



**MODIFICATION
MANUAL**



KRAFT SYSTEMS, INC.

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TO: ALL AUTHORIZED SERVICE STATIONS

The enclosed list of modifications are for
Service Station use only, and are intended to
be used to assist you in repair of Kraft
Radio Control Equipment.

GOLD MEDAL

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
GM	Tx	27 MHz	If troubled with extraneous oscillations, replace epoxy transistors in RF section with 2N2369A, P/N 101-006.
GM	Tx	72 MHz	If output is low, add a 10pf disc capacitor across R402 base resistor in the oscillator circuit for better oscillator drive. (Note: In some cases this mod will provide too much drive and cannot be used.)
GM	Tx		If it is necessary to replace the entire Tx antenna assembly, replace the antenna base with the current antenna assembly. Order P/N 200-144. It will also be necessary to add the following parts:
		27 MHz	Insert a .001uf disc capacitor in series with the antenna on the board, and install a 10pf disc capacitor from antenna to ground.
		53 MHz	Install a 6.2 or a 10pf disc capacitor from antenna to ground on the board.
		72 MHz	Install a .001uf disc capacitor in series with the antenna on the board.
GM	Tx		If it is necessary to replace just the antenna, bore out the old connector with a "Q" size drill. The new short antenna, P/N 200-057, will slip in with a tight fit. Retune the transmitter with the new antenna.

Gold Medal continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
GM-1971	Tx	72 MHz	If the transmitter splits pulses and has low power output, check for proper ground jumpers in the transmitter. On the back of the P.C. board under R132, there should be a jumper to the outside ground land under 1A.
GM-1971	Tx		T-10 and T-10-A Board. Insure that the ground jumper wire is installed at bottom center of the P.C. board as shown in Plate 24-G of service manual.
GM	Tx	27 MHz	When replacing the final in all 27 MHz transmitters without the buffer stage, they must have the final output transistor 2N2369A, P/N 101-006, installed as a common base amplifier. The emitter and base leads are reversed upon installation. Check all units to insure the final is installed as a common base amplifier.

SERIES 1971 - 1972

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1971-72	Rx		If the decoupled voltage is low, or the decoupled voltage is noisy with all the servos operating, replace the 2N5088 transistor with a MPS-6560 and the 10K bias resistor with a 3.3K resistor, P/N 057-332.
1971-72	Rx		If unstable operation is present, i.e., receiver in self oscillation, decoupling resistor R517 may be changed from 150 ohm to a 220 ohm. This change tends to increase AGC response time which is acceptable,
1971-72	Rx	53 MHz	If the receiver tends to be noisy and unstable, change C502 to a .5pf and R507 to a 2.2K resistor.

SERIES 1972

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification'</u>
1972	Tx	72 MHz	To prevent the buffer from over heating, R7 must be an 18 ohm resistor. Check all units and install this modification.
1972	Tx	72 MHz	Change C6 from a 22pf disc capacitor, to a 22pf silver mica capacitor, P/N 117-005. Check all units and install this modification.
1972	Tx	72 MHz	If output power is low, check to see that C11 is a 15pf silver mica capacitor, P/N 117-004, before changing output transistors. Some disc capacitors may be off-value and cause low power output.
1972	Tx	72 MHz	Check to insure that L2 has 1-3/4 turns on the bottom winding and 3-3/4 turns on the top winding. If not, replace with the proper coil, PA 103-052.
1972	Tx	All	Check all 1972 Series transmitters to see if R10 is present. If not, install R10, a 1K ohms. 1/4W resistor across L3, the 4.7uh choke.
1972	Tx		To increase stability, replace C42 with a .1uf mylar capacitor, P/N 115-018.
1972-1974	Tx		If troubled with rudder interaction, check to see that R21A is not lower than 1K in the retract channel.

Series 1972 continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1972-74	Tx		In severe cases of channel interaction, change diode gate coupling capacitors from .003uf to .002uf disc. If problem still persists, connect the collector of the 2N3392 transistor in the offending channel to B plus through a 4,7K ohm resistor.
1972-74 & 2/3 Tx	Tx	72MHz	To increase power output and obtain better tuning on L5, change C12 to a 6.2pf disc capacitor, P/N 113-032.
1972 (Early)	Tx		To prevent pulse splitting, delete the .01 disc capacitor between R31 and R7.
1972	2 Ch Brick Rx		To prevent strong transmitter interference caused by rectification in the 2N5083 amplifier transistor, add a .001uf disc capacitor, P/N 113-021, from the top of C29 (33uf) to the top of R18 (100K).

SERIES 1973 - 1974

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1975-74	Tx	72 MHz	If output power is low, check to see that C11 is a 15pf silver mica capacitor, P/N 116-004, before changing output transistors. Some disc capacitors may be off-value and cause low power output.
1973-74	Tx		To prevent pulse splitting in single stick transmitters, install a .0047uf subminiature capacitor, P/N 113-038, under the rudder pot, Connect capacitor from green to black lead.
1973-74	Tx		To prevent channel interaction between channels 3 and 4 in single stick transmitters, check to see that C10 and C12 are .022uf mylar capacitors, P/N 115-029.
1973-74	TX		Check that the off-time pulses of the transmitter are between 350us . and 450us in length. Usually R35 at 10K works best,
1973-74	RX		The clipper level should be at least 1 volt positive. If not, change R15 and R16 to an 18K ohm resistor to achieve the proper clipper level.
1973-74	RX		For proper AGC operation, it may be necessary to change C10 (AGC bypass) from a .05uf to a .01uf disc capacitor, P/N 113-016. The .05uf capacitor can cause sharply peaked pulses if it becomes leaky.

Series 1973 – 1974 continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1973-74	Rx		Most receivers will require the removal of C13, a .05uf disc capacitor located beside R1 and R2 to obtain proper receiver sensitivity, Receiver sensitivity must be readjusted after removal.
1973-74	Rx		If a National Semiconductor (NS) SN74L03 1C is used, P/N 110-102, as a replacement for IC-1, then 021, .22uf should be changed to a 4.7uf tantalum capacitor, P/N 116-004, for proper operation.
1973-74	Rx		Some receivers have the red colored .05uf disc capacitors installed that may become leaky with age. All of these should be replaced with the green .05uf capacitor, P/N 113-018.
1974	Rx		C1 and C3 disc capacitors in some receivers were temperature sensitive, To alleviate the problem, change C1 and C3 to the appropriate silver mica capacitors as determined by frequency.
1972 & Early 1973	Rx packs		Some KB-4E battery packs had the cell sets strapped together with solid straps. These straps may work loose under extreme vibration. Examine all packs and if solid straps are found, replace with stranded wire, Wrap the cells tightly together with mylar tape. Use RTV, P/N 990-003, in the top and bottom of the case to prevent any cell rotation.

SERIES 1975

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1975	Tx	72 MHz	If output power is low, check to see that C11 is a 45pf- silver mica capacitor, P/N 116-004, before changing output transistors. Some disc capacitors may be off-value and cause low power output.
1975	Tx		Some early KPT-3/5 transmitters may exhibit pulse splitting if the retract switch is thrown when the Tx battery is low. To eliminate the problem, install a .001uf disc capacitor, P/N 113-012, where the violet wire attaches to the P.C. board land from the retract switch to ground. On later transmitters, this capacitor is labeled C43. See overlay of T-22 Encoder P.C. assembly for proper location of part.
1975	Tx		The transmitter off-time in all seven channel transmitters must be at least 350us, If unable to obtain this minimum, change R6 in KPT-7B/7S encoders to a 10K ohm resistor. For the KPT-7Z Tx, change R35 to a 10K ohm resistor.
1975	Tx		If unable to obtain proper throw from the rudder channel on single stick transmitters with the I.C. logic, install a 3.3K ohm resistor in the encoder from the emitter of Q11 to ground.
1975	7M Rx		If R23 is a 4.7K ohm resistor, change it to a 10K ohm resistor, P/N 116-004, to reduce current drain.

Series 1975 continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1975	7M Rx		To prevent servos from pulsing when power is first applied to receiver, add C26, 4.7uf tantalum capacitor, P/N 116-004, from pin 9 of IC-1 to B plus. Also remove C20, a 1uf tantalum capacitor and replace with a 4.7uf tantalum capacitor, P/N 116-004.
1975	7M Rx		To prevent damage to Q8, 2N5088, if a customer attempts to plug in the power to the block plug upside down, move the white wire in the block plug that goes to the base of Q8 to the junction of C14 and R13.
1975	7M Rx	72 MHz	If a 72 MHz receiver has low sensitivity due to having a crystal manufactured by Sherrold installed, change R4 from 4.7K to a 3.3K ohm for proper drive.
1975	7M Rx		The plug latch on some of the early receivers did not latch properly. Replace latch with P/N 901-239.
1975	7M Rx		Check C10 to insure that it is a .01uf capacitor, P/N 113-016. If it is a .05uf, replace it.
1975	7M Rx		C2 is a tubular capacitor which is installed vertically on the P.C. board. Insure that the capacitor is RTV'ed to the yellow IF can, to prevent lead breakage due to vibration.

Series 1975 continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1975	7M Rx		Some receivers with H-10 type transistors may exhibit poor AGC operation. If H-10's are present in a receiver, they should be removed and replaced with 2N3663, P/K 101-034.
1975	7M Rx		The AGC resistor, RI0, which is normally a 220K ohm resistor, may be changed to a 120K ohm resistor, to suppress high negative spikes in the detected signal under high conditions.
1975	7M Rx		If a National Semiconductor (NS-) SN74L03 1C, P/N 110-102, is used as a replacement for IC1, C21, .22uf-should be changed to a luf tantalum capacitor, P/N 116-002, and R22 2.7K should be changed to a 4.7K ohm resistor. These changes will insure complete reset under all conditions of temperature and voltage.
1974- 1975	7M Rx		Some receivers may exhibit overload characteristics. A diode in the front end prevents overload (servo jitter at extremely close range). Install a 1N4148, P/H 100-101, across L2A, anode to ground. See ECN 50-77 dated September 27, 1977.

KP-5 SPORT SERIES

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
Sport	Tx		To prevent the first channel pulse from misfiring the 1C resulting in no first channel, remove and discard C16 (.001luf capacitor). Change R14 from 22K to a 10K ohm resistor.
Sport	Tx		Check to see that the sync pause is at least 6 milli-seconds. If not, change R5 to a 150K ohm resistor to widen the sync pause.
Sport	Tx		Off-time should be a minimum of 350 micro-seconds. If not, change R10 to a 30K ohm resistor to increase off-time.
Sport	Rx		The clipper level should be at least 1 volt positive. If not, change R13 and R12 to 18K ohm resistors, P/N 057-133.
Sport	Rx	27 MHz	If troubled by front end overloading, change R7 from 1K to 2.7K ohm resistor, P/N 057-272.
Sport	Rx		To improve operation in cold temperatures, change R20 from 33K to 56K ohm resistor, P/N 057-563.
Sport	Rx		If the mixer stage has an MPS H-10 transistor, replace it with a 2N3663, P/N 101-034. Some H-10's (next page)

KP-5 Sport continued

<u>Series</u>	<u>Unit</u>	<u>Year/ Freq</u>	<u>Modification</u>
Sport	Rx		cut out intermittently resulting in glitching. If the IF amps have H-IO's, replace with 2N3663's.
Sport	Servo		If the deadband appears excessively wide, change C1 to a .001uf subminiature disc capacitor, P/N 113-021.

KP-3C

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1978	Rx		Some decoders will, with some servos, cause a miscount of channels 3 & 4 when using an SSS 4017 I.C. Replace the SSS 4017 with a Fairchild 4017B. See ECN 63-78 dated April 5, 1978.
1978	Rx	72 MHz	Some 72 MHz receivers may show a lack of interference rejection caused by over coupling in the receiver. If so, change C2, the 1pf silver mica capacitor to a .5pf tubular ceramic capacitor, P/N 114-001. Sleeve and RTV the capacitor to prevent shorting to IF can. See ECN 74-78 dated August 18, 1978.

KF-5C & 5CS

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976 & 1977	Encoder		Check the encoder board to determine if D3 is present at the base of Q2. If so, remove it and replace D3 with a jumper wire. Install C5, a .001uf disc capacitor, P/N 113-012, if not present on the P.C. board, from the base of Q2 to ground.
1976 & 1977	Encoder		This modification is required in some encoders to prevent loss of first channel operation. Check the antenna wire and if necessary, shorten the white antenna lead wire to make direct connection to the antenna post lug. Make sure all other wires are away from the antenna leads.
1976 & 1977 -	Mechanics		When viewing transmitter from the rear, check to see if the battery switch wiring is routed on the left hand side of the RF module bracket. If so, move the wiring to the right of the bracket to prevent the wire from shorting out on the sharp edge of the RF bracket. It may be necessary to remove the battery pack to accomplish this.
1976 & 1977	5C Rx		If the receiver exhibits jittering servo pulses when the gimbal sticks are moved to wide pulse, it may be due to 1C-2, the 74C164, misfiring, i.e., the data insert line on pin 1 & 2 rises above .5 volts. If misfiring occurs, change R24 from a 4.7K to a 10K resistor and C22 from

KP-5C & 5CS continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976 & 1977	5C Rx		a 1uf to a .47uf, P/N 116-011, tantalum capacitor.
1976 & 1977	5C Rx		Some early receivers were produced with the "G" series ceramic IF crystal filters. If "G" series filters are present, remove the first crystal filter (G series) and replace it with an "F" series crystal filter, P/N 400-009.
1976 & 1977	5C Rx		If in some receivers, the AGC reacts slowly, remove R10 (680K resistor) and replace it with a 470K resistor. Also check the detector transistor Q5, 2N3392, for proper operation, i.e., (no signal collector voltage .1-. 2V below decoupled B+, full signal Baseline reaches ground, etc., see Service Manuals.)
1976 & 1977	5C Rx		To improve the KPR-5C receivers rejection of FM/TV interference, make the following modifications: add a .05uf disc capacitor, P/N 113-018. beside first IF filter; add .0047uf, P/N 113-038, capacitor next to R26 as shown in ECN 16, dated September 22, 1976. Recheck receiver sensitivity and adjust as necessary. This modification does not apply to the R20A P.C. board.

KP-5C & 5CS continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976	5C Rx		To prevent high amplitude signals from overloading receiver, change R13 from a 3.3K resistor to a 2.7K resistor. See ECN-13 dated September 16, 1976.
1976	5C Rx		If receiver appears very noisy and unstable, replace Q2 (oscillator) 2N5770 transistor with a 2N3663, P/N 101-034, transistor.
1976 - 1977	5C Rx	72 MHz 27 MHz	To improve stability at high battery voltages and interference rejection, replace Q1 (mixer) 2N5770 transistor, with a 2N3904, P/N 101-023. For 53 MHz receivers, Q1 should be a 2N3663, P/N 101-034. Verify at 6.0 volt supply. See ECN 49-77 dated August 17, 1977, and ECN 57-48 dated February 7, 1973.
1976	5C Rx		If there appears to be a decoder clocking problem when the Tx sync period is less than 8 milli-seconds, check to see if IC1 is a 74LS03 instead of a 74L03 1C, P/N 110-102. If so, change C22 from a .22uf capacitor to a 1uf, P/N 116-022 tantalum capacitor, and R24 from a 22K to a 4,7K resistor.
1976 - 1977	5C Rx		To reduce swamping add one diode, 1N4148, P/N 100-101, to the Rx front end across L2A with the anode to ground. See ECN 43-77 dated June 30, 1977.

KP-5C & 5C3 continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976 - 1977	5C Rx		To prevent pulse ride up on the reset circuit and shift in decoder channels, change R24 from a 4.7K resistor to a 27K, P/N 057-273, resistor. Also change C22 from a 1uf tantalum to a .22uf, P/N 116-001 tantalum capacitor. See ECN 56-78 dated January 31, 1978.
1976 - 1977	5C Rx		To reduce residual 455 KHz (greater than .3V P-P) in the detected signal, replace C15, the .05uf detector bypass capacitor, with a .047uf monolithic, P/N 113-046. See ECN 113-79-
1976- 1979	Encoder		If there is insufficient discharge of the modulator timing capacitor which is exhibited by a very narrow off-time pulse for the first channel, change R28, 4.7K resistor to a 1K resistor, P/N 057-102. See ECN 134-79 dated November 20, 1979.

KP-7C & KP-7CS

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976 - 1977	Encoder		On Series '76 and early '77 transmitters, check to see that a miniature green .001uf disc RP bypass capacitor C7, P/N 113-021, is installed under the encoder P.C. board near the antenna bumper pad from ground to B+. Check to make sure it is not shorting out any lands.
1976 - 1977	Encoder		To prevent flexing of the encoder board when the antenna is retracted into the case, install a 1/2" square x 1/8" thick foam pad on the bottom of the P.C. board next to the battery pack under the bumper pad. Also, cut the top half off the left foam pad on the transmitter back. This prevents the P.C. board from working up and down when the antenna is retracted which may cause the fifth channel plug to become detached.
1976	Tx Mechanics		On some of the early production single stick models, the throttle control and throttle trim were wired backwards. When looking into the back, the red wire on the throttle control pot, when correctly wired goes to the transmitter's left. On the throttle trim pot, the red wire should go to the bottom lug of the pot. Some elevator and elevator trim pots were also wired backwards. The red wire should go to the top lug on both pots.

KP-7C & KP-7C3 continued

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<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976 - 1977	Tx Mechanics		On some transmitters, the white stub antenna wire goes across the back of the antenna base. When the transmitter back is in place, the antenna stub wire is trapped and can short out. Turn the nut one facet towards the left hand holding screw to reposition the wire. Also, insure that the antenna wire is soldered to the nut and not held in place by a lug.
1976	Encoder		Check all encoders that use a. 3N163 FET for neutral shift at 9 volts. There should not be any neutral change 1 If shift is noted, replace the 3N163 with a MV840, P/N 101-030. See ECN 08, dated July 9, 1976.
1976	Encoder		Check the frame sync period, It should be from 6.0 to 10.0 milliseconds. If not, change R14, 220K, to 100K to shorten the frame. See ECN 12, dated September 1976.
1976	Rx IF Logic		Check the receiver to insure that the following values are present in the receiver IF section: R5, 5.6K; R7, 820 ohms; R10, 220K; and R11, 330K. They are required for proper AGC operation.
1976	Rx IF Logic		To prevent high amplitude signal levels from overloading the receiver when there is a fresh charge on the battery, change R13

KP-7C & 7CS continued

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<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976	Rx IF Logic		from 3.3K to 2.7K in accordance with EON 13, dated September 16, 1976.
1976	Rx IF Logic		To prevent high amplitude level FM signals from interfering with the receiver IF section, remove C12B the .0047uf AGC to ground capacitor. Lift the black wire from J2 at the P.C. board. Insert a 150 ohm 1/4W resistor into the remaining hole. Solder the black wire to the top of this resistor. Place a dab of RTV around the resistor and wire. Solder the two ground lands together at the receivers front edge using buss wire. Drill two holes and add a .05uf,disc capacitor, P/N 113-018, and a .0047uf capacitor, P/N 113-038, in accordance with ECN-15 dated September 20, 1976.
1976 -	Rx IF		To prevent pulse ride up on the 1977 Logic reset circuit and shift in decoder channels, change R24 from a 4.7K resistor, to a 27K resistor, P/N 057-273. Also change C22 from a 1uf tantalum to a .22uf tantalum capacitor, P/N 116-001. See ECN 56-78 dated January 31, 1978.
1978- 1979	KPR-7FM		To improve the starting of the oscillator on a 53MH2; FM receiver, change C6, 22pf capacitor to 33pf capacitor, P/N 117-007. See ECN 93-79 dated April 11, 1979.

KP-7C & 7CS continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1978 - 1979	KPR-7FM		At low temperatures, the LM358 OP Amp I.C. may exhibit a decrease in gain and leakage, therefore, change R2, 330K resistor to a 1 meg resistor, P/N 057-105. See ECN 97-79 dated April 23, 1979.
1976 1979	7C & 7L Rx		To reduce residual 455 KHz (over .3 volts P/P), in the detected signal, replace C15, the .05uf detector bypass capacitor with a .047uf monolithic, PA 113-046. See ECN 113-79.
1976 - 1979	Encoder		To improve RF immunity when using the RCA CA1458 I.C. Chip, in place of IC1, the NE 5558, add a .001uf capacitor, P/N 113-021, from pin 6 of IC1 to ground, on the bottom of the P.C. board,
1976 - 1979	Encoder		If there is insufficient discharge of the modulator timing capacitor, which is exhibited by a very narrow off-time pulse for the first channel, change R19, 4.7K resistor to a 1K resistor, P/N 057-102. See ECN 134-79 dated November 20, 1979.
1978 - 1979	KPR-7C/ FM		Change C7, 1uf tantalum capacitor to a 0.47uf, tantalum capacitor, P/N 116-011. Set up transmitter deviation so that at the Rx test-point (pin 8 of IC S041 or top of 47K resistor) the detected pulse amplitude with a strong Tx signal is plus-and-minus 0.25 to 0.30 volts

KP-7C & 7CS continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1978 – 1979	KPR-7C/		above and below the quiescent D.C. FM level at this point (measured with tx off).
1978	KPR-7L Rx		RF section P.C. Assembly values were changed in conjunction with the new type shielded RF transformers. For specifics, see ECN 72-78 dated August 19, 1978.
1978 - 1979	KPR-7DC		The small purple oscillator coil P/N 102-035, is no longer available, therefore if it is necessary to replace it, use toroid coil, P/N 103-130. Add a jumper between the old coil tab holes and change the resonating capacitor from, a 22pf silver mica capacitor to a 47pf silver mica capacitor, P/N 117-008. This value may have to be adjusted to obtain maximum receiver sensitivity. See ECN 78- 78 dated November 29, 1978.
1976 1979	Tx Mechanics		If the RF meter reading is low, yet the RF output is normal, change R51, 100K resistor which is connected from the meter lead to ground, to a 47K resistor, P/N 057-473.
1979	Non-Linear		If there appears to be a problem in RF entering the P.C. board, change the 22uf signal input and output chokes to 1K resistors, P/N 057-102. Also, add a .001uf capacitor, P/N 113-021 from pin 5, IC-2 to P.C. board ground. Solder this capacitor to the bottom of the

KP-7C & 7CS continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1979	Non-Linear Control		non-linear board. Additionally, add a .001uf capacitor, P/N 113-021, from the green lead of the RF meter to the transmitter chassis solder lug. See ECN 110- 79, dated July 9, 1979.
1978 - 1979	KPR-7FM	53 MHz	To improve IF bandpass ripple, add a 5.6K resistor, P/N 057-562, in parallel to the yellow IF transformer between pins 2 and 3 of IC SO42. Drill two holes in the P.C. board and add the 1/4W, 5.6K resistor vertically, positioning it between the yellow IF can and IC S042. Solder the short resistor lead to pin 2, and long-lead with sleeving, to pin 3 of IC SC42. Receiver tune-up remains the same.

PLUG-IN MODULES

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976	7C Rx Module		Some 53 Mhz 7C receiver modules used the non-shielded transformerwound with green wire. Replace it with the shielded transformer with the orange slug, P/N 103-069. R3 should be changed to a 2.2K resistor and C4 to a 10pf silver mica capacitor to match the orange transformer.
1976	7C Rx		Check to insure that all Rx modules have C2 potted with RTV to prevent it from shorting out on the metal crystal case. Also check to insure that the crystal is secured with RTV to prevent vibration damage.
1976	7C Rx		Check the value of C4, the receiver oscillator bias bypass capacitor, and change to the following as applicable. For 27 MHz C4 is 18pf, P/N 117-013; 53 MHz is 18pf, P/N 117-013; and 72 MHz is 27pf, P/N 117-006.
1976 - 1977	Tx Module		On 53 MHz modules, in order to increase the meter reading, change C10, 3pf, to a 6.2pf^capacitor, P/N 113-032. See ECN 61-78, dated March 29, 1978.
1976	Tx Module		Check 27 MHz Tx modules and change the meter rectifier coupling capacitor C10, 10pf, to a 6.2pf capacitor, P/N 113-032, in accordance with ECN 14, dated September 16, 1976.

Plug-in Modules continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1976 - 1979	Tx Modules		Transmitter modules for use in Europe are identified by their black color. These are only for use in transmitters that have a special filter circuit installed. See ECN 46-77 dated July 21, 1977.
1976 - 1979	Tx Modules		On 72 MHz Tx modules, if it is desired to improve the consistency of RF meter reading, change C10, the meter coupling capacitor from 3pf to 6.2pf disc capacitor, P/N 113-054. See ECN 136-79, dated December 4, 1979.
1978 - 1979	FM Modules		To optimize the modulators' capability to handle narrow pulses when using an FM Tx module, change C1, .047uf to .01uf capacitor, P/N 114-004. See ECN 130-79, dated November 12, 1979.
1976 -	Tx Modules	72 MHz	1979 If a 72 MHz Tx module output appears to be low, check to see if C15 is an 18pf capacitor. If so, replace it with a 22pf silver mica capacitor, P/N 117-005.
1976 - 1979	Tx Module	72 MHz	Check all 72 MHz Tx modules to determine if the output coil L6 has a long slug. If not, change it to Improve the tuning and output.

Plug-In Modules continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1978 - 1979	FM/Tx Module	53 MHz	The following procedure is recommended for alignment of FM transmitter modules, since the adjustment of the oscillator's RF transformer is critical with respect to temperature stability.

1. Start with transformer tuning slug flush with top of transformer.
2. Slowly turn slug (use proper tuning wand!) clockwise (down towards P.C. board) until oscillator starts.
3. Keep turning clockwise until oscillator quits; keep turning very slowly (clockwise) until oscillator restarts.
4. Continue turning slug clockwise until output frequency stabilizes (typically 1/3 turn). Oscillator now swings the crystal on the correct slope. Do not wax core yet.
5. Adjust buffer and antenna transformer slugs for maximum output.
6. Proper oscillator core adjustment must be verified during final deviation adjustment when monitoring receiver detector signal (at room temperature).
7. Following deviation adjustment, freeze and heat transmitter crystal and ensure that receiver remains operative. A small amount of DC level shift (+ and - 0.4V) is normal during this temperature test. "Receiver operative means: detected clock pulse at Pin 14 of I.e. 4017.
8. Bring transmitter module back to room temperature and seal oscillator slug with wax.

NOTE: The FM receivers must be sprayed with Krylon.

KP-2A, AS and AW SPORT SERIES

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1977	Tx Encoder		If the encoder exhibits lock-up when the Tx battery voltage is high, check the 4013B I.C. to determine if it is manufactured by RCA. If so, add a .001 disc capacitor, P/N 113-021, to the encoder from pin 12 of the RCA 4013B to ground. It is permissible to install this capacitor on the back (solder) side of the P.C. board.
1973 - 1979	System		When using the KP-2A, 2AS, or 2AW Systems with KPS-15IIHA servos, the receiver power source must be Nicad batteries due to the high servo current drain.
1978 - 1979	Tx		Check to insure that the plastic crystal holder is tight against the P.C. board. The socket leads should be bent over flush with the P.C. land and soldered. Place a drop of hot stuff or Zap under the plastic crystal socket holder to make the holder a permanent part of the P.C. board. This modification prevents breakage of the P.C. board land, when the crystal is repeatedly changed. See ECN 95-79, dated April 18, 1979.
1978	Tx		If, when using KPS-18A servos, servo chatter is noted, it can be caused by an excessive sample rate going to the servo. If so, change R7, 150K resistor to a 220K resistor, P/N 057-224. The frame period

KP-2A, AS & AW Sport Series continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1973	Tx		from the encoder should be 20 to 24 milliseconds. R7 may require further adjustment to achieve the required frame period. See EON 79-78 dated Dec. 5, 1978.
1973	Rx		To reduce voltage sensitivity of the receiver to be useable on 4.8 volt nicad batteries, 6 volt dry cells and 7.2 volt nicads in electric cars, add a 5.1 volt Zener diode, P/N 100-103, from the base of the Dynamic Decoupler Q6, MPS6560 to ground. The anode of Zener goes to ground. Change R21, 3.3K resistor installed from collector to base of Dynamic Decoupler, to a 1K resistor, P/N 057-102. This modification does not apply to the later model receiver that uses a TL430 voltage regulator.
1978	Rx		If a receiver double pulses on channel 2, change R20, 100K resistor, to a 470K resistor, P/N 057-474.

KP-4A/6A SPORT SERIES

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1977	Sport Tx		Check to insure that the 4025 FET final amplifier has a 3.9K resistor from the gate of Q13 to the junction of C12, C18 and L2, to properly bias the FET. The resistor may be on the top or bottom of the P.C. board. All Sport Series transmitter and receiver packs use low rate cells, i.e., C/10 charge rate. Do not attempt to charge them at high rate.
1977	Sport Rx		Check KPR-4A receivers to insure that the tap on the antenna coil is not too close to an IF can where it may short to the IF can. If it is, either insert and RTV in place and a small piece of fish paper between the coil and IF can, or replace the coil with P/N 103-062 coil which has the antenna tap on the opposite side. Solder the antenna wire into the hole provided which connects to the tap.
1977 - 1979	Tx Mechanics		If it is necessary to change an electrical trim pot in the gimbal assembly, the trim pot wipers must be set at the low resistance end to prevent excessive trim travel.
1977-- 1978	Rx		Some decoders will, with some servos, cause a miscount of channels 3 & 4 when using an SSS 4017 I.C. Replace the SSS 4017 with a Fairchild 4017B. See ECN dated, April 5, 1978.

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1978 - 1979	6A FM Rx		Change C7, 1uf tantalum capacitor to .47uf,tantalum capacitor, P/N 116-011. Set up the transmitter deviation so that at the Rx detector test point (pin 8 of I.C. S041 or top of 47K resistor) the detected pulse amplitude with a strong Tx signal is plus - and -minus 0.25 to 0.30 volt above and below the quiescent D.C. level at this test point (measured with Tx off).
1977 - 1973	Rx	72 MHz	Some 72 MHz receivers may show a lack of interference rejection caused by overcoupling in the receiver. If so, change C2, the 1pf silver mica capacitor to a .5pf tubular ceramic capacitor, P/N 114-001. Sleeve and RTV the new capacitor to prevent shorting to IF can. See ECN 74-7 78, dated August 18, 1978.
1977 - 1978	Wall Xfmr		A plastic strain relief disc, P/N 120-092, is available for use with plastic cap P/N 120-038 and 120-071, used on wall transformers to prevent rotation of the wires. See ECN 76-78, dated October 20, 1978.
1977 - 1978	Rx		If the reset period is less than 1 millisecond, change R24. 100K resistor to 82K, P/N 057-823. This should bring the reset period to an acceptable time, i.e., greater than 1 millisecond. See ECN 90-79, dated March 23, 1979.

KP-4A & 6A Sport Series continued

<u>Year/ Series</u>	<u>Unit</u>	<u>Freq</u>	<u>Modification</u>
1978	Tx		If L2 in the buffer stage does not tune or peak properly, change CI8, a 10pf to a 15pf capacitor, P/N 113-005.
1978 - 1979	KPR-6A FM	53 MHz	To improve the starting of the oscillator on a 53 MHz FM receiver, change C6, 22pf capacitor to 33pf capacitor, P/N 117-007. See ECN 93-79 dated April 11, 1979.
1978 - 1979	KPR-6A FM		At low temperatures, the LM353 OP Amp, may exhibit a decrease in gain and leakage, therefore change R2, 330K resistor, to a 1 meg resistor, P/N 057-105. See ECN 97-79, dated April 23, 1979.
1977 - 1978	Sport Tx		Check all units to insure that there is a piece of buss wire on resistor lead soldered to the antenna terminal and P.C. board. Purpose of the wire is to reinforce the connection to prevent the joint from breaking loose due to flexing of the case when Tx antenna is extended.
1978 - 1979	KPR-6A FM Rx	53 MHz	To improve IF bandpass ripple, add a 5.6K resistor, P/N 057-562, in parallel to the yellow IF transformer between pins 2 and 3 of 1C S042. Drill two holes in the P.C. board and add the 1/4W, 5.6K resistor vertically, positioning it between the yellow IF can and IC S042. Solder the short resistor lead to pin 2, and long-lead with sleeving, to pin 3 of 1C S042. Receiver tune-up remains the same.

SERVOS

<u>Year/ Series</u>	<u>Type</u>	<u>Modification</u>
KPS-9		Capacitor Q601 should be changed to a 2N4250 Feedback transistor to insure proper operation.
KPS-9	Capacitor Feedback	Move C607, 1uf tantalum capacitor from B plus to center tap (white wire) to obtain better pulse stretcher operation.
KPS-9	Capacitor Feedback	When replacing the motors, remove the red wire from the P.C. board and motor and discard. Move the black wire to the junction of the collectors of Q608/Q609. Attach the white wire and black wire directly to the motor terminals. Wire in a .05uf disc capacitor across the motor the same as used on all other servos, as shown in figure 43, Series '71 Manual.
KPS-9	Capacitor Feedback	If the capacitor feedback element is bad, replace unit with a 350-001 modification kit. This converts the servo to a feedback pot type KPS-9A servo versus capacitor feedback.
KPS-10	Gold Medal	When replacing gears in the older servos, the entire gear set should be replaced, due to a change in gear design and size.
KPS-11/ 11A		When replacing gears in the older servos, the entire gear set should be replaced, due to a change in gear material.

Servos continued

<u>Year/ Series</u>	<u>Type</u>	<u>Modification</u>
KPS-12		When changing the old flat top cases to the new arched style, make sure to use the longer gear pin, P/N 500-061.
All 1972 - 1973	I.C. Servos	Change the dead band capacitor C1 from 680pf to a .001uf disc capacitor, P/N 113-012, to reduce servo jitter.
1973 - 1974	KPS-14 & KPS-15	Remove adjustable centering shaft from servo since it can slip causing the servo center to change in flight. Replace the shaft with the knurled shaft, P/N 500-034.
Late 1975 & Early 1976	All	On some SG I.C. servo chips, P/N 110-113, used in servos, you will find an 18 ohm resistor in series with C2, the .47uf tantalum capacitor. In the event it becomes necessary to replace the I.C. chip in these servos with the 110-100 servo I.C. chip, it will be necessary to remove the 18 ohm resistor also.
Early 1975	All	On some SG I.C. servo chips used in production servos, there was a batch of these I.C. chips in May of 1975 that had a wider deadband. When working with one of these servos, it may be necessary to remove the deadband capacitor C1, a 680pf or .001uf capacitor, entirely from the servo to bring the deadband into tolerance, i.e., + 5 to 8 microseconds.

Servos continued

<u>Year/ Series</u>	<u>Type</u>	<u>Modification</u>
All	I.C. Servos	If servo draws excessive current in one direction and no other problems are apparent, C5 and 4.7uf motor capacitor, P/N 116-013, should be checked for leakage.
Sport Series	KPS-14IIA & KPS-15IIA	To increase the throw change the IK travel adjust resistor to 1.5K, P/N 057-152.
Sport Series	KPS-15A	If servo chatter occurs when used with a 2 channel unit, decrease the value of the pulse stretching resistor from 150K to 120K. If units still chatter, reduce the same resistor to 100K.
Gold & Sport	KPS-12, KPS-14II, KPS-17, & KPR-3/5	The previous motor used in these servos, P/N 800-007, is no longer available. It is replaced by P/N 800-011, which has smaller mounting dimensions. In order to use the new motor in an old servo case, a molded collar, P/N 901-493, must be used as an adapter. See ECN 127-79, dated October 8, 1979.
All	I.C. Servos	Check to insure that a small strip of mylar tape, P/N 990-013, is placed around the bottom of the motor to prevent the P.C. board from intermittently shorting out on the motor.