Transmitter tunes properly and shows proper RF output but no output when speaking into the microphone.

**CAUSE** Defective Q1 on audio board, A6.

**SOLUTION** Check to see if there is RF output when an audio signal is injected at the PHONE PATCH input. If signal is present, then Q1 is probably defective. Note that Q1 can be replaced without removing A6 by clipping the leads of Q1 above the board and soldering a new Q1 (2N5485) to the remaining leads.

**PROBLEM** Lock up in transmit mode.

**CAUSE** Defective transistor on Audio Board, A6.

**SOLUTION** Check transistors Q16 and Q17 on audio board A6. Either of these transistors can cause the T/R line to lock in the transmit condition.

## RECEIVER SECTION PROBLEMS

**PROBLEM** Excessive hum

**CAUSE** +34 volt power supply defective.

**SOLUTION** Check terminal 131 at the power supply board. If it reads approximately 43 volts (this terminal should read +34), check transistors Q4 and Q6 on the power supply board.

**PROBLEM** Receiver seems slightly or very insensitive.

**CAUSE** Bad front end FET (located on front end board, A2 and designated Q1).

**SOLUTION** Make the following check: Turn on the calibrator and adjust the PRESELECTOR and main tuning for maximum S-meter indication at 14.2 Mhz. If it is much less than +20 over S9, Q1 is probably defective. Replace Q1.

**PROBLEM** No signals or very weak signals but normal calibrate signal.

**CAUSE** Defective slide switch, S9 on rear of chassis and marked AUX-COM.

**SOLUTION** Replace this switch. Or better yet, if full break-in CW operation is not contemplated, wire this switch to the COM position.

**PROBLEM** S-meter readings seem low but receiver is operating normally.

**CAUSE** Defective transistor or misadjustment on AGC detector board, A9.

**SOLUTION** Check transistor Q14 (2N5183) on AGC detector AGC board, A9. Also check for proper adjustment of R26. This

adjustment requires the use of an external signal generator.

**PROBLEM** No slow AGC action.

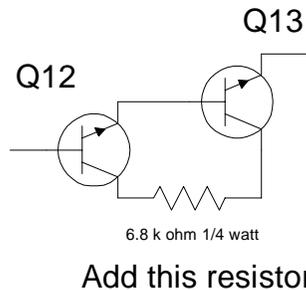
**CAUSE** Defective transistor Q12 (2N5183) on AGC detector board, A9.

**SOLUTION** Replace Q12. (A 2N2222 is a satisfactory substitute). Q13 should also be checked.

**PROBLEM** Loud pops in receive.

**CAUSE** Poor AGC action.

**SOLUTION** Add a 6800 ohm, ¼ watt resistor as shown below. Q12 and Q13 are located on the AGC board.



**PROBLEM** 8.8 MHz carrier misadjusted. (R46 on BFO board, A4)

**SOLUTION** Adjust using one of the following methods:

1. Set IF shift control such that switching from LSB to USB does not change the sound of the speaker hiss. Adjust R46 such that depressing the SPOT button does not change the character of the hiss. The BFO will now be on the same frequency in transmit as in

receive. (Excellent method for those without test equipment.)

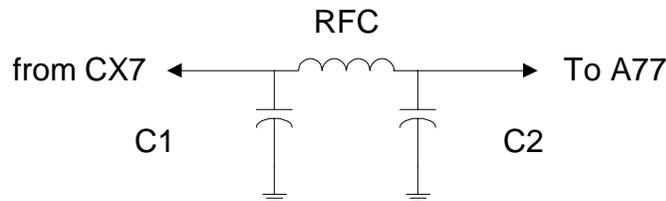
2. Remove the unit from the case, connect a dummy load and set the OUTPUT control to zero (full CCW). Turn audio gain up and switch between USB and LSB while adjusting the PASSBAND (IF shift) control for the same pitch from the speaker. Feed some carrier oscillator signal into a BC221 Frequency Meter by picking up the signal from terminal #495 on board A9, the AGC/Detector board. Using headphones with the BC221, tune the BC221 to zero beat with the carrier oscillator (8.8165). Depress key or TRANSMIT button. If R46 needs adjustment the signal will no longer be zero beat in the headphones. Adjust R46 for zero beat if necessary. (Exact method, but requires the use of a BC221) (or frequency counter, Ed.)
  
3. Adjust by using the counter in the CX7: Disconnect the shielded line #5 to the counter board and connect to the AGC board line #182 which is board pin #500. Set CARRIER OUTPUT to zero. Select TUNE. Ignore first digit of counter to read oscillator frequency. For example, when reading the LSB crystal 8.8135, the counter will read x135. Ignore the "x" digit. Make sure your 100KHz calibrator is zeroed with WWV. Refer to page 5-15 of the Thomas manual for additional details.

## OTHER PROBLEMS

**PROBLEM** Erratic Alpha 77 operation when being driven with the Signal/One. (For example, A77 cannot be tuned properly on one or more bands)

**CAUSE** RF is getting into the A77 via the control relay cable to the Signal/One.

**SOLUTION** Check to see if this is the problem by disconnecting the relay control cable and shorting the relay jack on the rear of the A77. If the problem no longer exists stray RF is the problem. Build the following circuit in a small minibox and insert it between the A77 and Signal/One relay control line.



C1, C2 are .001 1kv disc ceramic  
RFC in the range of 10-50 microhys and  
able to handle 100 ma.

**PROBLEM** One or more of the nixie tubes "jumps" or "rolls" from digit to digit.

**CAUSE** Defective integrated circuit on counter board.

**SOLUTION** Replace defective IC. If the least significant digit is the trouble (right hand digit as viewed from the front), check IC 9 and IC 13. If the "units" digit is the trouble, check IC 8 and IC 12.

If IC 9 and IC 13 check okay, try connecting a .1  $\mu$ fd capacitor between pins 5 and 6 of IC 8 to cure right-hand digit rolling.

**PROBLEM** Transceiver locks up in XMIT state after approximately 1 minute from turn-on. Also, the nixies do not light.

**CAUSE** Defective power supply transistors.

**SOLUTION** Check transistors Q3, Q7, Q8 on power supply board. (Q3 is a TIP-29A - the 5 volt regulator). Q3 is the most probable prospect - it works the hardest! Normal voltages for these transistors are as follows: (values shown are nominal and could vary  $\pm 20\%$ )

	Q3	Q7	Q8
BASE	6	.6	6
EMITTER	5	0	6
COLLECTOR	17	6	17

Volts

**PROBLEM** S-meter readings seem low.

**CAUSE** Misadjusted R26 on AGC Detector Board (A9) or improper bias on AGC amplifier, Q1.

**SOLUTION** Check a signal (as weak as possible with AGC ON). Turn AGC to OFF - signal should not increase in level. If it does, this indicates that the AGC is energizing and desensitizing the front end. Check voltages on pins 479 and 509 on AGC Detector board, A9 while adjusting R26 per the manual. If adjustment does not seem to be obtainable, change R8 from 10K to 15K. This changes the bias on Q1 and it will take a stronger signal to bias Q1 to the on state.

**PROBLEM** Receiver insensitive in both slow and fast AGC and S-meter hangs at S-9. With AGC off, operation is normal.

**CAUSE** Bad transistor Q3 (2N5183) on AGC detector board, A9.

**SOLUTION** Check transistor Q3 on board A9 for emitter to collector short. Replace.

**PROBLEM** Very poor sensitivity and obvious change in sensitivity when going from Transceive to Split frequency operation.

**CAUSE** Defective CR2 on audio board (1N270).

**SOLUTION** Replace CR2. To check this problem: Measure R/T voltage. If CR2 is defective this R/T voltage in receive will read +15 volts rather than the normal +.4 volts.

**PROBLEM** Lock up in receive mode.

**CAUSE** Defective CR5 on RF Driver Board.

**SOLUTION** Replace CR5.

**PROBLEM** Continuous sidetone generation.

**CAUSE** Shorted transistor on RF driver board, A5.

**SOLUTION** Check transistor Q7 on RF Driver Board, A5. Replace.

**PROBLEM** Instability in the 43.1 MHz oscillator.

**CAUSE** Defective components on BFO board, A4.

**SOLUTION** Replace zener diodes CR8, CR11 with 1N4738A. (These diodes are probably shorted.) Replace R47 which was probably overheated and suspect.

**PROBLEM** Sidetone too loud with sidetone pot full CCW.

**CAUSE** Sidetone potentiometer resistance too high when at minimum.

**SOLUTION** Replacement of the pot is not necessary. Install a 10K resistor in series with the center arm of the pot.

**PROBLEM** PTO-A quits oscillation at high end of its range. The frequency at which oscillation stops becomes progressively lower until the PTO stops oscillating altogether.

**CAUSE** Defective Q1 in PTO.

**SOLUTION** Replace Q1.

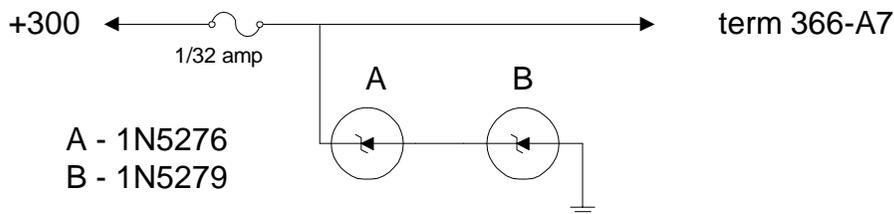
## MODIFICATIONS

### 1. Protection for Q1, input FET for receiver section:

Install back to back silicon diodes across the antenna input and ground. W3HRO suggests a pair of HE-9010's by Linear Systems, California.

### 2. Protection for counter board against inadvertent high voltage:

Install the following circuit between the 300 volt supply and the 300 volt terminal on the counter board, A7 (terminal 366):



If the +300 volts rises to a high value, the zeners will conduct and force the fuse to blow. (For example if the final develops a plate to screen short, +1500 volts will be placed on the +300 line which will wipe out nearly every semiconductor and tube on A7! If you don't believe it, ask W7IV)

### 3. Protection of the final tube, 8072:

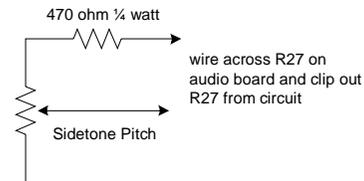
Fuse the plate at 0.5 amp and fuse the screen at .05 amp.

### 4. To cure parasitic oscillations:

Place a single ferrite bead at the 8072 socket on the grid and screen terminals.

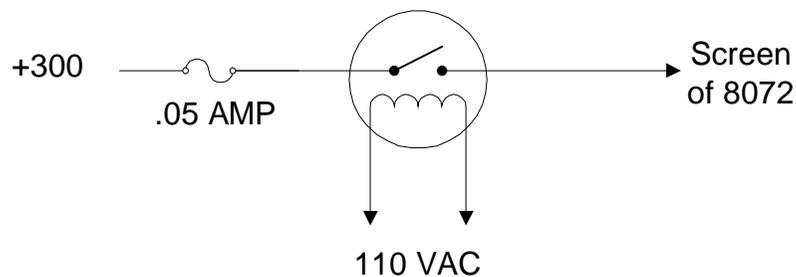
5. To provide variable CW sidetone:

Add the following fixed resistor and potentiometer. The new pot can be installed as a dual concentric unit with the present CW control.



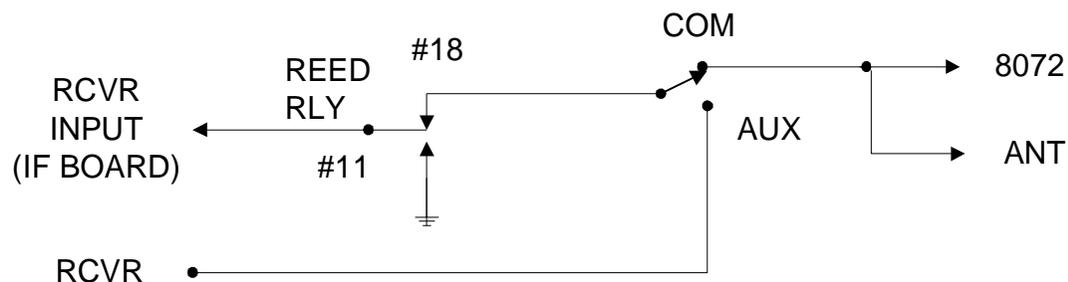
6. For better protection for the final tube:

Rewire the amperite time delay tube (K1) as follows:



The bias line that is normally controlled by K1 must be shorted (Short A5-259 to A10-5). According to Amperite, there is no problem controlling 300 VDC since heater to ground spec is 800 VDC.

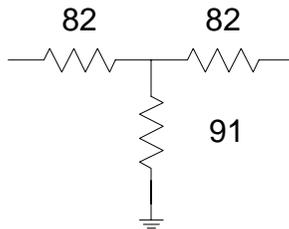
7. For better protection for receiver front-end when using the AUX RCVR jack: Rewire as follows:



8. To increase frequency response on units that exhibit a narrow response in transmit and receive making tuning difficult:

This is caused when the two 8 pole filters are not flat. solution is to remove one of them and replace with a simple pad.

Remove FL1 and insert the following pad made up of ½ watt resistors: (FL1 can be inserted into the CW3 position if desired)



9. To cure distortion on transmit (caused by the noise blanker failing to cut completely off on XMT):

Install a 6800 ohm ½ watt resistor from pin 3 of IC1 (on IF board) to ground. (Pin 3 of IC1 is available from the top of the board from the proper end of R42)

10. To prevent possible burn out of power transformer or High Voltage diodes:

Install a heavy duty globar-type resistor in series with the AC line. WB4RSK suggests a Workman model FRT2 located at the ON/OFF switch. Remember that these globars get quite hot, so space them away from everything to allow good air circulation around them.

11. To move the band from 3.0-4.0 MHz to 3.5-4.5 MHz:

change crystal Y7 to 43.5 MHz. Remember that if you make

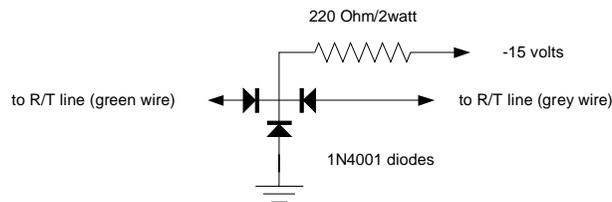
this change, the counter will still NOT display the proper frequency in the 100 Khz digits. Simply add 5 to the counter display.

**12.** To move the 160 Mtr band from 1.8 to 2.8 MHz:

change crystal Y8 to 41.8 MHz. Remember that if you make this change, the counter will still NOT display the proper frequency in the 100 Khz digits. Simply add 8 to the counter display.

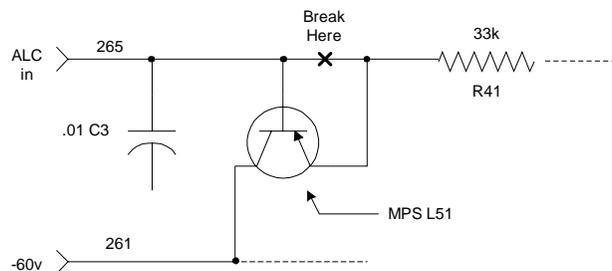
**13.** To cure frequency shift when switching from one transmit VFO to another:

Add the following network:



**14.** To allow the use of ALC with Alpha 77 linear amplifiers:

Add a single MP5L51 transistor to the RF driver board, A5 as follows:



The desired output may now be set with the ALC potentiometer on the A77.

**15.** To improve receive audio quality and eliminate AGC pumping action:

Make the following changes on the AGC detector board, A9.

1. Change R43 from 10K to 1K, 1.4 watt, 5%.
2. Change C30 from 1uf to 10uf, 35 volts.
3. Add an 8.2K, 1/4 watt, 5% resistor in series with the collector of Q13.
4. Change C12 from 10uf to 47 or 50uf, 35 volts.
5. Change Q4 from 2N5183 to Motorola MPSA13.

Notes:

C40 determines AGC hang time.

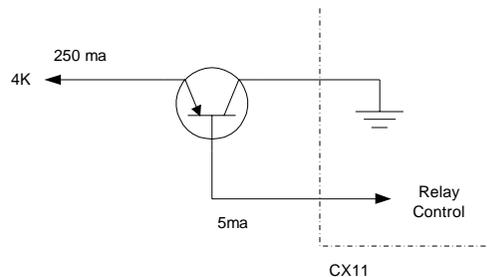
C12 determines slope of the SLOW AGC discharge ramp.

**16.** To provide protection for the driver board in the event of final tube plate-to-grid short:

Replace C30 on the driver board, A5, with a 3,000 volt disc in place of the presently installed 1,000 volt type. Use the same value.

**17.** To allow CX11 and Henry Ultra 4K Linear operation:

Add the following circuit between the two units:



**18. Replacement of the 8072 with a 4CX350:**

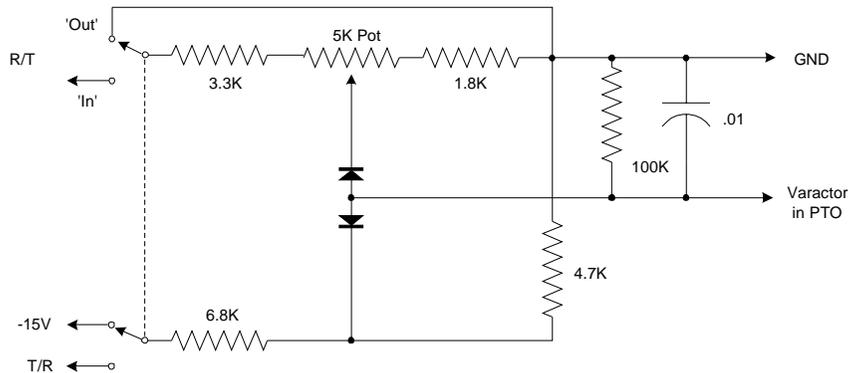
The socket and fin configuration is different for the 4CX350. Remove the rear heat sink and install the 4CX350 horizontally with the socket through the rear chassis. Mount a small blower to suck air through the plate fins and socket.

**19. Reducing the range of offset oscillator adjustment:**

Add a 2700 ohm resistor across the offset oscillator potentiometer, R8.

**20. Addition of Receiver Incremental Tuning:**

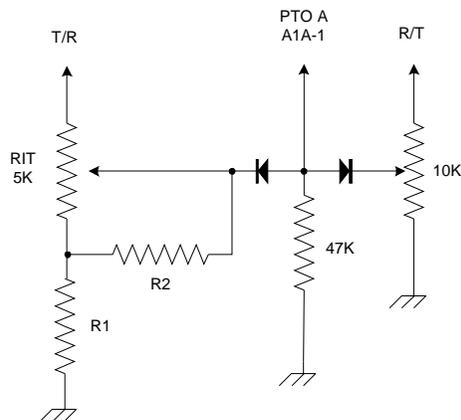
See circuit below. Connect terminal 1 of VFO A, the FSK varactor, to a pin on J5, the accessories connector on the rear panel. Disconnect one of the connections that would never be used (such as front-end AGC) to free a pin. All other necessary connections are already on J5. The RIT potentiometer and components can be assembled in a small minibox and placed near the CX7.



**21. Addition of Receiver Incremental Tuning utilizing FSK control:**

See schematic below. This circuit utilizes the existing FSK

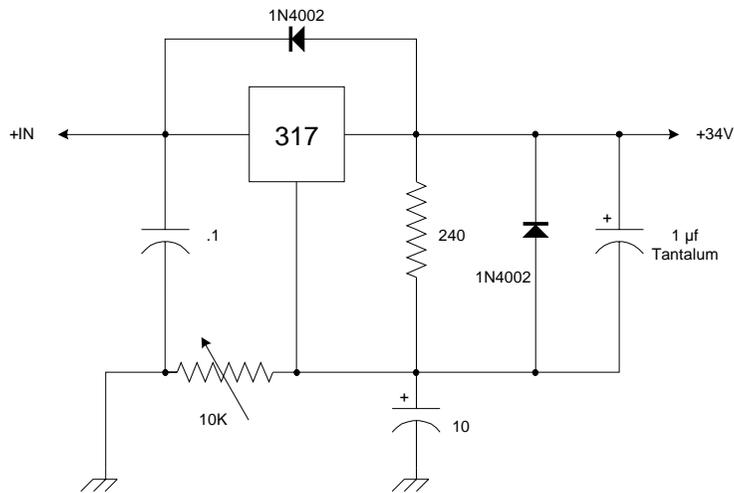
potentiometer. No switch is used since the total range is +/- 1KHz and is resettable to zero (The I in RIT on the panel) to within 10 Hz. All components are mounted on a small terminal strip soldered and epoxyed to the rear of the FSK potentiometer. R1 is selected for the range desired and is selected at the low end of the PTO range. Range of the RIT pot is slightly more at higher frequencies. R2 is selected to obtain centering of range at center of the RIT control rotation. Typically R1 = 4700 and R2 = 1000 for a range of +/- 1KHz. The XMIT SET potentiometer is a miniature trimmer. Diodes are 1N456.



**22.** To regulate the +34 volt power supply:

When going to the new MC series regulators for +15 and +5 volt supplies:

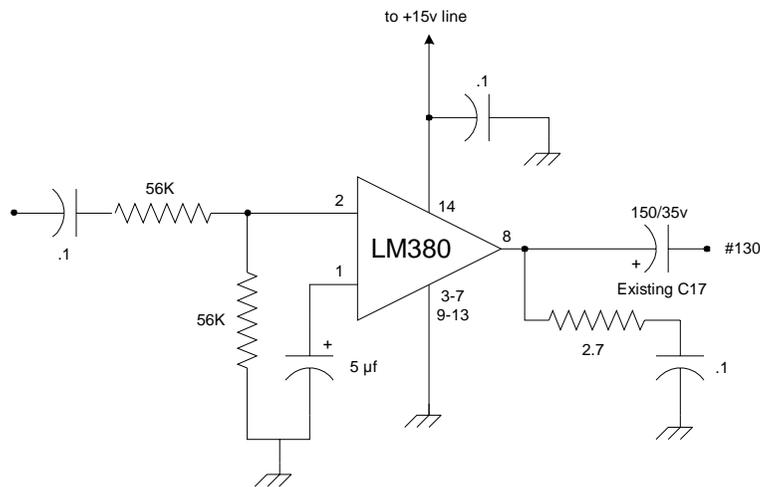
Use a National LM317K in the following configuration. Adjust the 10K pot for +34 volts. Mount the LM317K just to the left of the fuse on the rear panel and be sure to insulate it from the chassis. A heatsink is recommended - 3x5 inches will do nicely.



**23. Modified audio output circuit using fewer components than original**

The following modification will provide more and cleaner audio output:

The PA237 on the Power Supply Board is replaced by the following circuit:



Notes:

Use a small vector board for new IC and parts. Note that C17 (existing) may be used but with REVERSED polarity! The output transformer is no longer used - wire pin #130 directly to speaker jack. The 24 volt regulator is no longer used and may be disconnected at the power supply board

## MISCELLANEOUS INFORMATION

1. The driver transistors, Q3, Q4, located on the driver board, A5 are generally type SFR-53104. W7IV suggests the use of type 2N5641 which are easier to come by and by his report work very well.
2. It is recommended that a small muffin-type fan be placed on top of the unit near the rear and sucking out to help cool the final cage and power transformer.
3. It is suggested that BERYLLIUM COMPOUND be used rather than SILICONE GREASE when replacing the 8072.
4. Resistor R14 located on the RF driver board A5 is a bit underrated and if work is being done in this area it is suggested that it be replaced with a 2 watt unit (originally  $\frac{1}{2}$  watt). R14 is 470 ohms.
5. For those of you that have older CX7 units, you can illuminate the "S" meter by using a 6 volt lamp, model PTL-20D/6, Mura Corporation. 5 volts for the lamp is available at the back of the counter assembly, pin 7 (wire # 157)
6. Some transistors used in the CX7 are hard to acquire in small quantities. Some possible substitutes are as follows:

PRESENTLY USED	SUBSTITUTE
40603	40822
40604	40823
40468A	3N128
TIP29A	S5003 *
TIP30	S3027 *
J183	3904

\* These are Motorola numbers.

7. It is recommended that every time you have occasion to replace a transistor or integrated circuit, you add a socket prior to the repair. This will make future troubleshooting much easier.

## SIGNAL-ONE OWNERS

(circa 1977)

W0YVA/4 Bob Sullivan, POB 6226, Shirlington Station,  
Arlington, Virginia, 22206

W2CFP Dave Flinn,  
W0UCI Roy Fisher,  
K4BYM Butch Schartau, Route 4, Box 1737, Huntsville,  
AL, 35803

W8SWN Jan Jellema, 1348 W. Grand River, Howell,  
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K4JC Bob Fitz, Route 1, Springfield, Tenn., 37172

W3RHO Lee Whitmire, Jr., POB 578, Beaver Falls, PA  
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W7IV Harry Hyder, 9842 N. 57 St., Scottsdale, AZ 85253

W0NVE H. C. Snyder, POB 669, Fremont, NE 68025

WSPIH F. D. Mills, 2000 Lowel Huntington Rd, Ft. Wayne,  
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K4YYL Art Balz, Route 4, Greer, SC, 29651

K4CIW Bill Hopper, 513 Prospect St., Eden, NC, 27288

K9HMQ Miles Cundy, 4828 W. Fond Du Lac Ave., Milwaukee,  
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K9ECM James Davis, Box 522, Monroe, MS, 53566

YV4AGP Marcos Avellan, POB 18, Maracay, Venezuela, S.A.

W3HII Harold Wood, 2002 Rookwood Rd., Silver Spring,  
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W20QO Joe Calvanico, 2951 Pearsall Ave., Bronx, NY,  
10469

W1NXY Joe Santangelo, 194 Barbara Rd., Waltham, MA,  
02154

K0HHP Dick Cunningham, Omaha, NE

W0U?W Roy McCabe, Fremont; NE

WA0HBS Bob Carlson, Fremont, NE

W0QHO Roy Smith, Omaha, NE

W5RSZ Mark Mandelkern, 2020 Guthrie Pl., Las Cruces,

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R. Turner, 41 W. James St., Falconer, NY, 14733

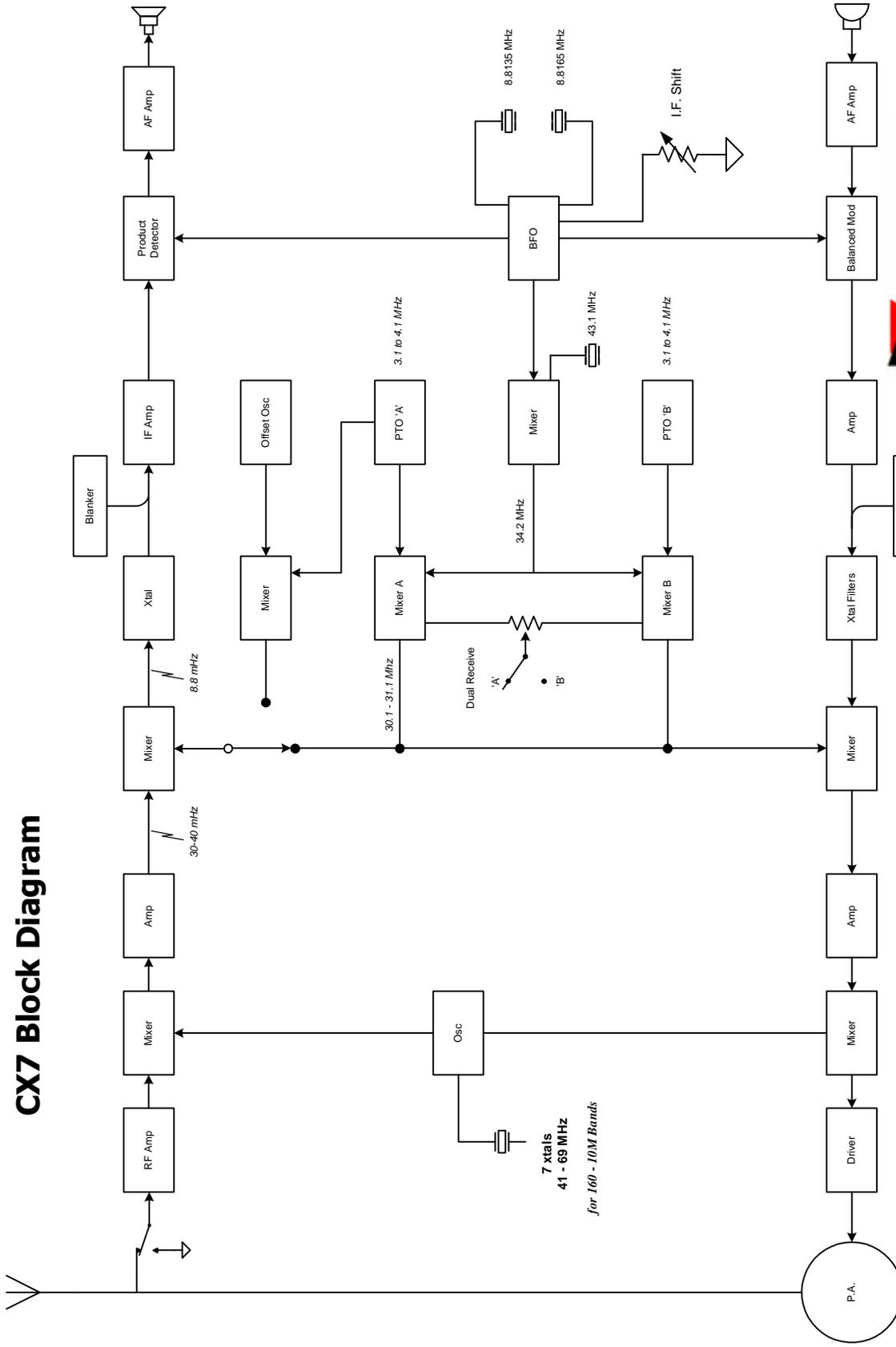
W. A. Culpepper, 8316 County Downs La., Matthews,  
NC, 28105

G. Roberts, Jr., Rt. 1, Box 99, Odessa, Florida,  
33556

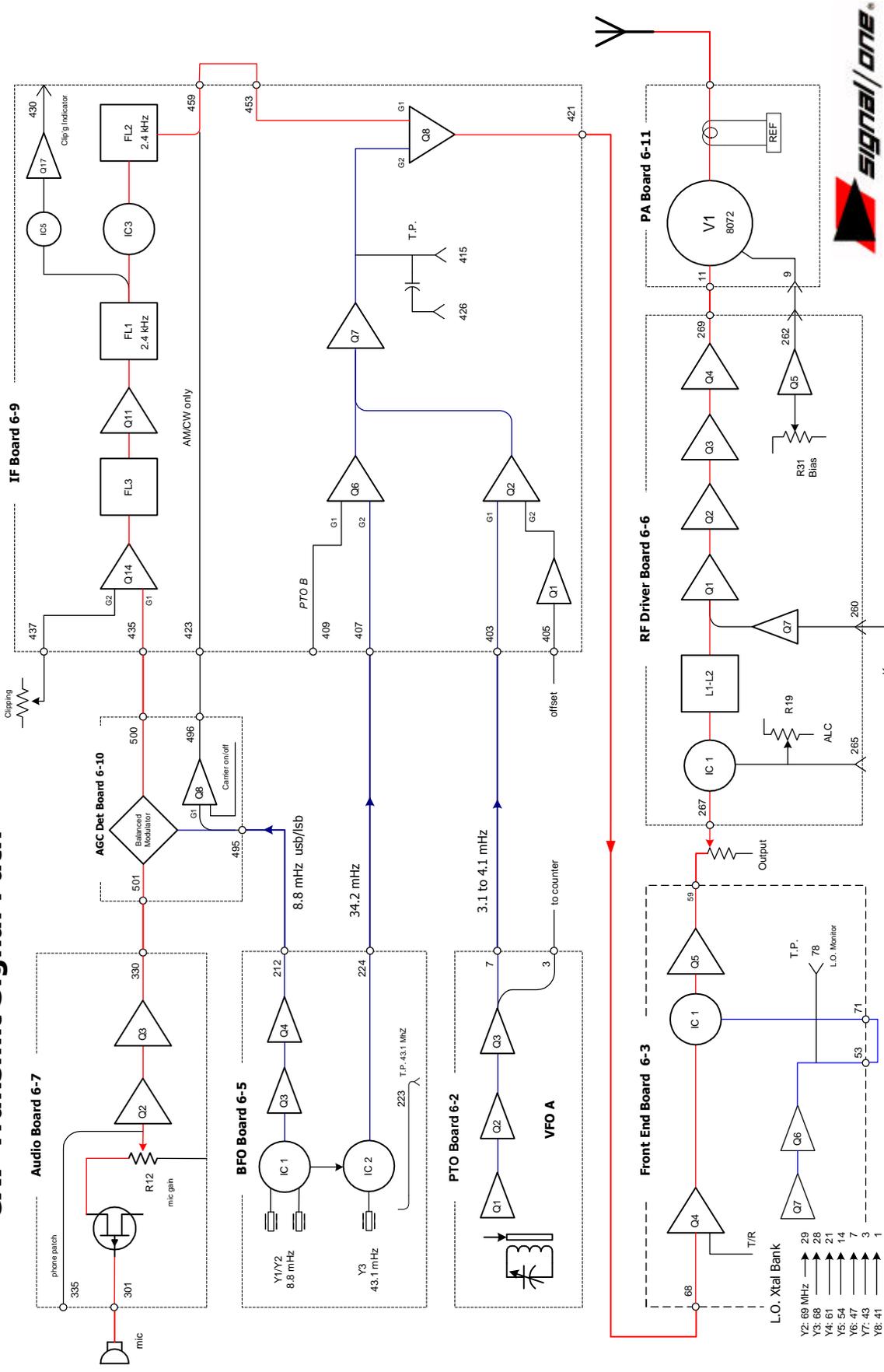
Ray Broughner, 2628 Highland Ave., Montgomery,  
Alabama, 36107

J. Marshall, 147 Middleville Rd., Northport, NY,  
11763

# CX7 Block Diagram

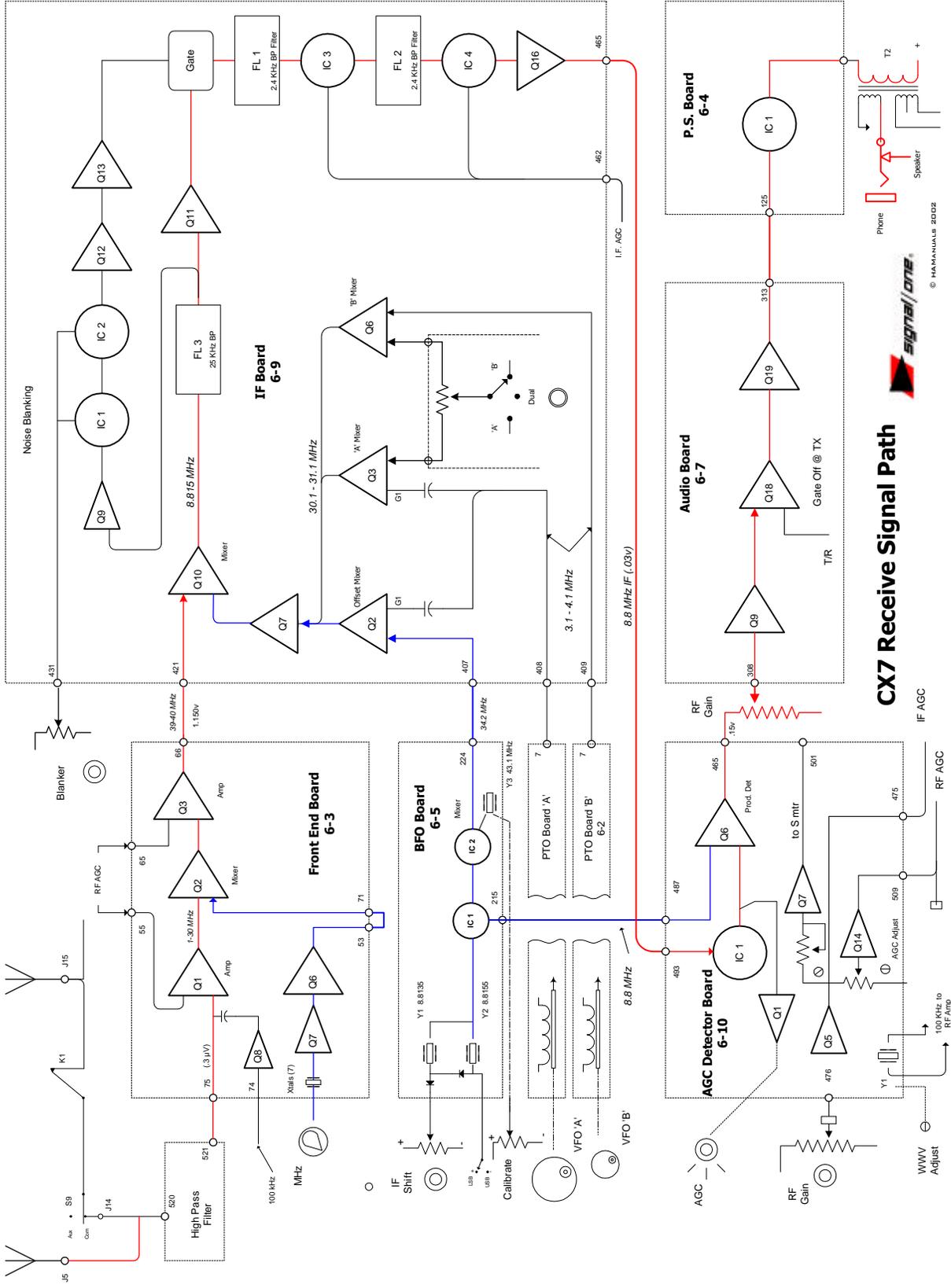


# CX7 Transmit Signal Path



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### CX7 Receive Signal Path



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