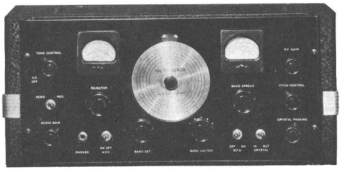
# OPERATING INSTRUCTIONS
# SKY CHALLENGER II
# MODEL S-18 & SX-18



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# OPERATING INSTRUCTIONS - SKY CHALLENGER II MODELS S-18, SX-18

THE SKY CHALLENGER II IS A 5 BAND 9 TUBE SUPERHETERODYNE RECEIVER COVERING THE FOLLOWING FREQUENCIES:

| BANDS | COVERAGE | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 545 | TO | 1230 | KC | ( 550 | TO | 243 | METERS) |
| 2 | 1.18 | TO | 2.85 | MC | ( 254 | TO | 105 | METERS) |
| 3 | 2.75 | TO | 6.82 | MC | ( 109 | TO | 44 | METERS) |
| 4 | 6.75 | TO | 16.40 | MC | ( 45 | TO | 18.3 | METERS) |
| 5 | 15.40 | TO | 38.10 | MC | (19.5 | TO | 7.85 | METERS) |

SEPARATE COILS ARE USED TO COVER EACH BAND. INDUCTIVE COUPLING TO THE ANTENNA PERMITS THE MAXIMUM TRANSFER OF SIGNAL ENERGY FROM EACH SEPARATE PRIMARY TO THE PARTICULAR SECONDARY SOIL IN THE CIRCUIT. THE UNUSED SOILS ARE SHORTED.

THE MAIN DIAL IS CALIBRATED IN KILOCYCLES ON BAND #1 AND IN MEGACYCLES ON THE REMAINING FOUR BANDS. THE CALIBRATION OF THE MAIN DIAL WILL HOLD ACCURACY ONLY WHEN THE BAND-SPREAD DIAL IS SET AT "0", WHICH IS THE POSITION OF MINIMUM CAPACITY OF THE BAND-SPREAD SECTION.

## ANTENNA

IN THE BACK OF THE CHASSIS WILL BE FOUND THE ANTENNA, DOUBLET AND GROUND TERMINAL STRIP. WHEN A CONVENTIONAL ANTENNA IS USED IT SHOULD BE CONNECTED TO A1. WHEN USING THIS TYPE OF ANTENNA BE SURE THE JUMPER REMAINS CONNECTED TO A2 AND G. IF A DOUBLET ANTENNA IS USED THE JUMPER SHOULD BE REMOVED AND THE TWO WIRES OF THE DOUBLET LEAD-IN CONNECTED TO A1 AND A2 RESPECTIVELY. PLEASE REMEMBER THAT THE NORMAL SHORT WAVE DOUBLET ANTENNA IS DESIGNED TO WORK BEST ON THE SHORT WAVE BROADCAST FREQUENCIES. IT WILL NOT PERFORM EQUALLY WELL ON THE AMATEUR BANDS, OR FREQUENCIES IN BETWEEN THE SHORT WAVE BROADCAST CHANNELS. ANTENNA LOCATION, LENGTH AND TYPE PLAY A MOST IMPORTANT PART IN THE SUCCESSFUL OPERATION OF THE RECEIVER. ON THE HIGHER FREQUENCIES COVERED BY THIS UNIT IT IS PARTICULARLY IMPORTANT TO USE THE PROPER TYPE OF ANTENNA. FOR MOST EFFICIENT ANTENNA SYSTEMS YOU ARE REFERRED TO THE ANTENNA DESIGN SECTION OF THE A.R.R.L. HANDBOOK, AS WELL AS CURRENT RADIO PERIODICALS. IT IS SUGGESTED THAT A LITTLE EXPERIMENTING BE DONE WITH ANTENNAE SO THAT YOU WILL EXPERIENCE THE MAXIMUM IN PERFORMANCE FROM YOUR RECEIVER.

## OPERATION

PLUG THE CORD ON THE RECEIVER INTO THE POWER SOCKET. (UNLESS OTHERWISE SPECIFIED THE RECEIVER OPERATES ON 60 CYCLE 110-120 VOLT ALTERNATING CURRENT.) TURN THE CONTROL MARKED "TONE" TO THE RIGHT. THIS WILL TURN THE RECEIVER ON. DURING THE TIME THE RECEIVER IS WARMING UP ALSO TURN THE "R.F. GAIN" AND "A.F.GAIN" KNOBS TO THE RIGHT. THE RECEIVER IS SHIPPED WITH THE BAND CHANGE SWITCH IN THEHIGHEST FREQUENCY POSITION. ADJUST THE "BANDS" SWITCH UNTIL THE POINTER ON THE KNOB INDICATES THAT

YOU HAVE THE BAND YOU WISH TO TUNE IN THE CIRCUIT. WHEN LISTENING FOR DISTANT OR POSSIBLY WEAK STATIONS, IT IS RECOMMENDED THAT THE CONTROL MARKED "BFO" BE USED BY SNAPPING THE SWITCH TO THE "ON" POSITION. ONCE THE TELEPHONE SIGNALS HAVE BEEN LOCATED THE BFO SHOULD BE TURNED OFF OR A CONTINUOUS WHISTLE WILL RESULT. WHEN LISTENING FOR OR TO CW CODE TRANSMISSIONS THE BFO MUST BE LEFT ON. THE "PITCH CONTROL" WILL PROVE MOST HELPFUL IN CHANGING THE BEAT NOTE TO ONE MOST PLEASING TO THE OPERATOR. IT IS ADVISABLE TO HAVE THE "AVC" SWITCH IN THE OFF POSITION WHENEVER THE BFO SWITCH IS ON.

## THE TUBE LINE-UP

6K7 PRE-SELECTOR, R.F. AMPLIFIER

6L7 1ST DETECTOR-MIXER

6J5 SIGNAL FREQUENCY OSCILLATOR

6K7 1ST I. F. AMPLIFIER

6K7 2ND I. F. AMPLIFIER

6Q7 2ND DETECTOR, AVC, 1ST STAGE OF AUDIO

6F6 2ND AUDIO STAGE

6J7 BEAT FREQUENCY OSCILLATOR

80 FULL WAVE RECTIFIER

THE 6K7 R. F. STAGE GIVES MAXIMUM GAIN IN INVERSE RELATION TO FREQUENCY AND PROVIDES INCREASED SELECTIVITY.

THE FIRST DETECTOR-MIXER IS A 6L7. THE OUTPUT OF THE 6J5 SIGNAL FREQUENCY OSCILLATOR IS ELECTRON COUPLED TO THE INJECTOR, OR # 3 GRID, OF THE 6L7. BECAUSE NO OSCILLATOR PLATE CURRENT FLOWS IN THE 1ST DETECTOR THE RATIO OF SIGNAL TO NOISE IS MORE FAVORABLE THAN THAT OBTAINED IN A COMPOSITE TUBE, OR IN CIRCUITS WHERE THE CATHODES OF TWO TUBES ARE TIED TOGETHER.

THE 6J5 OSCILLATOR HAS SEPARATE COILS FOR EACH BAND. SUPERIOR OVER-ALL PERFORMANCE OF THE SKY CHALLENGER II IS IN PART DUE TO THE DESIGN OF THE SIGNAL FREQUENCY OSCILLATOR. NO HARMONICS OF THE OSCILLATOR ARE USED ON ANY OF THE BANDS COVERED BY THIS RECEIVER.

THE TWO 6K7 I. F. AMPLIFIER STAGES USE IRON-CORE TRANSFORMERS WHICH RESONATE AT 465 KC. THIS TYPE OF TRANSFORMER HAS SO DEFINITELY SHOWN ITS SUPERIORITY OVER THE AIR CORE TYPE AS TO WARRANT ITS USE IN THE SKY CHALLENGER II . TREMENDOUS GAIN, AND A BETTER SIGNAL TO NOISE RATIO ARE BUT TWO OF THE MANY ADVANTAGES OF THE IRON-CORE SYSTEM.

THE 6J7 BEAT OSCILLATOR OUTPUT IS COUPLED TO THE DIODE PLATES OF THE 6Q7 SECOND DETECTOR. THE 6J7 OSCILLATOR IS ELECTRON COUPLED.

THE 6F6 AUDIO OUTPUT STAGE IS CAPABLE OF DELIVERING 3.5 WATTS OF AUDIO.

## SPEAKER - HEADPHONES ETC.

ON THE LOWER RIGHT HAND CORNER OF THE BACK OF THE CHASSIS YOU WILL FIND A TERMINAL STRIP MARKED 5000 OHMS. TO THIS STRIP SHOULD BE CONNECTED THE HALLICRAFTERS PERMANENT MAGNET DYNAMIC SPEAKER. THE TERMINAL STRIP DIRECTLY ABOVE THE 5000 OHM STRIP AND MARKED 500 OHMS CAN BE CONNECTED TO A LOAD OF THAT IMPEDANCE VALUE. THE OTHER TERMINAL STRIP TO THE RIGHT OF THESE TWO, AND MARKED "EXT SW", IS USED TO MAKE THE RECEIVER TEMPORARILY INOPERATIVE FOR STAND-BY DURING TRANSMISSION PERIODS. THESE TWO TERMINALS SHOULD BE CONNECTED TO ANEXTERNAL SWITCH WITHER IN CONJUNCTION WITH THE POWER SWITCH ON YOUR TRANSMITTER OR A MANUALLY OPERATED SWITCH AT YOUR OPERATING POSITION. WHEN USING AN EXTERNAL SWITCH THE SEND RECEIVE SWITCH ON THE RECEIVER SHOULD BE IN THE SEND POSITION.

IN THIS RECEIVER THE SPEAKER IS NOT A PORTION OF THE FILTER SYSTEM. THIS ALLOWS THE RECEIVER TO BE OPERATED INDEPENDENTLY OF THE SPEAKER. FOR MOST SATISFACTORY RESULTS AN 8 INCH HALLICRAFTERS SPEAKER SHOULD BE USED WITH THE SKY CHALLENGER II .

THE HEADPHONE JACK IS CONNECTED TO THE PLATE OF THE 6Q7 TUBE THROUGH A CONDENSER. THE POSSIBILITY OF SHOCK TO THE OPERATOR IS ELIMINATED BY HAVING NO DIRECT CURRENT FLOWING THROUGH THE HEADPHONES. CRYSTAL TYPE HEADPHONES CAN BE USED WITH THIS RECEIVER WITHOUT USING A SPECIAL COUPLING TRANSFORMER.

## CRYSTAL OPERATION

TO PROPERLY ADJUST THE CRYSTAL CIRCUIT FOR BEST PERFORMANCE THE FOLLOWING PROCEDURE SHOULD BE CAREFULLY FOLLOWED:

TUNE IN SOME STATION TRANSMITTING CONTINUOUSLY. BE VERY CAREFUL TO GET THE SIGNAL RIGHT ON THE NOSE. AFTER YOU ARE SURE THAT YOU HAVE THE SIGNAL RESONATED PERFECTLY, SNAP THE "BFO" SWITCH TO THE "ON" POSITION. YOU SHOULD HEAR A WHISTLE, OR BEAT NOTE. AFTER THE BFO IS ON ROTATION OF THE "PITCH CONTROL" WILL CHANGE THE TONE OF THE BEAT NOTE. PROPER OPERATION OF THIS CONTROL WILL BE INDICATED BY HEARING THE SIGNAL TWICE IN ONE COMPLETE ROTATION OF THE KNOB; THERE BEING TWO POSITIONS AT WHICH NO SIGNAL, OR WHISTLE, WILL BE HEARD. THESE TWO POSITIONS ARE KNOWN AS THE "ZERO BEAT" POSITIONS.

NOW SNAP THE "CRYSTAL SWITCH" TO THE "ON" POSITION. YOU WILL NOTICE A GREAT REDUCTION IN NOISE. CAREFULLY RETUNE THE SIGNAL ON THE BAND SPREAD DIAL. NOTICE HOW SHARPLY THE SIGNAL PEAKS. NOW TUNE THROUGH THE SIGNAL AND FIND WHICH SIDE OF THE SIGNAL IS THE WEAKER. TUNE IN THE WEAKER SIDE AND THEN CAREFULLY ADJUST THE "CRYSTAL PHASING" CONTROL UNTIL THE SIGNAL IS INAUDIBLE. GOING BACK TO THE OTHER SIDE OF THE SIGNAL SHOULD FIND NO CHANGE IN ITS VOLUME, AND KNIFE-LIKE SELECTIVITY RESULTING. USE WHICHEVER SIDE OF ZERO-BEAT ADJUSTMENT OF THE PITCH CONTROL, IN CONJUNCTION WITH CRITICAL ADJUSTMENT OF THE PHASING CONTROL GIVES THE GREATER REJECTION OF THE INTERFERING SIGNAL.

THE PHASING CONTROL AFFECTS THE SENSITIVITY AND SELECTIVITY OF THE RECEIVER WHETHER THE CRYSTAL IS IN THE CIRCUIT OR NOT. THE CRYSTAL MAY BE USED WHEN RECEIVING TELEPHONE SIGNALS WITH SOME SACRIFICE IN THEIR QUALITY DUE TO THE EXTREME SELECTIVITY DEVELOPED.

# THE IMAGE REJECTOR

THE REJECTOR CIRCUIT INCORPORATED IN THE SKY CHALLENGER II REPRESENTS A NOTEWORTHY CONTRIBUTION BY THE HALLICRAFTERS TO IMAGE-FREE HIGH-FREQUENCY RECEPTION. IT HAS LONG BEEN APPRECIATED THAT ADDITIONAL STAGES OF RADIO FREQUENCY AMPLIFICATION WAS NOT THE CORRECT ANSWER TO IMAGE SUPPRESSION. THROUGH THE USE OF THE "INFINITE IMAGE REJECTOR" IN THE SKY CHALLENGER II ALL PREVIOUS IMAGE RATIOS ARE OUT-MODED. IMAGE REJECTION OF INFINITY/1 IS NOW POSSIBLE.

THE REJECTOR IS UNIQUE. BECAUSE OF THAT YOUR ATTENTION IS CLOSELY DRAWN TO THE PROPER OPERATION OF THE CONTROL AS WELL AS WHAT TO EXPECT FROM ITS USE.

THE REJECTOR IS SWITCHED INTO THE CIRCUIT ONLY WHEN THE RECEIVER IS OPERATED ON BANDS #4 AND #5. YOU WILL NOTICE A LIGHT APPEAR BEHIND THE PARTICULAR CALIBRATED SCALE THAT SHOULD BE USED.

LET US OPERATE THE RECEIVER ON THE 14 MC, OR 20 METER AMATEUR BAND. IN TUNING ACROSS THE BAND YOU RUN ACROSS THE IMAGE OF SOME COMMERCIAL STATION, THE FUNDAMENTAL OF THIS STATION AS WE ALL KNOW IS REMOVED FROM THE 20 METER BAND BY DOUBLE THE FREQUENCY TO WHICH THE I. F. AMPLIFIER OF THE RECEIVER IS TUNED. NOW ADJUST THE REJECTOR CONTROL CAREFULLY IN THE VICINITY OF 14 MC ON THE CALIBRATED REJECTOR DIAL. WHEN PROPERLY ADJUSTED THE IMAGE WILL BE COMPLETELY ELIMINATED WITHOUT SERIOUSLY AFFECTING THE SENSITIVITY OF THE RECEIVER ON THE FREQUENCY TO WHICH IT HAD BEEN TUNED.

SHOULD YOU BE LISTENING AT A FREQUENCY NOT BEING BOTHERED WITH IMAGES, AND YOU DO NOT WISH TO USE THE REJECTOR LEAVE THE CONTROL AS FOLLOWS FOR THE TWO AMATEUR BANDS COVERED BY THE REJECTOR CIRCUIT.

20 METERS – LEAVE THE REJECTOR AT APPROXIMATELY 15 MC. (ON THIS BAND THE 14 MC HIGH FREQUENCY OSCILLATOR IS ON THE HIGH-FREQUENCY SIDE).
NOTE: THE 7 MC OR 40 METER BAND IS ALSO ON BAND #4 OF THE RECEIVER. WHEN RECEIVING ON 40 METERS THE REJECTOR CONTROL SHOULD BE LEFT 9 MC. USE OF THE REJECTOR CIRCUIT ON THIS BAND IS NOT NECESSARY.

10 METERS – LEAVE THE REJECTOR AT APPROXIMATELY 27 MC. (THE OSCILLATOR 28 MC IS ON THE LOW FREQUENCY SIDE ON THIS BAND).

CAUTION: SHOULD YOU NOT BE ABLE TO GET SIGNALS THROUGH AT ALL CHECK THESETTING OF THE REJECTOR CONTROL. IT IS POSSIBLE THAT YOU HAVE THE REJECTOR CONTROL AT A POINT WHERE THE FREQUENCY TO WHICH YOU WISH TO LISTEN IS BEING REJECTED, OR "BEING DROPPED IN THE SLOT".

ALWAYS REMEMBER TO KEEP THE REJECTOR CONTROL SET AT APPROXIMATELY THE SAME FREQUENCY AS THAT TO WHICH YOU ARE LISTENING. WHEN YOU MOVE THE MAIN TUNING CONTROL FOLLOW UP WITH THE REJECTOR OR OTHERWISE YOU WILL RUN INTO THE POSSIBILITY OF LEAVING YOUR MAIN TUNING DIAL AT A GROUP OF FREQUENCIES BEING REJECTED.

THE TOTAL POWER CONSUMPTION OF THE SKY CHALLENGER II IS 75 WATTS AT 115 VOLTS 60 CYCLE ALTERNATING CURRENT.

## CONDENSERS

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 250 | MMFD | | | | |
| C2 | 250 | " | | | | |
| C3 | 250 | " | | | | |
| C4 | 15 | " | AIR VARIABLE | | | |
| C5 | .002 | MFD | | | | |
| C6 | .002 | MFD | 400 | VOLT | MICA | |
| C7 | .25 | " | 200 | " | | |
| C8 | .002 | " | | | " | |
| C9- | .05 | " | " | " | | |
| C10 | .002 | " | | | " | |
| C11 | .05 | " | 400 | " | | |
| C12 | 50 | MMFD | | | " | |
| C13 | 25 | " | AIR VARIABLE | | | |
| C14 | .02 | MFD | 200 | VOLT | | |
| C15 | .25 | " | 400 | " | | |
| C16 | .02 | " | 200 | " | | |
| C17 | .1 | " | 400 | " | | |
| C18 | .05 | " | " | " | | |
| C19 | 250 | MMFD | | | | |
| C20 | 500 | " | | | | |
| C21 | 10 | MFD | 25 | " | ELECTROLYTIC | |
| C22 | 250 | MMFD | | | | |
| C23 | .05 | MFD | 200 | " | | |
| C24 | .005 | " | 400 | " | | |
| C25 | .1 | " | " | " | | |
| C26 | .05 | " | " | " | | |
| C27 | .003 | " | | | | |
| C28 | 10 | " | 25 | " | " | |
| C29 | 16 | " | 400 | " | " | WET |
| C30 | 16 | " | " | " | " | " |
| C31 | .01 | " | " | | | |
| C32 | 10 | MMFD | | | | |
| C33 | 250 | " | | | | |
| C34 | .02 | MFD | " | " | | |
| C35 | 25 | MMFD | AIR VARIABLE | | | |
| C36 | 25 | " | | | | |
| C37 | 10 | " | | | | |
| C38 | 200 | " | VARIABLE PAD | | | |
| C39 | 25 | " | MICA | | | |
| C40 | .0012 | MFD | VARIABLE PAD | | | |
| C41 | .0011 | " | " | " | | |
| C42 | .00093 | " | " | " | | |
| C43 | .00039 | " | " | " | | |

## RESISTORS

| No. | OHMS | |
|---|---|---|
| R1 | 250 | |
| R2 | 125 | |
| R3 | 100,000 | |
| R4 | 30,000 | |
| R5 | 10,000 | R. F. GAIN CONTROL |
| R6 | 250 | |
| R7 | 15,000 | |
| R8 | 100,000 | |
| R9 | 600 | |
| R10 | 100,000 | |
| R11 | 30,000 | |
| R12 | 100,000 | |
| R13 | 100,000 | |
| R14 | 1,000 | |
| R15 | 20,000 | |
| R16 | 4,000 | |
| R17 | 500,000 | |
| R18 | 500,000 | VOLUME CONTROL |
| R19 | 1,000,000 | |
| R20 | 500,000 | TONE CONTROL |
| R21 | 100,000 | |
| R22 | 250,000 | |
| R23 | 500 | |
| R24 | 250,000 | |
| R25 | 100,000 | |
| R26 | 100,000 | |
| R27 | 50,000 | |
| R28 | 10,000 | |
| R29 | 50,000 | |

# SCHEMATIC DIAGRAM – SKY CHALLENGER II – MODEL SX-18