CX7 Modifications

Area	Ref#	Description	Notes
RF Driver Board	1	Changed transistors Q3 & Q4 to TRW #PT-3657 or Kirtron K-1013 to eliminate spurious outputs. (All CX-7 units) Motorola 2N5641 may be used.	See item 105.
	2	Change underrated R14 to 1 Watt size, 470 Ohms.	S/l News
	3	Add CR8, lN456 - CR9, lN456 - R20, 560 Ohm, ½ W - and green wire to T/R voltage to cool Q3 and cut receiver noise.	All units after #200 was standard
	4	Add 0.1 µf, 100v disc cap across C25 to stop low frequency oscillation. Locate under board across R12.	CX-7A
	5	Change C30 from lKV to 3 KV size .01 µf disc to protect against tube shorts.	S/l News. Probably not needed, CR-l in A-10 protects
	18	Change Cll from 5 pf to 2 pf mica or ceramic to stop spurious oscillations.	CX-7A
	129	Note that the resistor R8 is not on top of board in all early boards. It is located under the board at pin #271. Also choke coil L6, resis-tors R49 and R20 are under the board. On late model "A" boards, R8 (4.7K Ohms), R49 & L6 are on top of board. Noted that R8 was missing on some "A" boards, and must be installed.	California production error.

Area	Ref#	Description	Notes
	105	To replace Q3 & Q4 transisistors with Motorola 2N5641 type which are larger than the original transistors: The hole in the board must be enlarged with a file to a "D" shape to fit properly. The distance from the bottom of the circuit board to the outside of the metal plate that connects the two transistors must be *exactly* 3/16". The additional length of the 2N5641 must be compensated for by reducing the two spacing washers in thickness from 1/16" to about 1/32" (.031") to avoid bending the board or breaking the transistors. Change R30 to 820 - ½W & C21 to 0.l µf for stability.	
	74e	Most units have all changes, but check circuit around Q7 to see if parts are as shown on the drawing. (Change to -13.5V not good) Many units were corrected when returned to the factory for early trouble and all after #200 have the changes. T/R now will be +.5 v and -13.5 volts.	T/R voltage change on late models. This was not a good idea.
BFO Board	6	Change C12 from 82 to 47 pf ± 5%, 500 V dipped mica.	Standard on all units after #200
	7	Cut hole in top of cover for access to adjust R43 pot, Offset (A/TO) frequency. (W8CXS)	
	8	Grounded case of crystal Y4, 11.4278 MHz, with short wire to reduce dual transmit signal level using A/TO. Problem is the 43.1 MHz oscillator circuitry surrounds the 34.2 MHz offset circuit and couples in a weak signal also. (W8CXS)	
	9	Grounded case of Y3 crystal 43.1 MHz on #00121 only. No change was noted. (W8CXS)	
	33	Install R51 & R52, 1500 Ohms. (Standard on all units after #200, but missing on early production)	See note 74.

Area	Ref#	Description	Notes
	96	The difference between the 2 crystals 8.8 MHz, should be exactly (±50Hz) 3.000 KHz with good IF filters. The specs on page 5-16, Paragraph 5.3.2.d, steps 6 & 7 should be changed. Step 6 should be 8.8165 MHz ±0 Hz. Step 7 should be 8.8135 MHz ±25 or 50 Hz. This aids getting the carrier down on the filter sides better. Better sideband suppression and ease in setting the IF Offset control. In CX-ll, the frequencies are set exactly at 8.8165 & 8.8135 MHz with trimmer cap. On many radios, frequencies as low as 8.816350 & 8.813350 are best due to off center I.F. filters.	
	112	On early boards, R15 & R16 board markings are reversed. The book schematic drawing is correct and later boards are marked properly.	
	92	To check Zener diodes in cases of frequency jumping, measure the voltage from both sides of the Calibrate pot to ground. Should be about 9 or 10 volts + or - for a good one. (W8CXS)	
	74b	Add R51 & R52, 1500 Ohm, ¼ watt under board.	
	138	IF SHIFT control not centered in rotation. Resistor R-5 is factory selected to equalize the control range, although 1.5k ohms is shown in the drawing, other sizes are common. If, after adjusting the knob as described in the book, the knob cannot be set to "-2" on panel markings, R-5 must be changed. A *smaller* value resistor is needed. ¼ watt sizes are satisfactory, but is *less* than 1000 ohms, it may burn. ½ watt sizes are required 470 - 1000 ohms. Do not select the size of R-5 to go beyond "-2". Y-1 and Y-2 crystals may have to be changed if they have drifted frequency too much.	

Area	Ref#	Description	Notes
	140	Noted that R46 (1000 Ohms, TX frequency adjust) is always at the low end, 30 to 200 Ohms, and is critical to adjust. A resistor, 50 to 270 Ohms, may be added across the original control to ease adjustment. Select resistor by measuring R46, when set correctly, double that resistance value, and use closest higher value available. ½ watt size is adequate. A better replacement control would be 250 Ohms. R1 (750) runs 1.1 to 1.2 watts. R46 at typical settings runs .15 to .30 watts.	
S2 Board	10	Add lN456 diode underside of switch board. Cathode to pin #12 of switch S2B (A/TO) - Anode to pin #17 of switch S2E (Spot). To cutoff A/TO oscillator on receive to stop dual receive signals on A/TO operation.	S/l News
Counter Board	11	Add R24, 3.3 Meg resistor, ¼ W from terminal #367 (C47) to ground inside counter cage to reduce arcing of switch from Nixie decimal for offset.	Standard on all units after #200
	12	To speed up keyer dot start time, add .003 to .005 µf disc cap from base of Q5 to Pin #362 (Pin #6 of IC-15). Best average size is .0035 µf made from pair of smaller sizes and measured on cap tester. (W8CXS)	
	35	Installed WB4VVF keyer inside counter cage, but cut foil at IC-Ul, pin #2 to defeat the Dash memory feature.	

Area	Ref#	Description	Notes
	88	Hash from the counter getting into the front end board. Most noticeable when calibrating. A ground loop between the AGC and Counter boards exists on some units. Re-route coax wire #154 direct from AGC board pins (100 KHz) to the counter board pins #358 & #359 by removing the teflon feedthru at the counter cage rear and runing the cable through the hole. (W8CXS)	This is used on the CX-ll.
	76	On early Nixie counters, Resistors R22,23,24,25,38 were mounted tight to the board causing overheating and burning the board. Also when the Nixie tubes start to glow with a Blue tint, the resistors have lowered their resistance. The decimal light may glow also. Resistors should be mounted 3/8" above the board. (W8CXS)	Ok on #300? and above.
	111	Early radios may be missing 2 capacitors at outside rear terminals of the counter board cage causing counter noise and tones in the receiver. A 0.1 µf - 100V disk capacitor should be connected to a ground lug and to the -15 Volt terminal (Blue wire) and one capacitor to the +5 Volt terminal (Brown wire). Standard on all late radios. In addition, a 0.01 µf - 1 KV disk can be added to bypass the +300 Volt terminal (Violet wire) on Nixie counters to reduce the noise.	
LED Counter Board	115	Do not use a 74LS90 type I.C. in U-18. This type tends to divide by 3 instead of the required 10 times. The standard 7490 type I.C. works properly. Note that an error is on the original outline drawing showing U-18 and U-l9 were shown interchanged in position. Some boards are missing U-l9 which is only used for the special purpose of checking BFO frequencies.	

Area	Ref#	Description	Notes
	13	On early LED counter boards, the ground foil at all 4 corner mounting holes is not carried together. Wire jumpers to all 4 corners, top and bottom both. (K4FU)	
I.F. Board	14	Add capacitor C3 to allow separate adjustments of PTO A or A/TO injection. Erie 2-8 pf ceramic trimmer installed and existing parts rearranged.	Standard on all units after #200
	15	Change R55, 33K Ohms to a 150K Ohm resistor and R79, 150 Ohm to a 390 Ohm resistor to reduce cross modulation.	CX-7A
	16	Installed shielded cable between plug-in filters on mode switch to reduce leakage around the filters.	Standard on all units after #200
	17	Change C27 on mode switch from 20 µf to a 10 µf, 20-35 Volt tantulum cap to speed up the VOX attack time.	CX-7A & late prod. Low side of 10 µf better.
	95	The Deluxe CW filter has 6-10 dB additional loss. Add 2N3904 transistor amplifier on small circuit board soldered to the filter socket pins. Connect with small coax and power from the -15 Volt supply. Adjust the gain by selecting the size of the unbypassed emitter resistor.	
	97	Coax #25 running near ungrounded coax #180 in the noise blanker area (Pin #456) has some noise pickup which can be heard good at 1825 KHz. Re-route coax #25 away from this area.	
	98	Wiring error on many California radios, serial numbers ending in 420 to 440 series. Capacitor C115,located between filter FL-3 & CW filter bracket, was installed as a .01 µf ceramic disc instead of the required 120 pf silver mica.	

Area	Ref#	Description	Notes
	81	To increase PTO Spot audio level, cut foil at Q5, Gate #1. Add 15K Ohm resistor to ground and .00l µf capacitor to Pin #403 (PTO A input). Note that spot audio level is still slightly lower than the Offset spot audio level. (W8CXS)	
	82	Moved ground from center corner of board from common transformer ground point to separate ground screw to reduce hum. (S/l News)	
I.F. Board Test	128	Rotate SPOT LEVEL control full CW and listen for noise from shorted Spot Mixer Transistors Q4 or Q5.	
AGC Detector Board	19	Add R57, 5K Ohm pot for "S" meter adjustment and change series resistor R28 to 22 K Ohm for centering the range. 18K Ohm size was correct for one other. Rearrange parts & drill holes to fit.	Early prototype board only. Standard board was used on all units after #200
	20	Add 6800 Ohm, ¼ W resistor between collectors of Q12 and Ql3 to eliminate AGC "Pop" action.	CX-7A. Mount at transistor on top of board. The S/1 News specified the I.F. Board for this change. WRONG! On old model boards, just cutting the foil and tacking in the new resistor does the job nicely. However on late model boards, the foil connection to Q11/ Q12 goes to Q13 first. Two foil cuts and a jumper are required.

Area	Ref#	Description	Notes
	130	The book drawing shows C44 as 2 pf across the balanced modulator diodes to optimize the SSB carrier suppression. This value is almost never correct and many radios had no capacitor, which is located under the board. Capacitor values from 0.50 pf to 1.5 pf, selected by experimentation, will improve supression by typically 20 DB.	
	120	To greatly improve receiver audio quality and reduce distortion, change R20 from 22K Ohms to a selected value about 47K to 51K Ohms. Suggest installing pin jacks to allow ¼ watt resistors to be tried and select the value that produces the maximum audio level at the loudspeaker while listening to the 100khz Calibrate tone. Typical 3 DB increase in audio level will be noted. Check that R18 (2.2K Ohms) is very close to correct value, within 5%.	
	94	"S" meter readings are typical 2-3 dB/"S" point and no action at low signals. The dynamic range can be increased so S-l is about 1 uV by adding a resistor in series with the base of Q7 and reducing the resistance setting of pot R57 to maintain S-9 at 50 µV. The value of R28 may be reduced to center the adjustment of pot R57. Select value of resistor at Q7 base to give 5 dB/"S" point near S-9 and give the correct 10 dB steps up to at least 40 over S-9. About 82K to 330K Ohms at the base. Note that too high of a value will prevent the meter from returning to zero with no signal input. Typical R28 is 15K Ohm.	
	99	Coil L3 was found to be 3.3 µh size (Orange-silver-orange) in many California radios instead of the required 2.2 µh size (Red-silver-red). The lower carrier insertion level was partially corrected by removal of C-19, (.01 µf disc). When coil is changed, re-install C-19.	

Area	Ref#	Description	Notes
	90	R23, 390 Ohms, ¼ watt is running hot in the "S" meter circuit. Replace with ½ watt size to reduce drift. (W8CXS)	Not a problem in most radios.
Front End Board	74d	Change resistor R19 from 10K Ohm to 8200 Ohm, ¼ W.	
	21	Install sockets for Ql & Q2 to allow selection for best cross-mod. Install two Vector pin sockets at R8 location (Fits ¼ W resistor) to allow selection of R8 for lowest cross-mod, a 100K or 120K seems best. (W8CXS)	
	22	Washered up the rear switch bracket to better align the shaft coupling. (W8CXS)	
	37	Remove R46, 1000 Ohms to increase 10 meter receiver gain. (CX-7A)	See item 108 also for a problem caused by this change.
	83	Add 220 Ohm to lK Ohm at pins 58 & 66 to stop motorboating. (1 and 3 MHz bands when receiving strong signals)	S/l News
	84	Change xtal Y7 to 43.500 Mhz to reduce spurious outputs, band now tunes 3.5 to 4.5 Mhz. Add xtal at socket "A", 41.800 Mhz to reduce spurious outputs & increase receiver sensitivity on 160 meters. (Tunes 1.8-2.8 Mhz)	S/l News.
	86	Moved the ground strap (corner of board) from the power transformer mounting bolt to a separate point to reduce high AC hum voltage getting on the board. Hole drilling is required. (W8CXS)	
	100	Wiring error on many California radios, serial numbers ending in 420 to 440 series. Capacitor C4 installed as a 10 pf mica instead of the required 1000 pf mica. Correct code marking is CM05CD - 102D03. Located under a band switch wafer. Improper size causes poor 40 meter receiver front end preselector peaking.	

Area	Ref#	Description	Notes
	108	Removal of R46 increases 21 MHz band receiver gain excessively to the point of oscillation in some cases. Cut strap between 21 & 28/29 MHz contacts of switch wafer S7G and connect a 3.3 µh choke with selected size parallel resistor (lK to 1.5K typical) to 21 MHz lug & other end of combination to one hole of board where old R46 was located.	See items 37 & 93.
	93	Receiver gain on 14 Mhz is not as high as the lower bands due to the RF choke in the output of the RF amplifier transistor not being the optimum size to cover all bands. Separating the switch, S7G, contacts # 6 & 7 from the others and adding a separate RF choke from the contacts to one hole in the board where resistor R46 was removed will allow the gain to be equalized. A 10 microhenry ferrite choke, shunted with a resistor, which is selected for the gain that is required, about 1500 Ohms, works nicely. A longer wire is needed to connect the remaining contacts, #1 to #5, to the board. (W8CXS)	
	133	If "hand capacity" frequency changes are noted when touching the knob on the 3 MHz band, move wire on 2nd wafer from the front away from the metal spacer/screw, to the edge of the wafer switch.	
	134	To protect transistor Q1, RF amplifier, from burnouts due to lightning or poor switch timing, add 4 diode network (two 5.1 volt Zeners and two 1N4148 switching diodes) from common connection of switch wafer 7E to ground. One Zener and one switching diode in series with back to back polarity, second string uses the opposite polarity.	
	137	If a 41.8 MHz or 42 MHz crystal fails to oscillate, check size of C-70. Only 2 pf lower than 56 pf will fail. Select a mica on high side of 56 pf or up to 62 pf maximum.	

Area	Ref#	Description	Notes
PTO Modules	23	Replaced CRl, lN270 diode with Hewlett-Packard #HPA-5082-2800 diode.	Standard on all units after #200. Reduces drift.
	24	Reduced output levels to reduce spurious & noise to 160 Mv min to IF board. R7 to 150 - 330 Ohms. Output to counter is not critical.	See also #119.
	25	Add 47 Ohm resistor in series with the +15v line to reduce zener drain and decoupling. (CX-7B) Locate direct at outside terminal.	
	26	Installed 100 Ohm, ¼ w resistor in series with -15 volt lines. (CX-7B) For decoupling. Mount direct at outside terminal.	
	27	Installed a 1 µf , 35 or 50 volt tantulum and a pair of 0.1 µf discs at each + & - 15v. terminal to reduce the ±100 KHz spurious transmitter outputs.	S/l News. May use 0.1 µf monolythics at both locations or 1 µf monos.
	28	Add a ferite bead to each of the - and + 15 volt leads close to each PTO. Whitehouse #FB73-801 or Amidon. To reduce ±100 KHz trans-mitter spurious outputs. (W8CXS) The resis-tors of items 25 & 26 work just as good.	
	29	Cut off from PTO A terminal, wire #6 coax to rear plug and tape back to reduce PTO leak-age and loading. (W8CXS)	
	117	Hard turning PTOs may be due to an under-size hole in the rear plate for the rear plastic bearing. The hole may have not had the burrs removed. Proper hole should be a 15/64" drill.	
	119	Refer to note #24. Alternate output level adjustment that works better/easier is to add a resistor under board between the base of Q2 and the emitter of Q3 as inverse feedback. Values of 27K Ohms to 47K Ohms are typi-cal.	

Area	Ref#	Description	Notes
	103	To test for PTO oscillators which will not turn off, use 7 MHz band, tune "A" to 196.5 on digital display, tune "B" to 500.4 on display and select "A" receiver to hear the "B" oscillator running. Reverse to test "A".	
	79	Wiring error on many units. C-17 & C-18 were reversed.	
	80	Add 2 transistor isolation switches to reduce frequency change. Add "Break timing circuit" to hold RF output on longer. (CX-7B)(K6BE) Used modified circuit by W8CXS with 2 MPS-3702 transistors, 2 - 47K resistors, 1 - lN270 diode, 27 Ohm resistor, & 15 µf, 20 v tantulum cap.	See item 89.
	89	The "Break Timing" circuit alone (See item 80), with lN270 diode, 27 Ohm resistor, & 15mf - 20v capacitor, gives adequate isolation for frequency change due to slight voltage difference in most cases.	Used alone in CX-7B.
Audio Board	30	Replaced Q16 & Q17 with MPS-U05 transistors. (CX-7B T/R voltage change to 0 and -15 volts). Replaced R65 & R66 with jumper wires.	See items #40 & #71.
	31	An .01 µf disc capacitor was installed across R61 (Q9 to ground) on CX-7A modifications in Calif. It causes a 6 dB receive audio rolloff on receive to reduce the white noise level - Most sound better without this capacitor.	
	32	Changed C3 from 0.1 µf to a 10 µf , 20 volt tantulum with + toward gain control side. Improves low frequency transmit audio 1½ dB at 500 Hz.	Standard on CX-7A
	34	Phone patch filter not in. Installed L2, 100 µh and C43, 56 pf mica under board at pin #335 to C8.	Standard on #300 ? or above.

Area	Ref#	Description	Notes
	122	Add 1N270 diode, anode to pin #338, cathode to ground, to protect Q4 transistor gate from shorting. This fault causes continuous sidetone on CW.	
	104	Transmitter audio gain checks: With 1000 Hz tone at 10 milli-volt input to "patch" jack (using 600 Ohm termination at generator) should get about 34 mV at pin #501 on AGC board high impedance meter. With 10 mV input to "Mike" jack (Using 600 Ohm termination at generator) and mike gain control set at maximum, should get about 36 mV at "Patch" jack with high impedance meter.	
	74c	Add R65 & R66, 12 Ohms, ½ Watt. Some wiring changes needed to agree with instruction book drawing.	*NOT* recommended, see notes 30 & 40
Audio Receive Circuit	70	Changed audio gain control circuit to be located between the audio board amplifiers and the power supply I.C. audio amplifier. • Add 20 µf , 25 volt tantulum capacitor (pair of 10 µf) to audio board with + to drain of Q19 and the - to Pin #313. • Add 1800 Ohm, ¼ W resistor from pin #485 (or #489 on some) on AGC board to ground. Add new shielded wire from pin # 485 (or #489) on AGC board to Pin # 308/309 on audio board. • Remove shielded wires from audio board pins # 308/309, wire #136 and pins # 313/314, wire #55 and connect wires together. • Remove wire #186 from pin #485 (or #489) of AGC board (cut loose and add a connector terminal on early units). • Pull wire # 186 back and connect to pins #313/314 of audio board. • Cut ground on AF gain control (shields to ground lug). Must run new ground wire to RF gain control. Note: On late models, pins #485 and #489 are separate.	*This modification still needs work* due to high/low levels on the SPOT tone. It allows the AF gain to control the sidetone level. Distortion may be higher and maximum audio output is low. (CTlVX)

Area	Ref#	Description	Notes
Keyer	36	Switching mode switch caused keyer to operate, so installed shielded pair wire from rear of counter cage to the keyer jack to stop induced voltage. Grounded shield at jack end only and used pair of .005 µf disc caps at jack. Must modify output circuit to prevent short dots. Change Q3 to MPS-3702 and Q4 to 2N5184 transistors. Also wiring changes. (W8CXS)	Only if WB4VVF keyer is installed.
Power supply Board	38	Add 7 Zener diodes to power supplies for +15, -15, +5, +34, for spike protection.	CX-7A. See items 65 and 74.
	39	Modify for IC voltage regulators for +15, -15 & +5 volt supplies. (K0HHP)	S/l News.
	40	Add diode network to change T/R & R/T voltages to a true 0 and -15 volts. (Signal/One, New Jersey) (CX-7B). One 220 Ohm, 2 Watt resistor and 3 or 4 lN4001- lN4007 diodes needed. Typicaly:l lN4007 at Green wires, lN4004 or medium drop lN4001 at common, parallel two lN4001 at Gray wires. (W8CXS)	See items 30 & 71. Reduces PTO frequency shift using split operation.
	41	Install 1 µf , 35 volt tantulum cap at each IC regulator to prevent oscillation. Locate about l" from the IC, spliced into the wire going to the Input side. 1 mfd. 50 v monolithic ceramic may be used. (W8CXS)	
	42	Remove foil from R14 to pin #152 (+300 volt lead) and replace with Teflon covered wire to prevent arcing. (S/l News)	

Area	Ref#	Description	Notes
	118	A short in +300 V will burn R6 (100 - ½W) and sometimes damage other adjacent parts. Install new resistor (flameproof type only - 100 Ohms, 5 watt) at chassis mounted capacitors C-3 (Can side which is insulated) to C-2 (Can side which is grounded). Cut old R6 leads off to avoid losing the thru board ground connection. Add new 100 Ohm, ¼ watt Flameproof type only in +300 volt line at C3. Wire #80 to C3, wires #158 & 191 to resistor.	
	43	Add G.E. #V130LAlOA varistor to 120 VAC input, Pins # 164 to #165 to absorb transient spikes. (CX-7B) Two required if 240 volt operation is planned. One across each primary winding.	
	44	Installed W0YVA/4, N4RS Audio Board and a MC7818CP or 7815 regulator, plus a 150 µf , 35 volt cap on IC reg output, plus 1 µf, 35 volt tantulum on input side of IC reg to keep audio out of + supply.	Use of LM-380 amplifier board or CX-7B power supply board requires reverse polarity on C18 (1µf 50v) capacitor on audio board, A6. (K6BE/5)
	52	Early boards did not have CR20, 3.9 Volt Zener diode. Installed. (Standard in all units after #200) (W8CXS)	See item 74.
	62	Add 1 Ohm, 3 Watt resistor at output of CR12 & CR14. Also at output of CR13 & CR15 (0.5 Ohms w/L.E.D. counters).	Used in CX-7B boards.
	65	The Zener diode supplied on CX-7A change was a lN4734, 5.1 volt across the +5 volt supply. This diode conducts heavily at all times and degrades the regulation of standard boards. It adds to the load on I.C. regulated supplies. Replace with lN4735A, 6.2 volt Zener to stop current drain, but retain surge protection. (W8CXS)	

Area	Ref#	Description	Notes
	68	On some early CX7B and some modified standard boards used with I.C. regulators, CR13 & CR15 were not changed to 3 amp diodes. ONLY CR12 & CR14 can remain 1 amp size or changed as desired. (S/l News) (W8CXS)	Early Johnson CX7B boards.
	73	Cll (150 µf) audio output coupling cap is reversed polarized on all boards. Metering resistors on some boards were not precision types or wrong sizes, R2, R3, R6. 18 volt regulator input connection must be moved to the +23.5 volt side of the 7.5 or 10 Ohm dropping resistor or it will not regulate due to low voltage.	Early Johnson CX7B boards.
	74a	Add CR20, 3.9 volt, 1 Watt Zener diode under board near Q9.	
Power Supply Circuit	75	Zener diode locations in CX-7A	Also see items #38 and #65.
1N4754A, 39.0 volt	75a	Anode to hot side (-) of C6 & cathode (banded side) to ground. Add 0.1 µf, 100 v disc across it if not already in.	
1N4754A, 39.0 volt	75b	Cathode band to hot (+) side of C9 & anode to ground. Add 0.1 µf disc across it if not already in.	
1N4735A, 6.2 volt	75c	On the board, Cathode band to R32. (This is the emitter of Q3 junction to R32 at pin #136) and anode to foil ground. (+5 v supply)	
1N4754A, 39.0 volt	75d	On board, cathode band to foil at Qll transistor & anode to ground foil. (Collector of Qll is connected to small foil area)	
1N4746A, 18 volt	75e	On board, cathode band to terminal #168 (One side of R8) and Anode to foil ground. (+ 15 volt supply).	
1N4746A, 18 volt	75f	On board, Anode to left side of R31 (This is -15 volt supply pins 147,118,119,etc) and Cathode band to ground foil.	

Area	Ref#	Description	Notes
1N4757A, 51.0 volt	75g	Cathode to hot side (+) of C2 and Anode to ground. Add 0.1 µf disc across it if not already in.	
Power Supply Circuit	101	To prevent shorts on -25 / -27 Volt supply on early model radios using Aerovox capacitors which are uninsulated, cover chassis mounted capacitor (1500 µf - 50 Volts) with fiber or plastic sleeve, 1-3/8" diameter x 2-1/8" long. Capacitor is marked C3 on uncorrected figure 4-1). Later radios used Mallory capacitors with plastic covers. (Capacitor is C-2).	
	102	To prevent shorts at the hot mounting screws for two of the rear panel mounted voltage regulators, change the insulating plastic shoulder washer to a position at the regulator, inside the chassis, and the 4-40 nut & lockwasher on the outside of the chassis. If the regulator has too small of a hole, enlarge with a #25 drill (Remove burrs carefully). Mount the other two grounded regulators with 6-32 hardware for better cooling.	This insulator method is used in the CX-llA.
	121	Remove high voltage wire from rear chassis RED test jack for safety and to reduce noise.	
	135	On California CX7A radios, chassis capacitor C-2 is mounted with pop rivets. Many are not making a good ground connection. A wire from a capacitor lug to a new screw/drilled hole/ground solder lug, may be needed.	
Power Circuit	45	Insulated chassis electrolytic cans C2 & C9 and ran grounds to same point as the power transformer center-taps go. Moved ground braid of the power board corner to the same point. To reduce hum if used on 240 volt operation due to transformer winding unbalance. Also better on 120 volt. (W8CXS).	Also connect ground of C6 to this point.

Area	Ref#	Description	Notes
	46	Installed fuse holder on chassis rear (1/16 Amp fuse) in the lead to PA screen, +300 volt lead. Add 100K Ohm, 2 watt to ground on units with Nixie counter or a 15K Ohm, 10 Watt resistor for units with LED counters to prevent tube plate current runaway if fuse blows due to internal tube screen voltage generation. (Eimac) The larger resistor also regulates the +300 volt supply if Nixie counter is not used. To reduce plate current overshoot. (W8CXS) (S/l News) Replace R4 on power board with a size to re-zero the screen current meter reading. About 36K to 39K Ohms for Nixie and LED counters. Experiment for best size. (W8CXS)	See item 85.
	47	Power transformers went bad on all first 100 units.	Mfg error.
	107	Typical power supply hum levels with R.F. Gain full CCW and Audio Gain full CW: +15V 2.2 to 4.5 mV -15V 1.65 to 2.45 mV + 18 V 1.1 to 2.35 mV + 34 V 2.5 to 4.5 mV CR13/CR15 diodes, banded ends (+) 1.2 to 1.35 Volts CR12/CR14 diodes, unbanded ends (-) .77 to .8 Volts Input to +18V regulator .5 to .8 Volts Audio Input 4 to 10 mV with hiss Audio Output 20 to 51 mV with hum & hiss -60 V 21 mV D.C. Voltage Audio Input coax at power board 8.74 to 9.6 Volts D.C. A.C. High Volts 572 to 595 VAC depending on line supply,	

Area	Ref#	Description	Notes
	85	Install switch in the 13.8 volt AC lead to the PA tube filament. Use double pole switch for reliability. Locate on rear of chassis. If a screen fuse holder is in place, it may be relocated inside to free the hole for the switch mounting. (W8CXS)	S/l News.
	87	Some power transformers have a higher radiated AC field and can induce hum into nearby wiring. Insure that wiring is dressed away from the transformer. Some transformers have a small voltage on the frames that will go through the ground straps going to the front end and IF boards. Straps should be relocated and the transformer mounting bolt hardware changed from a flat washer to a toothed lockwasher close to the chassis. (W8CXS)	
	114	The AC power switches are underrated and overheat. To increase the usefull life, remove the 3 small wires from one section of the DPDT switch, (These are not used for anything), and install wire jumpers to the parallel switch contacts.	Due to multiple make-break action of "slide" type switches, recommend leaving switch "on" at all times and using external A.C. switch.
Power Amplifier	126	Check that the screw and washer at the top of the plate RF choke are stainless steel. Check with a magnet. Brass screws are good also.	
	48	Early production units, the tube sockets were not wired as in book photograph, figure 4-26. Rewired and used Teflon tubing as in the photo. (W8CXS) .	Ok after #200
	49	On all units up to about #300, the hole in the rear of the chassis which passes the heat sink to tube clamp block was too small to permit full contact of the heat transfer block. Enlarged hole to l" high which is minimum for clearance. (W8CXS).	Ok on later units.
	50	On early units up to #200, the choke coils Ll & L2 were high resistance 100 µh size. Changed to 22 µh low resistance coils.	Standard in later units.

Area	Ref#	Description	Notes
	51	Installed 100 Ohm, 2 watt resistor at relay contact #13 to choke L2 in lower PA cage to reduce relay arcing when using Alpha type linear amplifiers. (W4ETO)	S/l News.
	139	If MANUAL LOADING control binds or is difficult to turn, inspect and measure the lengths of the two pins in the brass shaft. The pins should be free of sharp burrs and not extend *more* than 9/64" from the brass shaft. Trim to exactly 9/64".	
AF/RF Pot	53	Replaced Audio/RF gain pot with 2K - 20K Ohm size to agree with drawings and allow the receive audio to be turned down to zero. Pot was 2K-2K. (W8CXS)	See item 132.
Wiring Errors	54	High Serial Numbers: Wire #104 connected to switch connector plug P3-1. Should have been on P3-6 terminal. Error causes excess 2 tone transmitter output on A/TO. (W8CXS) This is a Blue wire. Florida made radios with serial numbers in the series of 00793 - 00895 had this problem.	
	55	Early serial numbers: 10K Ohm resistor R23 at TUNE switch was on terminal #11 with wire #156. Moved resistor to terminal #10 as shown on circuit drawing, figure 3-10. (W8CXS)	
	69	Info in S/l News called for the screen current to be run through the thermal time delay relay. This can cause tube plate current runaway by opening the screen to cathode path. Recommend that standard circuit with relay in the bias lead be retained. (W8CXS)	Eimac tube spec.

Area	Ref#	Description	Notes
Cabinet	63	Install 12 press-in chassis nuts on all bottom chassis holes, 4-40 size. A #19 drill hole is required. Available from W0YVA/4 - N4RS.	
	64	Install finned aluminum heat sink (4 ½" high x 4 3/8" wide with notch for key jack) on rear panel to cool the four regulators. (W8CXS)	
Service Items	66	Dow Corning #340 silicon grease is used for thermal conduction. After several years of heavy use, it drys out to a powder. Recommend that the tube clamp block be disassembled and greased every 2 years. I.C. and transistor regulators should be inspected and greased as required. (W8CXS)	
	67	Apply "Lacquer Stick" to worn push button lettering.	
Drawing Error	77	On Figure 6-10, AGC board, lower right: Pin #483, -15v does not exist on the board. R54 & R55 are connected to Pin #491, T/R. No wire exists to the left of R54,R55 going toward the C21/R27 junction. (W8CXS)	
	72	On photograph, Figure 4-1: Capacitors are marked wrong: C2 should be marked C9 --- C9 should be marked C2. C3 should be marked C6 --- C6 should be marked C3. C5 should be C7 --- C7 should be C5.	

Area	Ref#	Description	Notes
Other Problems	56	Signals leak into front end board. Tried shielded leads for speaker lead to front Phone jack, No improvement. --- Reroute speaker lead from directly crossing the front end board, small help. --- Add Ferite beads to speaker leads at rear jack, no help, but might reduce RF feedback. (W8CXS)	
	57	RF getting into CX-7 when using Alpha linears, possibly other types also. Feedback is via the RLY (Amplifier keying relay) jack. External Pi filter added as in S/l News cures problem, 22 µh choke and pair of .001 µf caps in shielded box. Also can add Ferite beads to leads at RLY jack. (W8CXS)	This makes the amplifier appear not to be neutralized on one or more bands.
	58	Trouble with corrosion on MIKE jack, modulation loss and hum. Clean, adjust, or replace. Lockwasher too thin on some units and paint on surface. (W8CXS)	
	59	Receive hum from ground loops. Eliminated by cutting bare wire connecting sidetone pots ground lugs to braid on the shielded wires.	S/l news.
	71	The T/R voltage change to -15 v applied to AGC circuit modifies the action and requires readjustment of "S" meter and AGC pots. Still needs work to find optimum resistor values for AGC. Selection of R51 size & R26 adjustment for 2.00V (AGC Off) & -.15V (Max signal/AGC On) at pin #509 on A9, works good.	A 10k trimpot or a top adjusting multi-turn pot may be used for R51.
High Pass Filter	60	High Pass Filter missing on some early units. Installed. (W8CXS)	
Meter Lamp	61	Add Meter Lamp, Mura Corp. #PTL-20D/6, 6 volt. Connect to +5 volt connection at rear of counter cage. Mount to top of meter with bent solder lugs. On LED counter board installations, install Mura Corp. #PTL-20D/12, 12 volt lamp with series 27 Ohm, 1 Watt resistor. Connect to 13.8 volt PA filament connection to reduce +5 volt power supply load.	

Area	Ref#	Description	Notes
T/R voltage Change on Early Models	74	The first 100 CX-7 units had a T/R voltage of +0.5 and -15 volts. Changes required on 4 circuit boards	Only correct the the +0.5 volt to zero.
75h. Misc.	75h		Also see item 72 for chassis capacitor locations.
Replacement Parts	78	The large toroids in the lower PA cage are same as Amidon #T-200-2 Iron Powder Toroid cores. Two glued together and taped with glass tape make up the large one. Slots must be filed with a ¼" round file inside the cores to clear the switch assembly.	
R.I.T. for Receiver	91	Replace FSK pot with 10K Ohm pot equipped with push-pull switch. Components on a small perf board: 1 - 6.8 v-Zener, 1 - 15K, 1 - 150K, 1 - 1K, 2 - 2700 ohm, 1 MPS-3702 transistor. Connect to -15v supply and use T/R voltage to disable on transmit.	
Transmitter Troubles	106	Spurious outputs is evidenced on a monitor scope on 28.5 MHz by "Fuzz"(a dual signal overlap of 10% or more on scope pattern) on "Tune". Problem is transmitter mixer I.C.#1 (CA-3028A) on front end board or a leaky gate on Q4 (40603) transistor.	
California CX-7A Radios	109	On "A" model boards, A6, A9, etc., inspect ground holes for components to insure that they are soldered on both top and bottom. The holes are not plated thru on these boards. Also, on AGC board, A9, R43 was found to be 1K Ohms on serials #411 - 417, etc. Should be 10K Ohms to allow proper Slow AGC operation.	

Area	Ref#	Description	Notes
Lower PA Cage	110	Inspect the two long screws of the bandswitch to insure that a fiber shoulder-type insulator washer is under the screw heads. Missing washer will cause the screws to heat up due to the effect of a shorted turn on the RF coils. One possible cause of low transmitter power output.	
Add VOX Delay to CW Operation	113	Audio Board, A6: Connect 6.8K resistor and 1 µf monolythic capacitor in series. 6.8K resistor to pin #336 (To VOX Gain control) and the 1 µf capacitor to pin #338 (Sidetone Keying). Adjust VOX Gain control to maximum, press in VOX button, select CW, and adjust VOX Delay control as desired. Add .01 µf across pins #322-323.	NOTE: This change does not work well on SSB operation and is *NOT* recommended.
Receive Audio High Frequency Rolloff In CW Only	116	May be due to an oversize capacitor at the Tip connection of the microphone jack. Should be 0.01 µf , but 0.1 µf were found on many radios. This jack Tip connection is the PTT control for the microphone on SSB, but on CW it has audio direct from the receiver product detector and an oversize capacitor bypass will reduce high frequency audio.	
Excess Sidetone Level	123	Disconnect coax from center arm of SIDETONE control on rear chassis and add 4.7K Ohm resistor in series. Clean control with spray.	Also see item REF 132.
Excess RF Output on TUNE	124	With OUTPUT control at minimum, ohmmeter from the coax cable at RF Driver Board to ground must be less than 5 Ohms. If cleaning the control does not fix the problem, add 1000 Ohms with 2 AMP connectors at Front End Board, in series with Coax #28 and pin # 59.	Also see item REF 132.
TX VFO Switch, S-2	125	Many CX-7A California radios, the eyelets for switch spacing and thru board connections were not soldered good. Make ohmmeter tests and also clean switches with spray cleaner/lubricant.	

Area	Ref#	Description	Notes
LM380 Audio Amplifier Sub-boards	127	Long loudspeaker leads and bypass capacitors on radio jacks may cause an audio parasitic, distortion at high audio levels, and inability to get full rated output level. Add low resistance 100 µh choke coil, 1 Ohm maximum, directly at the amplifier, in series with output. A Radio Shack #273-102 choke works well, although is a bit large in size to fit well.	
Excessive Clipping	131	May be bad transistor Q14 (40603) on IF Board, A8, but is usually a defect in the gate control voltage on Pin #437 of A8 board. Typical minimum DC voltage is -0.6 Volt at 0 control setting of CLIPPING, to +1.3 Volts at 10 setting. Many shorts at the control, to ground lug have been found. If control is too low resistance overall, a resistor may be needed in series with one side arm. Typical 100 Ohms is enough. Voltage may be tested in Receive also.	Case of Q14 is 0 volts in receive. In transmit, +0.09 to +4.5 volts, typical with control 0 to 10.
PTT for SSB & CW	136	See Figure 3.9 (Thomas Manual ?). Connect cathode of 1N270 diode to MODE switch, IF board A8, wafer S8E #6 (this wafer has (-) end of 50 ufd, 15 volt capacitor and wire #145). Route new wire from the anode of the 1N270 diode, following the cable around the front of the IF board, down under the relay, to jack J-19 on the rear panel. Add .01 ufd bypass on J-19. Insure that the boards can still be raised for service.	

Area	Ref#	Description	Notes
Centralab Controls	132	If can not turn RF "output" power down to low values, and spray cleaning does not cure problem, it may be poor factory crimping of the two outside terminal lugs to the resistance element. This is only a pressure connection and pliers can be used to tighten the lugs. Ohmmeter should read less than 3 ohms with control full CCW or less than 3 ohms at coax #130 on Driver Board A5.	Most late California radios use this type control, early Florida radios used "CTS" controls which do not improve with this fix. CTS controls have a rear bearing in the cover. Also CALIBRATE control for frequency jumping, SIDETONE LEVEL too loud, AF GAIN cannot turn down levels, IF SHIFT moves zero, and others, AF GAIN if can not turn to zero audio, and others in the radio.

W8CXS

Notes:

1. Paul's original list was hand typed and new modifications were added at the end as he found them.
2. I took Paul's modifications list and sorted it by board or area to make it easier to note all the changes to the board you were working on. With Paul's original list, you had to go thru the list, noting down individual changes to the board you were working on. Paul thought it a great idea and distributed that version of his list in his last year.
3. The reference numbers are the numbers in Paul's original list. I made no effort to change them and the references to them in the modifications list.

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