CX11 Modifications

Board		Notes
	Most drawings have many errors. Drawings were intended to partially cover the older CX-11 model, which had numbered wires. A ribbon/ wire connector system is used on the CX-11A, but plug connections were not standardized on the first few produced. Caution on these, since plug-in units are not interchangeable with later radios. Radio #1058 was the 20th produced with ribbon cables and is standard. #908 was third ribbon cable radio and is non-standard.	
A3	Q2 (2N2060) is reversed 180 degrees in socket, board marking is wrong, install with keyway toward center of board. Change R24 from 470K to 220K Ohms for proper operation of the overcurrent shut down circuit. A matched pair of 2N3904 transistors may be used as Q2 if the 2N2060 is not available, emitters toward dot mark on board.	
A3	Change R7 from 1 Ohm to 0.5 Ohms, 3 to 5 watt size to correct marginal voltage input to +5 volt regulator circuit with low line voltage conditions.	
A3	R33 (120 Ohms, ¼ watt) is overheating. Change to 110 Ohms, 1 watt size, or parallel 220 Ohm ½ watt resistors which are closer to the optimum size for the 5v relay, 110 Ohms.	
A3	T/R Voltage is not going to zero, so on separate VFO operation, output shows breakups on leading edge of CW waveform. Note that Q7 on audio board just turns off the -15 volt bias on the PTO's and the +15 volt regulator on the board (VR-1), and R2 drive the residual -15 volts down to 0 volts, and for proper operation, this voltage should be +.01 to +.05 volts to absorb the high current pulse on CW transmit. R2 is too large and must be paralleled with enough resistance to provide the required + volts.	Typical value is 2K ohms.
A3	Slight frequency shift on one VFO when the other VFO is selected for transmit. R4 is too large to provide the required stiffness of the supply to the voltage balancing diodes. Change R4 from 1K ohms to 560 ohms - 1 watt to reduce the shift. Selection of diodes for CR17 & CR18 may be needed to refine the results. Also, R3 (1K ohm) must be paralleled with a resistor to reduce the voltage shift of the R/T line to minimum.	Typical value is 2K ohms.
A3	As received, band "D" tuned 25-26 MHz. Reprogrammed diode matrix to new W.A.R.C. band 24-25 MHz by removing one diode (Plug-in)	

Board		Notes
A3	Inaccurate P.A. current reading. Factory changes were made on the meter board to correct excess meter deflection, but not enough to completely correct the calibration. With current measured by voltage drop across parallel .05 Ohm resistors (.025 ohm total), meter resistance at 35 ohms, resistor R4 meter board (A13) of 1K ohms ± 10%, the resistor on A3 must bring total to 1250 ohms. R39 would be 220 ohms if the 1K resistor on the meter board is accurate. Change R39 from 100 ohms on A3. Full scale will now be 0-50 amps.	(The book notations of 0-25 amps full scale were never correct.)
A6	Capacitor C15 (4.7 µf) is installed in reverse polarity. Should be changed to that (+) goes to ground and change board markings.	
A6	As received, C32 was reversed polarity causing no CW sidetone. (47 µf). Original drawings showed C32 & C33 incorrect polarity.	
A13	P.A. volts reading is meaningless. R3 on meter switch board A13 is 33K ohms ± 10% resulting in meter reading of 3.6 ±. Changing R3 to 47K to 50K Ohms will give a 0-50 volt scale, so the meter reading will be 2.4 for 24 volts on the regulated power supply which is a useful reading. Some meters are non-linear, so the new R3 may require a selected, high value, parallel resistor to be added.	
A6 & A1	As received, CW waveform has no break shaping with straight key or external keyer. Change C6 (22µf) on A6 to 47 µf or 60µf as needed to delay switching back to receive enough to pass the full CW waveform. The actual shape of the break side is determined by C-18 in the PTO module A1. Originally was 4.7µf, but 2.2µf is better to sharpen the break shape. A 1µf or no capacitor is used in some where the break is extra long. A small high frequency burst was noted on the base of Q6 on the audio board A6 due to high resistance in the connections from C6 thru various boards back to the mode switch, A34. A good ground on Pin #1-E on the mode switch cures this or a wire from Pin #1-E back to the audio board mounting screw near C6 is better.	Since this depends on foil, connector, resistance of the mother boards, it may not be a problem in most radios.
A34	Short first dot with internal keyer. Jumper out CR-1 on mode switch, A34. Note that this diode is only used for full breakin keying with the Alpha 77D linear amplifier that is connected to the CX-11A thru the accessory plug wiring. Note that Q-1 on A34 is reversed and only acts as a diode. The built-in time delays require this for the internal keyer.	May add socket pins for Q-1.
A1	Noted that no grease was factory applied to the brass slide bar of the PTO's and the bar is wearing badly. Also check for shaft play when dial is pressed in and out, 100-200Hz is normal. Some stamped anti-backlash washers were used that had burrs and after a short time, the shaft becomes loose. Proper washers were machined smooth.	

Board		Notes
Chassis	As received, the plug at the anti-vox control was reversed with pin #1 down. This reduced speaker output when anti-vox control was full CCW.	Note that coax #60 goes to the output of the audio amplifier on the power board.
A17	Resistor R17 is changed form 2.2K to 1.5K ohms to improve synthesizer operation at high temperatures.	
A3	Resistor R34 (22 ohms - ¼ watt) is in series with the external amplifier keying relay. Resistor may burn with some linear amplifiers. Change to at least ½ watt size. For Alpha 70-77 linears, install 100 ohms, 2 watt size for best operation and long relay life. Most Henry amps use 27 ohms - 1 watt.	Select exact size using test clips across amp control line for minimum sparking.
A31	Red and amber lamps glow faintly on some radios. Install 2.7K ohm - ¼ watt resistors from L.E.D. hot terminal pin on board to ground for each to stop continuous glowing.	
A18	Change V150LA10A M.O.V. at location C-1 to 0.01 µf - 1KV disc capacitor.	
A18	Early radios used 14 pin DIP relay which was underrated for switching the internal fan. (200VDC contacts) Replace with Aromat or similar relay rated for 125 VAC switching at 0.5 amp or more. Latest relays have 400 Ohm coils for 12 volt operation which require a 100 ohm resistor at R12 on power board A3. Some radios had Aromat (Yellow color) 5 volt relays with 70 ohm coil which require 220 ohms as R12 on board A3. Note that this allows only 3.3 volts to operate the relay, but seems to be satisfactory. The early DIP, 14 pin relays were 12 volt with 500 ohm coils and require 1000 ohms as R12. All radios were incorrect with 220 ohm causing overheating of the relays and early failure.	

Board		Notes
A9	Non-linear “S” meter. Design error in IC-2A connections. Must be changed from non-inverting to inverting operational amplifier circuit to allow correct “S” meter calibration above “S-9”. Note that on early boards, no “S-1” adjustment control exists. The circuit for Q4 on the AGC board, A9, must be changed to a gain type stage and add a gain control for it. This becomes the “S-1” adjustment to be set with 1 microvolt input to the receiver. With both circuits in place, the “S” meter may be calibrated for 5 dB / “S” point below “S-9” and correct scale calibration above “S-9” to 60 dB scale which is 50,000 micro-volts. If still non-linear above “S-9”, select new size for R29 (0 - 1.2K). Use pin jacks.	See Item #23
A9	On early and late radios, the connections to J1, J2, J3 coax cables #131, 154, 174, are “Berg” connectors. These leak RF badly causing strong signals every 100 KHz with the Calibrate control off. Most radios use gold colored SMB or SMC coaxial connectors. Berg con-nectors should be changed to the SMC plug/jack arrangement or the coax may be soldered direct to the board holes with “Zero” length leads. Very early boards used a different component placement which requires extensive rearrangement of parts, and addition of L-C filter and feedthru capacitor along with the Berg connector replacement to reduce 100 KHz signals.	
A9	Audio overshoot, slow AGC attack time. Change oversize C23 from 10 µf to 0.01 µf capacitor. Additional AGC improvements are to: Change C24 to 10 µf; Change R22 to 1 K Ohms; Jumper across R29 (1.2K) or change to smaller value to correct non-linearity at high sig-nal levels, typical 680 to 470 Ohms.	See item #21
A9	Early radios may “pop” the speaker when the microphone button is released and the receiver recovers before the transmitter stops on SSB operation. All radios should have the modification which adds a 2N3904 transistor, 8.7 v zener diode, and resistors under the board, tacked in on the foil.	This was included on the latest pro-duction board foil design.
A20	For receiver front end protection from lightening and overloads, add two strings of diodes at location DS-1 on the receiver high pass filter board. Back-to-back 8.7 Volt zener and 1N4148 or similar switching diodes arranged to clip both + and - voltages. Standard on late radios. Some wiring errors in use of 3.9V zeners, change if they are 1N5228B type to stop broadcast station cross mod.	

Board		Notes
A16	CW waveshaping to suit individual, but good results from: Removing C5; Retaining C13 as 0.047 µf; Jumpering ineffective R24 control; Jumper out CR-6 (1N270). Improved CW sidetone quality by changing C8 to 0.1 µf, but this also sharpens the "Break" CW shape, so C12 must be changed to 1.5 to 2.2 µf to compensate. To insure that one VFO stops before the other starts on split operation, add 1.5 µf capacitor from Q8 base to ground. Installing C5 as 0.01 to 0.1 µf will soften the click on "Make" if desired.	Select value of C5 for best shape.
A16	Change R16 from 1 Meg to 1.5 Meg ohms for better drive meter operation. Change R5 from 10K to 18K Ohms to allow transmitter to work into a higher SWR load without exceeding the transistor ratings.	
A10	Add double sided circuit board piece to side of board to shield the transmitter mixer from the driver board. Tack solder in place. Change mixer cutoff circuit from R/T line to ALC control to insure complete cutoff. 2 resistors and a foil cut are required. Also transistor Q3 is plugged in differently.	
Chassis	Rear jack J19 is not connected on early radios. Later radios is marked RTTY and is used for FSK operation. On rear accessory jack, J10, upper jack, splice a wire to the orange lead of ribbon cable which goes to pin #3 (Wire #229) and connect wire to J19 / mark jack RTTY.	
A8	Due to low I.F. gain and high loss CW filters, a one transistor amplifier is needed for the plug in filters. Note that the standard factory supplied board will not fit on CW3 / FSK position directly. Modifications are required for connections.	
A6	Add 0.01 µf capacitor at Jack J4 (Sidetone Level) and J9 (VOX Gain Control), to ground to reduce RF feedback. If microphone gain is too low, add 100 µf - 15 Volt capacitor across R6 (near Q1) and reset mike gain control. Low impedance mikes increase hum, ground loop problems. If phone patch input gain is too low, or wrong impedance for the type of phone patch used, change R9 (680) to 47K Ohms. This makes phone patch input high impedance instead of 600 Ohms. Ground loop at Mike jack causes hum. An insulated type Mike jack will reduce hum, Collins #647-2739-001, Jack, J2, NSN (Switchcraft).	

Board		Notes
A11	To optimize power output vs frequency better: Change C-1 from 100 pf to 200 pf (Add second 100 pf chip capacitor on top of existing one); Change C-4 from 680 pf to 1680 pf (Add 1000 pf chip capacitor on top of existing C-4 - **CAUTION** to use a thin capacitor due to clearance problems). Add 1000 pf chip capacitors in parallel with both C-2 and C-3 (Place between foils near the other capacitors); Change C-5 to 560 pf - 300 volt, mica type capacitor, soldered directly to output coil T-3 (Note on some early radios, a chip capacitor at C5 location may be on the top side of the circuit board under T-3. This must be removed. Also some radios may have a 390 pf mica on T-3 which should be changed to the 560 pf size); Change R17 to 39 Ohms - 5 watts to improve bias stability. (Many different sizes were originally used).	
A29	Early boards displayed yellow decimal for "Overrange" indication on IC-3. Remove existing R9 (150) and connect new R9 (150 - ¼ watt) to pin #6 of IC-1, red band display digit. IC-1 must be changed to Hewlett-Packard #5082-7650 which has a left side decimal if one of the red digits is not this type already.	
A17	Early boards had some incorrect resistor wattages. Check R15 for 10 Ohms - 1 watt (Early paralleled resistor combination); R18 for 390 Ohms - ½ watt (was ¼ watt); R21 for 220 Ohms - ½ watt (Early paralleled resistors); R29 for 100 Ohms - 1 watt (was ¼ watt).	Synthesizer board.
A2	Early radios may have band pass filters for band "A" connected to the 1-2 MHz filter instead of the 3-5 MHz filter for proper operation on 4 MHz. Band "D" may be connected to wrong filter for proper 24 MHz operation.	
A27	Early radios had wrong connections to transmit low pass filters for proper operation of band "B" on 10 MHz and band "C" on 18 MHz WARC bands. The printed circuit boards holding the band switch wafers have foils etched on both sides of the boards for late radios. Otherwise, jumpers must be added.	Band switch must be removed for modification.
A33	(High Power) The modification to use the vacuum relay omitted connection of CR-1 (1N4003) across relay windings to protect the switching transistor from spike damage. A foil cut and 2 jumpers are needed to connect CR-1. Capacitor C2 (.01), from +24 Volt to ground, was omitted due to circuit board foil trace conflicts. Install C2 under board at +24 V input jack.	

Board		Notes
All	Wiring error in late radios. Torroid T-2 wound with single #22 wires instead of twisted pairs of #22 wires as in early radios. Overheating wire and torroid core due to 20 amp collector current. Rewind with 6 turns #18 wires (red/green bifilar) wound. Use Amidon FT-50-61 replacement core if original is damaged. Inductance of T-2 is still too low for 1.8 MHz operation, move capacitors C12 & C13 to +24 Volt end of L3 & L4.	Will improve efficiency and output 25 to 50 watts on 1.8 MHz and some on 3.5 MHz. Will prevent future capacitor damage if 1.8 MHz operation is done at over 100 watts.
A28	Add 1 µf monolithic capacitor at +5 Volt input pin, short leads & mounted under board to reduce 100 KHz birdies in receiver on low bands.	
A3	Rear panel I.C. regulators. All plug connectors should be checked for loose pins. Most "tinned" color connector pins must be adjusted to make good contact.	
A15	Design error causes "1.5" position to rolloff at 800 Hz. Change R13, R14, R15 to 5.60K Ohms - R16, R17 to 7.87K Ohms, R18, R19, to 9.31K Ohms - C9 to .022150 µf - C10 to .003221 µf - C11 to low side of .022 µf - C20 to low side of .033 µf - C21 to .056440 µf. Note that C12 and C13 remain at original .01 µf sizes. Gold socket pins for the 7 resistors will allow corrections in cutoff frequencies if desired. Note that a true "2.4" KHz active filter is available at pin #7 of IC-3. The stop may be moved at the selector switch to provide one more position and the "Bypass", which was the "2.4" position, can now be designated as "X". A Berg pin is placed in the switch and a wire with connector run to one side of C21 which goes to pin #7 of IC-3.	
A26	Select CR-2 (1N270) diode) for minimum noise level when SPOT LEVEL control is set at maximum. Note that pin jacks are in place for this diode already.	
A26	Plug coax cable #168 into only the hot pin of the board jack to eliminate a buzz in the loudspeaker at zero audio gain due to ground loop. Coax shield of connector is not plugged in.	
A9	Microphone talk-thru into the receiver (on receive). Change Q13 from a 2N3904 to a 2N3563 type transistor that the circuit was originally designed for. Substitutes that also work are ECG-108, WEP-56, SK3452/108.	

Board		Notes
A9	Meter reads down scale if CR-7 (1N270) is leaky.	
A5/A10	Remove R-19 (51 Ohms) from board A10. Add 51 Ohms, ¼ watt across the input jack, J-10 of board A5. Standard on late radios.	Stabilizes amplifier.
A5	Resistors R26 and R27 (82 Ohms, 1 watt) overheat and go high in value, causing oscillations on some bands. Change to 2 watt size, carbon composition.	
A6	Low VOX sensitivity. Change R15 from 220K to 470K Ohms.	
A11	On early radios, R1, R2, R3, R4, R5, R6, R7, R8 were 1 watt composition type resistors. Late radios use 3 watt metal film type resistors for reliability.	
Tests	Receive audio gain. 10 millivolts into coax #186 (Removed from J10 on board A9) gives 18 mv across coax #55 on board A3 and 130 mv across a 4 Ohm loudspeaker with AF gain at maximum. CALIBRATE tone gives 4.3 volts across speaker.	
Chassis	On early radios, without the printed circuit boards on lower rear of chassis, use tooth type lockwashers on the A.C. socket to insure that the Green (A.C. Ground) safety wire is secure.	
Chassis	Early radios may have 1 or 2 .01 µf capacitors at the PHONES jack. Should be a single .001 µf.	
All	The use of MRF-422 transistors with BLUE dot codes will cause the amplifier to oscillate at low frequency in broadcast band. Only transistors with RED dot codes or ORANGE dot codes should be used. In some cases, YELLOW or GREEN dot codes will work perfectly if on low end of their Beta ranges.	
A5	Note that only the nut and bolt that hold transistor Q4 (2N5190) complete the Collector connection. Insure that nut is tight. Add jumper wire if the foil is already burned.	
A10	Add 10K Ohms from junction, CR3/CR4/R5, to ground to improve mixer turn-on timing.	Insures mixer is on before RF output starts.
A3	Change C12 & C18 from 0.1 µf to 1.0 µf and C27 from 0.1 µf to 0.22 µf to improve receiver audio amplifier frequency response.	
Notch Adjust Control	Early radios used a 5K Ohm, metal cased control. Later radios used 10K Ohm plastic control which makes adjustment too difficult. change this to 5K Ohms, A-B U5K type.	Lug or pin types will fit.

Board		Notes
A9	Frequency readout accuracy is poor due to use of a non-adjustable 10 MHz I.C. oscillator (Dale XO-33A). Change this to the factory optional High Accuracy oscillator, A9A, board. An adjustable 10 MHz TCXO may be used if arranged to plug into the existing 14 pin I.C. socket, much less costly.	
A33	The factory installed vacuum relay circuit, for the High Power Option, that replaces the reed type relay, K-2, does not use the receiver switching relay, K-1. When using an Auxiliary antenna, transmitter RF can damage receiver circuits. Relay K-1 should be installed, to ground the receiver input while transmitting. Magnecraft W172 DIP-8, Magnecraft W172 DIP-4, ECG RLY-F71C24 relays are suitable. Coil is wired in parallel with K-2.	
A1-PTO's	Early radios used 560 Ohms for R-17, but Q-1 transistor had to be selected to insure reliable starting of oscillator. Some used type J308 transistors as Q-1. Late production changed R-17 to 330 Ohms so that almost any J310 transistor would work properly.	Note that C11 is not on late circuit boards.
A9	Due to a board etching error, capacitors C-28 and C-29 are in parallel, 1 µf, instead of series 2.2 µf as in the CX-11. Since the AGC voltage changes polarity across the capacitors, non-polarized types are required instead of the existing tantalum type. SLOW AGC is improved if both C-28 and C-29 are 1.5 µf monolithic types is preferred.	
A17	The level of 100 Hz tones on low bands may sometimes be reduced by setting the synthesizer voltage, as described in step #14 of alignment list, at 69 MHz, to higher than the 8.0 Volts specified. Up to 10 Volts may be used, with reduction in the tone levels. Insure that Volts at 41 MHz end of the range has enough control also.	
A9	In early radios, CR-16 and CR-17 were 1N456 diodes and R59 was 330 Ohms. This allowed some carrier on SSB to leak through. Late radios used PIN type diodes, MPN-3500, for CR-16 and CR-17 and R59 was 1.2K Ohms to reduce the carrier leak. Type BA-282 diodes may be used, since the MPN-3500 type is no longer made, and was replaced with a larger plastic cased type MPN-3400 series which do not fit as well.	
A9	Early radios did not have the control to adjust "S-1" with 1 microvolt input. A 1K Ohm trimpot was added and Q-4 transistor was rewired to a "Gain" type amplifier stage, in all late radios. Q4 was changed from a metal cased 2N5179 transistor to a 2N3904 plastic type transistor.	

Board		Notes
Chassis	Although the main fuse holder is marked “MDX-7A SB”, a 10 amp fuse is now specified. The factory used MDL-10 fuses, but these are rated to open with less than 32 Volts. The proper fuse must be rated at 125 Volts or higher. A ceramic body fuse such as Buss ABC-10, a fast blow type, works well.	