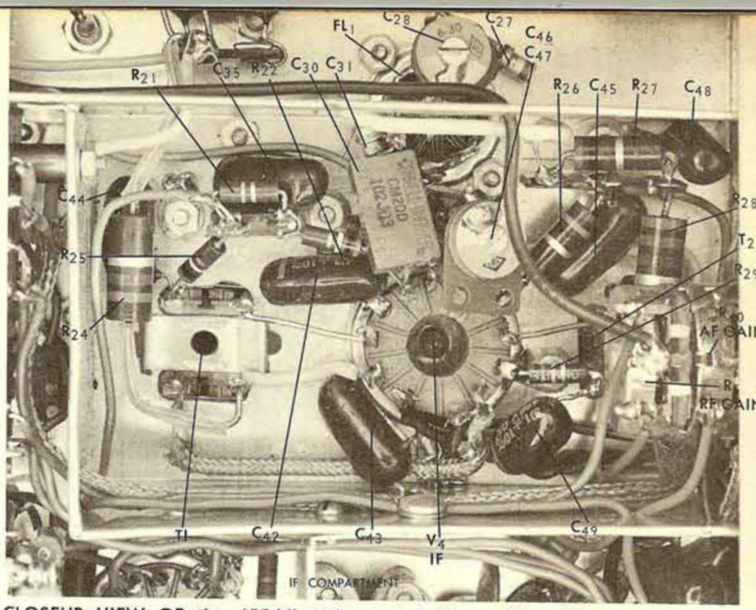
GE TUBES HAM NEWS

SPRING, 1963



CLOSEUP VIEW OF the 455-kilocycle second IF amplifier (V_4) compartment. The neutralizing capacitor (C_{46}) which assures stable operation is on the 12-pin compactron tube socket. Note the shield partition running across the 9-pin miniature tube socket for FL_1.

KCS COMPACTRON

AMATEUR BAND RECEIVER

PART II — Construction, Alignment and Operation

By Norman L. Morgan, W7KCS/9

PART I —

Design and electrical circuit details of the KCS Compactron receiver appeared in the November-December, 1962 issue.

CONSTRUCTION of the KCS Compactron Amateur Band Receiver is outlined in detail in this issue. About 80 to 100 hours are required for assembly and alignment, or about twice the time that assembling a comparable receiver assembled from a commercial kit will take. The mechanical work — drilling the chassis, sub-chassis, dial brackets and assembly, bandswitch and coils, etc. —should be pretty well completed before the wiring is started.

MECHANICAL CONSTRUCTION — The main chassis of the receiver is 8x12x3 inches, of aluminum (*Bud* AC-424, or equivalent). The chassis layout diagram, Fig. 3, shows the mounting dimensions for the components. It is suggested that these be followed closely because of space limitations.

Dimensions shown for the crystal sockets (Y_1 to Y_8) are for *National* type CS-6 ceramic sockets. Other types may require slightly different dimensions. The crystal sockets touch each other to conserve space.

Location of the VFO subchassis is shown in the center of the drawing. The shaft extensions for the various control knobs are shown through the front edge of the chassis. Dashed lines indicate the positions of the shield partitions below the chassis which isolate the various sections of the receiver.

Six ¾-inch long spacers with No. 6-32 threaded holes space the front panel away from the front edge of the chassis. All panel controls are mounted behind the front edge of the chassis, except for the function switch (S_3) and the vernier mechanism for the PRE-SELECT control, which are mounted on the front panel.

THE VFO CHASSIS is a 3¼x2⅛x1⅝-inch miniature aluminum box (*Bud* CU-3001 *Minibox*, or equivalent). It is drilled according to the layout diagram, Fig. 4. When drilling the bottom section of the box, clamp it to the main chassis in the proper location and drill all holes through both parts at the same time to assure good alignment.

The front wall of the bottom cover is cut out as shown in Fig. 4, and a 1⅝x3 3/16-inch cover plate made of 1/32-inch thick sheet aluminum is fastened over the opening with self-tapping screws. A ⅜-inch diameter hole in the cover is drilled for the lead running to C_{24B}. A completely-enclosed oscillator box is necessary to prevent feedback from the oscillator.

THE CRYSTAL OSCILLATOR coil assembly (L_{13} to L_{20}) is built into the home-made box shown in Fig. 6. This box is made of 1/32-inch thick sheet aluminum in two parts, the main body and a small cover. The box is folded after the various holes are drilled. The box is then centered over the large cutout in the chassis above S_{1E} and S_{1F}. Matching holes for machine screws are drilled through the box bottom flanges into the main chassis.

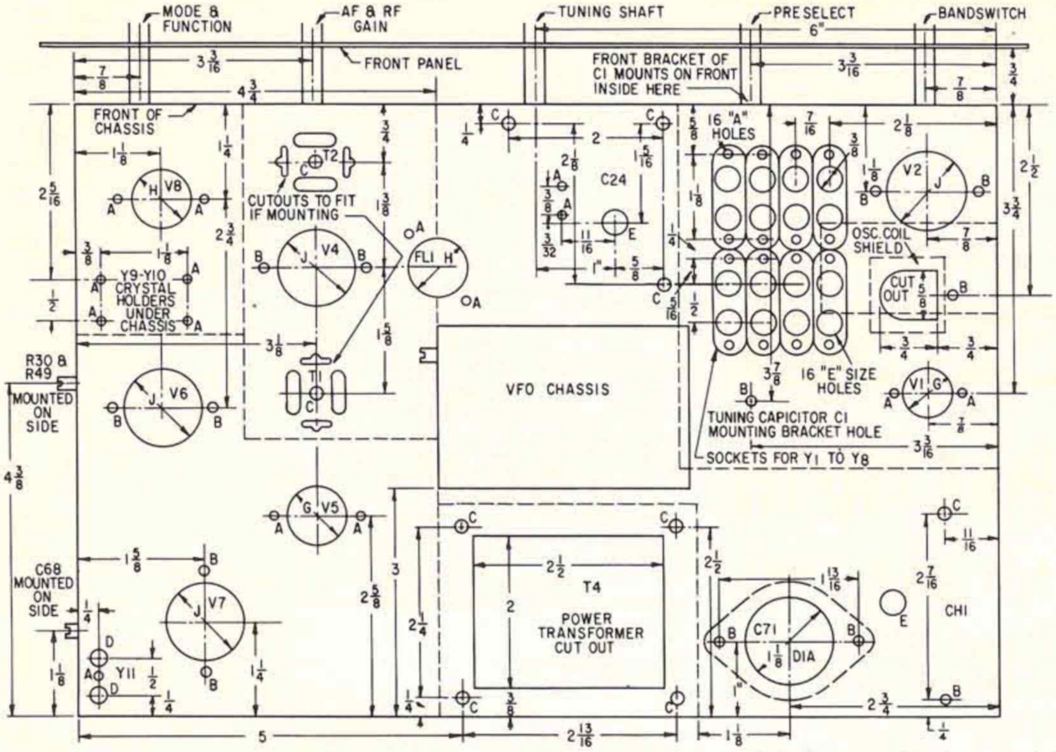
Shield partitions made from 1/32-inch thick sheet aluminum are next installed in the chassis in the locations shown in Fig. 6. Flanges ¼-inch wide are bent on the sides and ends to facilitate mounting on the underside of the chassis deck, and to the side walls of the chassis and adjacent shields. All shields are 2¾-inches wide. The straight shield running from front to rear between the worm-gear drive and the 455-kilocycle IF amplifier runs across the 9-pin miniature socket for the mechanical filter. A slot is hacksawed across the portion of the socket in line with pins 3 and 8 down to the metal mounting ring on the socket. The partition is then cut out to fit into the slot. This effectively shields the input and output circuits of the mechanical filter, preventing the IF signal from leaking around the filter.

W7KCS/9 DEMONSTRATES the performance of his new KCS Compactron receiver to a youthful aspiring novice radio amateur.

The small 2¼x1 3/16-inch "U" shaped shield which fits onto the bandswitch (S_1) should have a ¼-inch wide slot cut into it so that it will slide over the switch shaft and side rods. This shield encloses S_{1E} and S_{1F}—the crystal oscillator switch sections—and isolates segments S_{1A} and S_{1B} from segments S_{1C} and S_{1D}.

THE CABINET for the receiver is a *Bud* type SB-2140 *Shadow Cabinet* and is 14¼-inches wide, 8 inches high, and 10 inches deep. A home-made cabinet for the receiver — similar in construction to that described for the LWM-3 transceiver in the January-February, 1962 issue of *G-E HAM NEWS*—could be made from solid and perforated sheet

IN THIS ISSUE



NOTE: Fig. 1, block diagram, and Fig. 2, schematic diagram, appeared in Part I of this article in the November-December, 1962 issue.

FIG. 3. MAIN CHASSIS layout diagram of the KCS receiver. Dimensions shown are those for the parts actually used in building the model receiver. Hole sizes are given by code letter, per TABLE III — HOLE SIZE CHART. Note that the PRE-SELECT tuning capacitor (C_1) mounts on brackets beneath the eight crystal sockets for Y_1 to Y_8. The cutout for the power transformer (T_4) is needed only if a half-shell type transformer is used.

aluminum. It would be a couple inches smaller in width and depth, and about an inch shorter in height and still provide clearance for the controls coming out the side of the main chassis.

Two 6¼x3-inch holes are cut on either side of the cabinet and covered on the inside with do-it-yourself perforated aluminum to provide adequate cross-ventilation for cooling the internal compartment. The 3x5-inch oval speaker is mounted inside the top of the cabinet near the rear with baffle material between it and the inside of the cabinet.

The front panel should be drilled as shown in Fig. 7 by clamping it to the chassis and all holes drilled through both units at once to assure good alignment. In cases where the holes in the front panel are larger than those in the chassis the smaller size hole is drilled first and the front panel removed before the larger hole is drilled.

THE BANDSWITCH ASSEMBLY is built around two aluminum brackets on which the RF amplifier grid and plate coils (L_1 to L_6, and L_7 to L_{12}) are mounted. Drilling and bending instructions for these brackets are shown in the bandswitch assembly diagram, Fig. 8. The brackets are first used as templates to drill ¼-inch diameter holes in the front and rear of the chassis, and the front panel, through which an alignment screwdriver is later inserted to adjust the RF coils.

The bandswitch is then disassembled and the front bracket inserted immediately behind the switch detent assembly. Then, the spacers and switch wafer sections are reassembled in the same order as they were originally. The rear bracket is added last at the rear of the switch, held in place by the side rods. All coils are later wound and installed on the bandswitch before it is mounted in the main chassis.

THE PRE-SELECT tuning capacitor (C_1) is suspended below the chassis on two brackets formed as shown in Fig. 9. The rear grounding lug on the capacitor frame is removed, and two No. 6-32 holes are drilled and tapped in the back frame. Be careful when doing this to not drill into the capacitor plates, or disturb the plate spacing. When fastening the rear bracket onto the capacitor, do not overtighten the screws which might deform the capacitor frame and cause binding.

The front mounting bracket is held on with the large nut at the front of the capacitor. The bracket is fastened to the inside of the chassis front wall with one of the machine screws which hold a ¾-inch long panel spacer.

The tuning dial for the PRE-SELECT capacitor (C_1) is a planetary reduction type having a reduction ratio of 5 or 6 to 1. On this model, a *Lunar* 36-millimeter (1½-inch) diameter drive and dial was used. The knob was changed to one which matched the other control knobs on the panel. Several types of miniature planetary reduction drives are available: one readily-obtainable type is a Jackson precision planetary-vernier drive sold by Arrow Electronics, Inc.[1] The drive is fastened to the front of the chassis, or rear side of the panel, whichever is the proper location to couple to the shaft on C_1.

TUBES

HAM NEWS

Presents Electronic Components Application Notes from the 999 radio amateurs at GENERAL ELECTRIC

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TABLE III HOLE SIZE CHART

"A" drill — No. 31 clears 4-40 screw.
"B" drill — No. 26 clears 6-32 screw.
"C" drill — No. 9 (.196) clears 10-32 screw.
"D" drill — ¼-inch in diameter.
"E" drill — ⅜-inch in diameter.
"F" drill — ½-inch in diameter.
"G" socket punch — ⅝-inch in diameter.
"H" socket punch — ¾-inch in diameter.
"J" socket punch — 1 1/16-inch diameter.

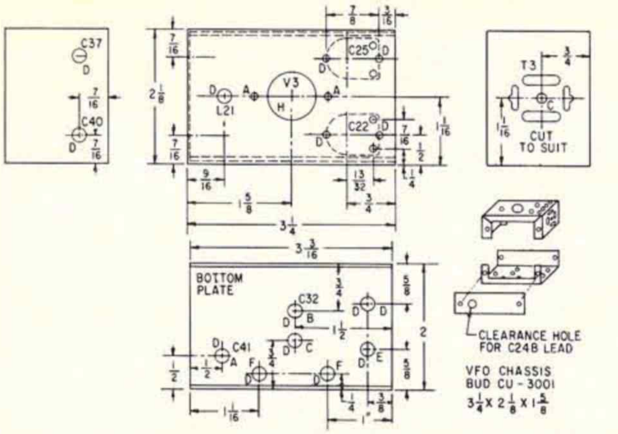


FIG. 4. VFO SUBCHASSIS layout diagram. Holes in bottom plate marked "A" through "F" are for small feedthru bushings (National TPD), and C_{32} and C_{41}. They should be drilled through the main chassis to allow connections to be made below the chassis.

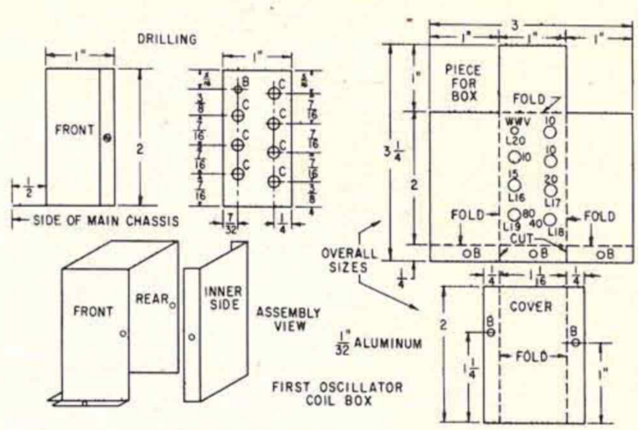


FIG. 5. FORMING AND DRILLING diagrams for the first oscillator coil box which houses L_{13} to L_{20} on the chassis of the receiver. Holes for the coils are drilled after folding the main piece. Matching holes for No. 6-32 machine screws are drilled into the main chassis.

THE GEAR DRIVE used on the tuning dial is a 50-to-1 ratio right angle worm gear drive obtained from any tuning unit (TU-5B, etc.) from a BC-191 or BC-375 surplus transmitter. It was used on the master-oscillator dial. The worm-gear output shaft, ¼-inch in diameter, is removed from the gear so that the shaft of C_{24} will fit into it. The worm shaft extension comes loose, exposing a 3/16-inch diameter threaded shaft. A coupling with a ¼-inch diameter hole and ¼- to 3/16-inch reducing bushing is then slipped onto the threaded stub shaft. A ¼-inch diameter shaft fastened into the other end of the coupling runs out to the tuning knob.

The worm-gear unit is mounted on the underside of the chassis with three 7/32-inch long spacers and No. 8-32x½-inch long machine screws. Capacitor C_{24} is mounted vertically on the chassis between the VFO box and the panel with two No. 6-32 machine screws and the 1/16-inch thick washers provided with the capacitor to space it above the chassis. The two mounting holes on the front frame are not threaded, and thus are tapped for a 6-32 thread. The large nut on the front shaft also is tightened to help hold the capacitor securely.

The drive gear should be filed down and smoothed on the capacitor side so that there is no step in the hub. This leaves an approximate ¼-inch-long hub which may be drilled and tapped for two No. 6-32 screws. This gear is then adjusted on the capacitor shaft, the worm and leg assembly is placed over the gear with the spacers between the legs and chassis, and the worm and gear snapped together. The gear will have to be sprung slightly during this operation. A clearance hole is drilled in the front edge of the chassis to provide a hole for the tuning shaft. Some side clearance may have to be provided for the three mounting screws for the gear unit so as not to bind with the capacitor gear. Insertion of the three No. 8-32 screws completes this assembly.

THE TUNING DIAL assembly is next undertaken by first cutting out and drilling the two brackets shown in Fig. 10 from 1/16-inch thick sheet aluminum, which support the tuning scale drum with the frequency calibrations in it. These brackets fasten to the rear of the panel with the same machine screws which hold the escutcheon plate on the front side. Dial assembly details are shown in Fig. 11, and the top view of the receiver (see page 3, November-December, 1962 issue).

The tuning dial drum is made from 1-inch diameter, 1/16-inch wall thickness clear plastic tubing, 6½ inches long. The ends fit into the 1-inch diameter holes in the support brackets and should turn smoothly without binding. A calibrated scale card — preferably printed on translucent paper — is then inserted inside this tubing. Back lighting is provided by the pilot light and bracket (PL_1) mounted on the right-hand support bracket.

A runner plate for the dial pointer is made from 1/16-inch thick aluminum 6 inches long and ½-inch wide. It is fastened to the step in the dial drum brackets with No. 6-32 machine screws. Two small plastic idler pulleys are then mounted on top of the brackets to support the ends of the dial cord. The dial pointer is made of very thin aluminum or other light metal with two tabs on the back which attach to the dial cord. After the correct location is found for the pointer, it is cemented to the dial cord.

The pointer drive pulley — of ¼-inch thick clear plastic, 3 9/16-inches in diameter — is cut out first with a coping saw, then mounted in a drill press or electric drill and filed round. Then, a groove is filed in the rim with the corner of a file so that the bottom of the groove measures exactly 3½ inches in diameter. It is cemented to the top shaft of C_{24} on this receiver, but a more secure mounting can be made using a small brass hub with a ¼-inch diameter hole.

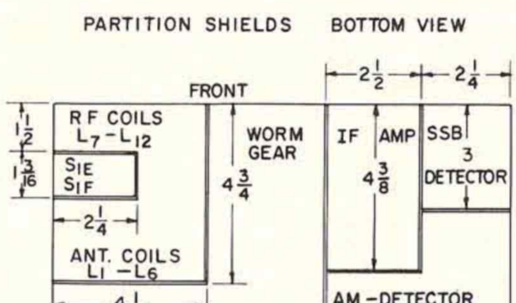


FIG. 6. SHIELD PARTITION locations inside the main chassis. An "L" shaped shield encloses the entire RF coil section, with a small "U" shaped shield in the middle of the bandswitch. A straight shield runs from the front to the back of the chassis alongside the IF amplifier, and a small straight shield runs from this to the side of the main chassis.

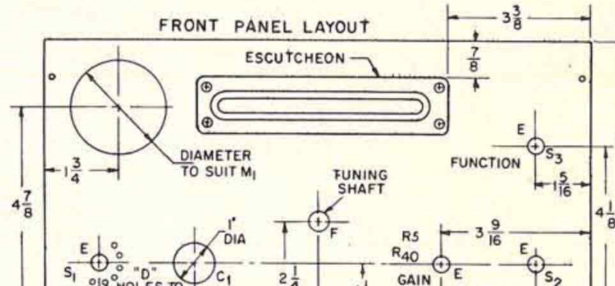
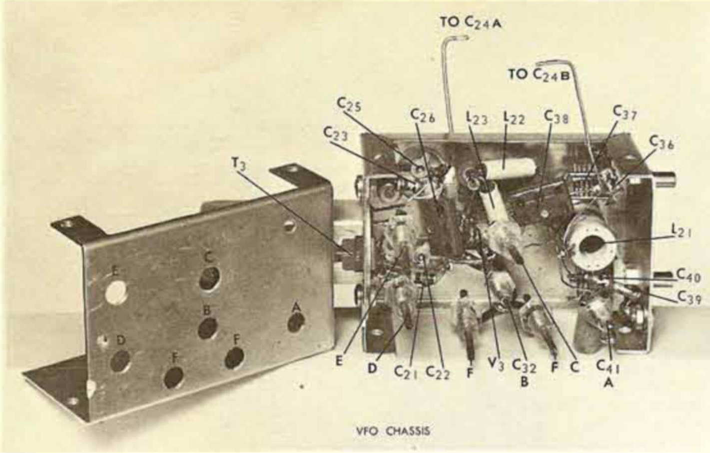


FIG. 7. PANEL LAYOUT diagram for the receiver. Holes for the lower row of controls are drilled through into the front of the chassis, except for the 1-inch diameter hole for the planetary reduction drive on C_1, which is ⅜-inch diameter in the chassis. The circle of holes surrounding the bandswitch shaft are drilled using the coil bracket shown in Fig. 8 as a template.



INSIDE VIEW of VFO-second mixer (V_3) subchassis with bottom cover plate (at left) removed. Machine screws on both sides of first IF transformer (T_3) are for grounding lugs on inside of box to which grounded ends of C_{22} and C_{25} are connected. Note that opening is cut in one side of bottom cover for cover plate which provides access to inside of VFO box after it is installed on chassis of receiver.

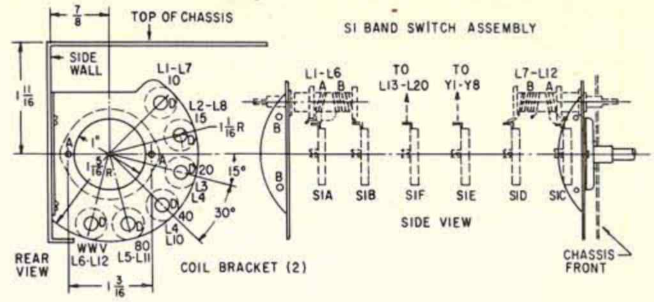


FIG. 8. BANDSWITCH ASSEMBLY, showing the positions of the switch wafers and coils. The brackets on which the RF coils (L_1 to L_6, and L_7 to L_{12}) are mounted are cut as 2⅝-inch diameter circles from 1/16-inch thick sheet aluminum, then drilled, trimmed and bent as shown.

A ¼-inch diameter hole about 1 inch deep is carefully drilled in the rim of the pulley so that a small spring may be mounted inside to exert a tension on the dial cord.

THE DIAL SCALE is rotated as the bandswitch turns by a second dial cord drive. It starts with a 1½-inch diameter pulley on the bandswitch shaft, and runs up to the dial drum, passing around a short brass rod screwed to the front panel to provide the 90-degree change in direction required. Since the bandswitch does not make a complete revolution, only one turn of the dial cord around the lower pulley is needed.

However, the dial drum has two turns of cord around it, with a small holding pin in the center to prevent slippage. A similar pin keeps the cord from slipping on the bandswitch pulley. A small piece of springy material is mounted on the front edge of the chassis and rides against this dial cord to provide a constant tension takeup. A rubber band is wrapped around the dial drum at each end to keep it from slipping out of the support brackets.

An escutcheon plate for the tuning dial is made from ¼-inch thick sheet plastic material — black was used on this model — cut and drilled as shown in Fig. 12. The slot may be cut out with a saber saw, or hacksaw after drilling holes to start the blade. The bevel is formed, and the corners rounded, with a half-round file to a smooth surface. Sanding the escutcheon with fine sandpaper or emery cloth will give it a satin-smooth appearance.

After openings and holes are cut for the major components — power and IF transformers, capacitors, switches, etc.— the parts should be fitted into place and any necessary trimming and filing done. When all such work — cutting, drilling and folding — is completed, remove all sharp edges and burrs before the metal pieces are assembled. Use lock washers under the nuts on all machine screws to prevent parts from becoming loose later on.

Starting with the bare chassis, install all tube and crystal sockets, but the shield partitions can be left out temporarily to allow more room to work inside the chassis.

ELECTRICAL CONSTRUCTION — The largest subassembly — and the most critical— to go into the receiver is the bandswitch and RF coils, so it should be assembled first. One of the reasons for the outstanding performance of this receiver is the high Q of the RF coils. The coils should be wound with care using close winding techniques and the finished coil covered with a good grade coil dope. When the completed coils (L_1 thru L_{12}) have dried they are mounted one by one on the coil brackets with necessary solder connections completed before the next coil is put into the bracket.

On coils L_1 thru L_6 the end of the A, or antenna coil, together with the end of the B coil, are connected together and soldered to the lower coil solder terminal. The other end of Coil A is connected to the respective switch terminal of S_{1A}. The beginning of coil B is connected to the top of the coil terminal lug and this combination soldered directly to the appropriate switch terminal on S_{1B}.

All of the lower terminal lugs are connected together with a piece of No. 18 solid tinned wire to form a ring which is finally connected to a convenient chassis ground at L_6. Assembly of the coils should start with L_1 and proceed around the bandswitch, since the higher frequency coils have heavier wire and can support the ground wire ring better without the undue stress which would be placed on the smaller wire of the lower frequency coils.

The RF amplifier plate coils (L_7 to L_{12}) are also mounted by starting with L_7 and progressing to L_{12}. These coils are mounted on the bracket so that the top coil terminal rests on their respective switch terminals of S_{1D}. The top of coil A is connected to the respective switch terminal of S_{1C}. Two solid wire rings are required for this coil set, one at the end of coil B, which is grounded at a convenient point, and the other at the end of Coil A, which is connected to C_5 and R_6 for plate voltage. Make sure this latter ring does not touch ground around its periphery since it does carry plate voltage. After the bandswitch assembly has been completely finished and appropriate leads brought out for later connection, it may be set aside to await further completion of the under-chassis wiring.

The oscillator coils and tuning capacitors L_{13} thru L_{20} and C_{12} thru C_{19} are all mounted inside the oscillator coil shield box. There is not a great deal of room inside the shield; consequently, it is wise to wire in one coil and capacitor combination at a time starting with the WWV coil (L_{20}). The leads from these coils which go to S_{1F} should be labeled, stripped and have sufficient length to easily reach S_{1F} under the chassis after assembly.

The bottom ends of the coils—actually the physical tops—are all connected together and brought out to C_{20} and R_{13} which are mounted close to the switch on the underside of the chassis. Resistors and capacitors associated with the 6BZ6 RF amplifier tube (V_1) should be mounted close to the socket, except for R_6, R_{10}, R_{14}, R_{11} and R_2, which may be mounted on a terminal strip behind the RF tuning capacitor (C_1). Wiring of the first mixer V_{2A} and V_{2B}), together with the crystal oscillator (V_{2C}), should be completed before the bandswitch assembly is installed in the chassis. Input and output leads should be well separated to avoid intercoupling or oscillation in the mixer.

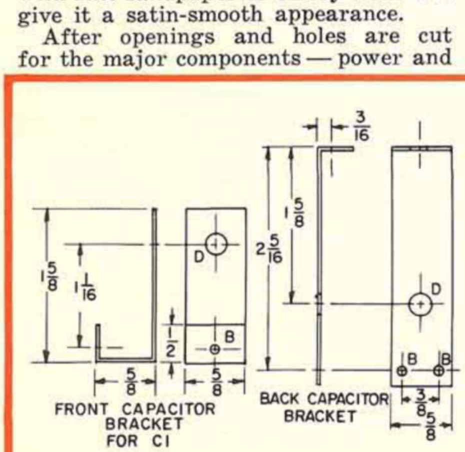


FIG. 9. BRACKETS supporting the dial scale tubing are formed using this diagram as a guide.

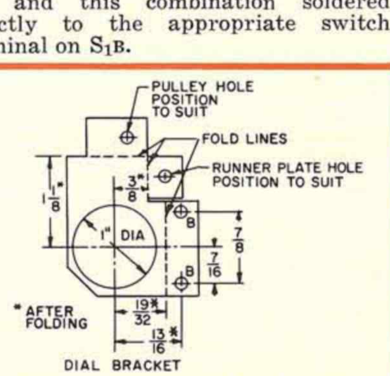


FIG. 10. DIAGRAM showing how the brackets on which C_1 is suspended below the chassis are formed and drilled, using 1/16-inch sheet stock. The dimensions and holes fit the Hammarlund MCD-100-S RF tuning capacitor used on this model.

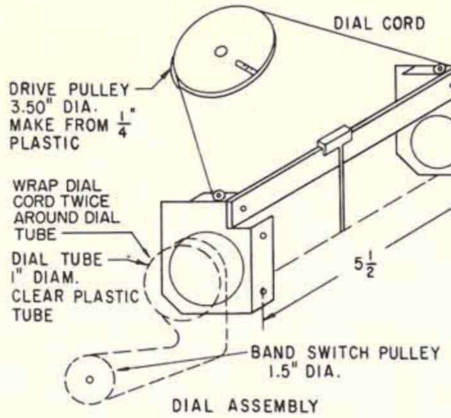
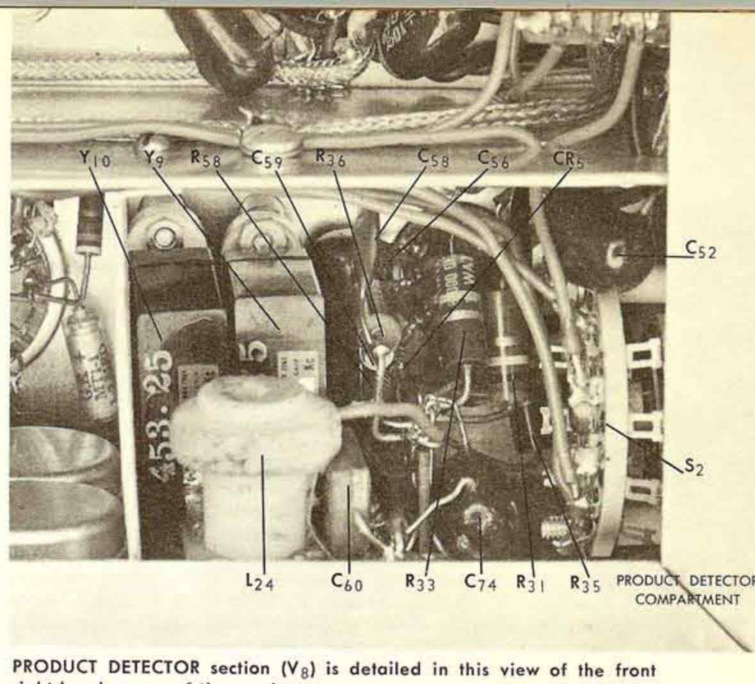


FIG. 11. DIAL ASSEMBLY detail drawing, showing how the brackets, dial scale tubing, runner plate for the pointer, and dial cord and pulleys are assembled. A second dial cord rotates the dial scale, driven from a pulley on the bandswitch shaft between the panel and chassis, as shown in Fig. 8.



PRODUCT DETECTOR section (V_8) is detailed in this view of the front right-hand corner of the receiver.

After the underchassis wiring of the RF amplifier and mixer stages is completed, check to insure they will operate correctly. The first oscillator coil box (housing L_{13} to L_{20}) is mounted on top of the chassis, and the various leads run down through the chassis to section S_{1F}.

Next, the bandswitch assembly is mounted in place in the chassis, and the leads to S_{1F} from the oscillator coils are dressed and soldered into place. Leads from the oscillator crystal sockets (Y_1 to Y_8) are brought to S_{1E} and permanently connected, after making sure that they are bundled and lay against the under side of the chassis. Before putting in the RF tuning capacitor (C_1) the small shield around S_{1F} and S_{1E} should be permanently installed, making sure that no leads touch it and are grounded. All the connections are then completed inside the RF amplifier compartment area and the preselector capacitor (C_1) is assembled into its position and soldered in. The shield around the RF and mixer stage may next be installed to protect these components from damage during assembly of other sections.

VFO ASSEMBLY — Next, the components for the VFO and second mixer (V_3) are mounted on the *Minibox* which was previously drilled, and oscillator connections made with No. 14 solid tinned wire. Those connections running via the feedthru bushings to the underside of the chassis should be cut to lengths which will allow the respective feedthru bushings to line up with the holes "A" through "F" indicated on the drawing for the bottom cover of the box in Fig. 4.

The first IF transformer (T_3) is made from a *Miller* 13W1 1500-kilocycle IF input transformer. It is taken apart and the two capacitors across the coils are disconnected. They are at the bottom of the transformer and are formed by the extension of the solder terminal lugs on the bottom. Drilling through the small metal grommet on the bottom releases the capacitor plates and they are removed. The transformer is then reassembled and is ready to be assembled into the VFO chassis. The solder lugs on the IF transformer are glued to the plastic support inside the IF shield and make convenient and rigid connection to the respective feedthru insulators.

A hand-wound coil was originally used on one of the experimental prototypes of this receiver, however, it was found that it was exceedingly difficult to wind anything by hand approaching the quality of commercial IF coils. Before completing the VFO compartment set the bottom slug of T_3 six turns away from the full clockwise position.

After all wiring is completed, heavy wires for connecting to the stators of C_{24A} and C_{24B} are brought out through the access opening on the front side of the box. The bottom cover is then assembled, slipping the various feedthru bushings through their respective holes. The VFO box is then placed in position on the main chassis with the feedthrus through their holes in the chassis.

The removable side plate on the *Minibox* allows a small screwdriver to be used to advantage in positioning the feedthrus, guiding them through the holes. Nuts are then installed on the feedthru insulators to hold the VFO chassis in place. Lastly the leads running to C_{24A} and C_{24B} are connected. When soldering leads to the feedthru bushings, use needle-nose pliers as a heat sink to prevent the feedthru wires from becoming too hot. These are polystylene insulators and will melt if undue heat is applied to them. The heater voltage feedthrus provide convenient junction soldering points to continue the heater leads to other tube sockets on the chassis.

Next the shield running across the chassis and through the center of the mechanical filter socket is installed after appropriate lead holes are drilled. C_{28} is mounted directly on the mechanical filter socket. The IF stage is wired, making all leads as short as possible between tube elements, and making sure that bypass capacitors have short leads to ground. C_{47} is wired directly between the screen grid of V_{4B} on pin 7 and a ground lug on the mechanical filter socket. Two terminal strips are shown in the IF compartment picture, one in the lower left corner holding the grid capacitors and resistors, and the plate and screen capacitors, and resistors for V_{4B} on the strip in the upper left hand corner.

Note that the input leads to V_{4B} and output leads are shielded. This stage is somewhat critical and it is wise to follow the component placement in the product detector detail view as closely as possible. Before the L shaped shield is placed around the right side of the IF compartment, wire the product detector (V_8) compartment in the upper right hand corner of the chassis. The various dropping resistors to the 6JH8 tube should be soldered in first, followed by the crystal sockets which mount below the chassis on ½-inch spacers.

Next the switch S_2 is installed and wired, using leads with sufficient length to run to other points where needed. Lastly, coil L_{24}, with C_{60} soldered across its leads, is assembled and soldered into the circuit. After completing this stage, the L shaped bracket on the right side of the IF stage, and the small shield behind the product detector, are installed. Finally those leads running through the shields are connected to their appropriate locations.

Various components should be grouped around the 6AL5 AM detector tube (V_5) and the audio amplifier (V_{6A}) together with the gate and diode sections V_{6B} and V_{6C}. A terminal board of thin Textolite or other insulating material is made approximately 4½ inches long by 1¾ inches wide with 14 positions. The bottom view of the receiver (page 6, previous issue) shows 17 positions, all of which are not needed. These should be equally spaced with eight on one side and six on the other. This allows easy assembly of various resistors, and bypass and coupling capacitors.

The audio output transformer (T_5) is assembled before the output tube (V_{7A}) and crystal calibrator (V_{7B}) have their components wired in. A small piece of coaxial cable is run from C_{75} back to the antenna terminal coaxial input. Finally, R_{49} and R_{30} are assembled in the right hand side wall of the chassis and connected into the "S" meter circuit.

Holes should be provided near the bottom of the front of the chassis to take various leads to the S meter, and switch S_3. Although R_{40}, the audio gain control can be assembled now, it is better to temporarily ground the end of R_1 and not assemble the RF gain control (R_5) until after the IF stages are aligned. Unfortunately, even though R_5 is short it has sufficient length to cover the IF output transformer lower tuning hole.

The small components in the power supply — rectifiers, resistors and capacitors — are all mounted on a terminal board made of 1/16-inch thick sheet Textolite* or other insulating board, assembled as shown in Fig. 13. The terminal lugs for tie points were made by running short No. 6-32 machine screws through the board with soldering lugs under the heads and nuts.

The power transformer (T_4) as purchased has No. 10-32 machine screws just long enough to fasten the transformer to the chassis. These screws should be removed and replaced with screws which extend about 2 inches beyond the chassis bottom. The power transformer is then mounted in its hole, and the rectifier components board is suspended from the ends of these screws with No. 10-32 machine nuts on either side of the board.

Other miscellaneous small parts and wiring are installed to complete the electrical assembly of the receiver. It is best to finally install the tuning dial mechanism after most of the construction has been completed to avoid damaging it while working on the receiver.

RECEIVER ALIGNMENT — The alignment method used and described by W7KCS/9 is unique in that the receiver is aligned by starting at the antenna terminals and peaking each succeeding stage for maximum performance. This is in contrast to the usual receiver alignment procedure which starts at the last detector stage and proceeds back through the receiver to the antenna input circuit. However, it is a good idea to first check out the audio portion of the receiver by feeding an audio tone (a code-practice oscillator is a good source) into the arm on the audio gain control (R_{40}). All tubes should be plugged in to check the heater circuit.

The test equipment needed for alignment includes a signal generator covering 455 kilocycles and the amateur bands from 3.5 to 30 megacycles and a vacuum-tube voltmeter with an RF probe. A general-coverage communications receiver also comes in handy for making certain tests. Connect the signal generator to the antenna jack (J_1), and a 72-ohm resistor from the center terminal on J_1 to a chassis ground. Set trimmers C_2 and C_6 to the center of their capacitance range.

RF AMPLIFIER — Starting with the 3.5-megacycle band, set C_1 near maximum capacitance. Set the signal generator at 3.5 megacycles and adjust L_6 and L_{12} for maximum signal, obtaining a VTVM reading with the RF probe on the control grid (pin 11) of V_{2A}. Tune the signal generator and PRE-SELECT knob to 4.0 megacycles. If the slugs in L_6 and L_{12} need adjustment to peak the signal, adjust C_2 and C_6 instead. Recheck the adjustment of L_6 and L_{12} at 3.5 megacycles so that the same meter reading as noted at 4 megacycles is obtained.

Next turn the bandswitch to the 7-megacycle position, turn the PRE-SELECT knob to 7, and with the signal generator on 7.0 megacycles, tune L_5 and L_{11} for maximum signal strength. Do not adjust C_2 and C_6 once they have been adjusted on 4.0 megacycles. Proceed to the higher frequency bands, setting the PRE-SELECT knob, and adjusting the proper RF amplifier grid and plate coils with the signal generator set on 14.0, 21.0 and 28 megacycles, respectively. The tuning of the high "Q" RF coils is quite critical.

THE CRYSTAL first oscillator (V_{2C}) is then checked by adjusting the coil for each crystal, (L_{13} to L_{20}) until the mixer injection voltage — as measured with the VTVM RF probe on pin 9 of V_{2B} — is about 1 volt on all bands. The negative control grid voltage on V_{2C} (pin 11) is about 0.3 volts. This much of the receiver can now be checked by connecting the antenna lead from a general coverage receiver to feedthru bushings D and E through a blocking capacitor (0.01 mfd.). The receiver may then be used as a tunable IF amplifier, tuning from 3495 kilocycles down to 2995 kilocycles, to check the operation of the front end.

The tunable IF transformer (T_3) is next roughly aligned by removing the 6D10 first mixer tube and applying a 2995-kilocycle signal to points D and E through a blocking capacitor. The capacitor tuning knob is rotated 2½ turns from the maximum capacitance position of C_{24}. The top slug of T_3 is adjusted for a maximum reading at this frequency. The RF output voltage is read with the VTVM RF probe on capacitor C_{24A}. Set the RF signal generator at 3495 kilocycles and the tuning dial 22½ turns from maximum capacitance of C_{24}. Then adjust C_{25} for maximum voltage at the stator of C_{24A}.

Capacitor C_{22} should be adjusted to approximately one-half maximum capacitance before these adjustments are made. This adjustment is to get the mixer tuned circuit close until the tunable oscillator circuit is aligned. With voltage applied to the oscillator portion of the 6U8A tube check for oscillation by measuring the bias voltage on pin 9 of V_3. If oscillation does not occur reverse the connection to L_{21B}. If oscillation still does not occur more turns may have to be added to L_{21B}. If the oscillator frequency is not stable, this is indicative that L_{21B} has too many turns.

The best procedure for roughly aligning the VFO is to check the frequency coverage by listening on another communications receiver. Adjust capacitor C_{37} and C_{40} to approximately their center positions. Rotate the tuning dial to 2½ turns of maximum on C_{24} and adjust L_{21} so that the oscillator frequency is 2540 kilocycles.

Next, rotate the capacitor tuning dial 22½ turns from maximum on C_{24} and adjust C_{37} until the oscillator is tuned to 3040 kilocycles. Turn the tuning dial to 12½ turns from maximum on C_{24} and adjust C_{40} for an oscillator frequency of 2790 kilocycles. Repeating this procedure, readjust L_{21A}, C_{37} and C_{40} until the desired tuning linearity is achieved.

Now with the correct frequency tracking of C_{24B} accomplished, go back and readjust the mixer coil and trimmer capacitors (T_3 and C_{25}). For greater accuracy after this rough alignment is completed the crystal calibrator may be turned on and used as a marker for final VFO and mixer adjustment.

IF ALIGNMENT — With a 455-kilocycle signal from the generator applied to the grid of V_{3A}, and the VTVM RF probe on the control grid (pin 5) of V_{4A}, adjust C_{28} for maximum output reading. This tunes the mechanical filter input; the mechanical filter output tuning is fixed and needs no adjustment.

Using the same setup, as above except with the VTVM connected to pin 11 of V_{4B}, adjust both the primary and secondary of T_1 for maximum RF reading. Connect the VTVM at the output of T_2 and adjust the output IF transformer (T_2) for maximum reading. Make sure that this reading is not from an oscillation within the IF stage. If so, capacitor C_{47} is adjusted until no output RF voltage is read on the output of T_2 with no signal at the antenna input. Recheck the alignment of the IF transformers by connecting the vacuum tube voltmeter at some audio point, such as pin 7 of V_{5B}, with a tone-modulated signal from the generator. Incidentally during IF alignment the AVC line should be disconnected. After the IF stages have been aligned, install R_5 and its associated components.

No problem with the SSB oscillator section of V_8 should be encountered if the circuit and component values specified are used. However in case of no oscillation, C_{60} should be increased in

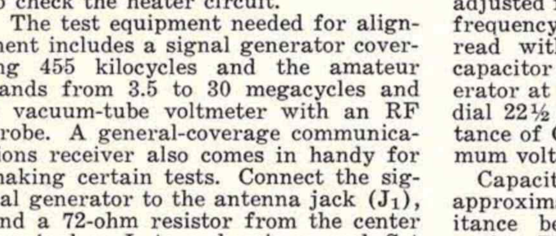


FIG. 12. DIAL ESCUTCHEON is formed ¼-inch thick plastic with window slot for dial scale. It may be painted in a color which matches the color scheme selected for the receiver.

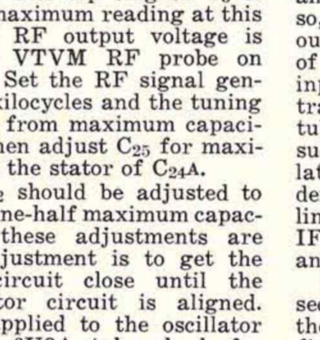


FIG. 13. ASSEMBLY of the rectifier circuit board, looking from top of chassis. Mounting holes in corners should match the mounting bolt locations on the power transformer.

FOOTNOTES

[1] The Jackson Bros. Precision Planetary-vernier drive is listed for $1.50 in advertisements of Arrow Electronics, Inc., 65 Cortlandt Street, New York 7, N.Y., in QST, CQ and 73 magazines.

[2] *Electro-Kit* is manufactured and sold by Halmar Electronics, 1550 West Mound Street, Columbus 23, Ohio.

*T.M. of General Electric Company

value by adding small capacitances across it, or by using the next lower value and adding small capacitances to it if the value appears to be high. Should a high mixing noise level be heard from the 6JH8 when the mode switch is in the single sideband position, it is probably due to the bias voltage on the deflector (pin 2) being too high. In this case reduce the value of R_{29} accordingly to reduce the mixing hiss noise.

The S meter should be calibrated with the mode switch (S_2) in the *AM* position, and set on zero with the zero set potentiometer (R_{49}) with the antenna terminals open. Maximum setting is adjusted with R_{30} while listening to a loud signal and calibrating the S meter according to one's own estimation of the signal strength. On single sideband the S meter will characteristically read higher than on AM; however its purpose is primarily for indication of relative signal strength within the mode of operation rather than an absolute reference. If single sideband operation is mainly contemplated, the zero set and maximum set on the meter may be calibrated with switch S_2 in the LSB or USB positions.

The crystal calibrator is adjusted by means of C_{68} with the mode switch in the calibrate position. After allowing some warm up time zero-beat its 100th harmonic against WWV on the 10-megacycle WWV band of the receiver.

After alignment is complete the receiver is slipped into its housing by sliding the top part of the cabinet over the chassis, since the controls on the sides of the chassis prevent its assembly via the cabinet front.

OPERATION — Operation of the KCS Compactron Receiver is quite simple, requiring only that the function switch be turned on to operate, and after a suitable warm up period, selecting the band of operation by bandswitch S_1. After the PRE-SELECT knob is set in the approximate position for the particular band in use the tuning dial is tuned to the desired signal frequency. The PRE-SELECT knob is once again peaked for maximum signal strength as read on the S meter. The RF gain control may be reduced on 3.5- and 7-megacycles especially if background noise and QRM are bothersome. If single sideband reception is desired the mode switch (S_2) is switched to either the upper or lower sideband and the tuning dial tuned until the signal is copyable at a natural voice pitch.

In the CALIBRATE position of S_3 harmonics of the 100-kilocycle from the crystal calibrator injects into the antenna circuit. These signals are strong on the 3.5- and 7-megacycles bands, and adequate for checking calibration on the higher frequency bands.

The KCS compactron receiver, as in the case of all receivers, represents a compromise between several mutually incompatible criteria. It has proven to be a very versatile, easily used receiver capable of reproducing signals with performance comparable to commercial receivers costing several times as much. Its characteristics on single sideband are hard to beat. The fast attack, slow release AVC circuit on single sideband is quite effective and proves very useful during rapid break-in operation. It is rather difficult to realize that the receiver is on even on 28-megacycles with the volume control full open and no signal being received.

Using all new parts the cost of this unit should run about $250 and, of course, may be much less, depending upon whether the coils are wound by the constructor and the parts in his junk box. Changes in various components can be made by using less expensive parts in various stages. However, this type of experimenting was not done on this receiver although a great deal of experimenting and "optimizing" was done with the circuit themselves to insure peak performance.

The receiver weighs approximately 22 pounds and its small size should be attractive to the XYL.

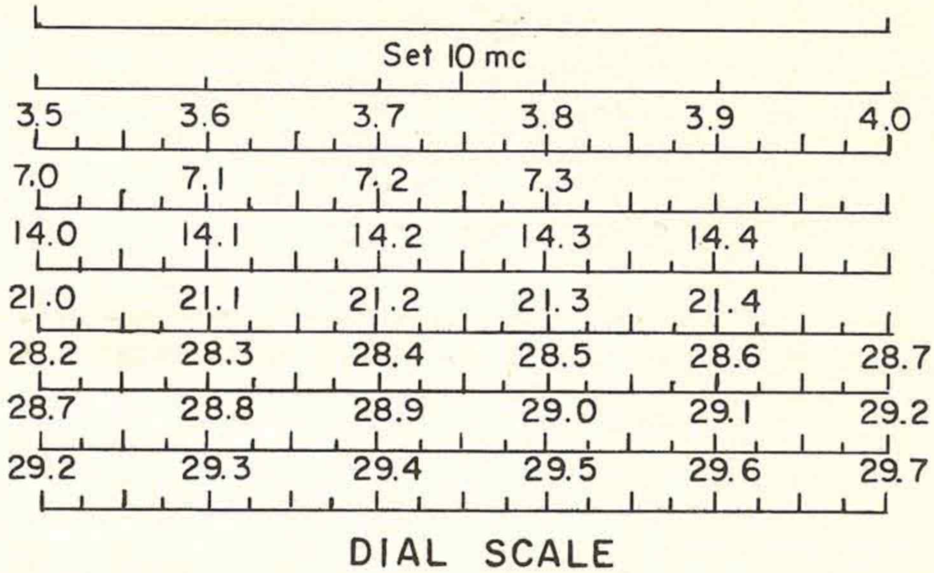


FIG. 14. DIAL SCALE used on the receiver, reproduced in full size here so that it may be clipped out and inserted into the scale tubing shown in Fig. 11.

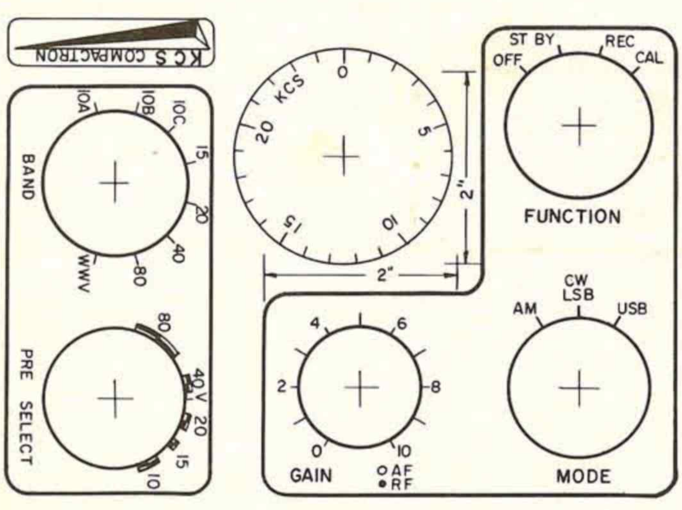
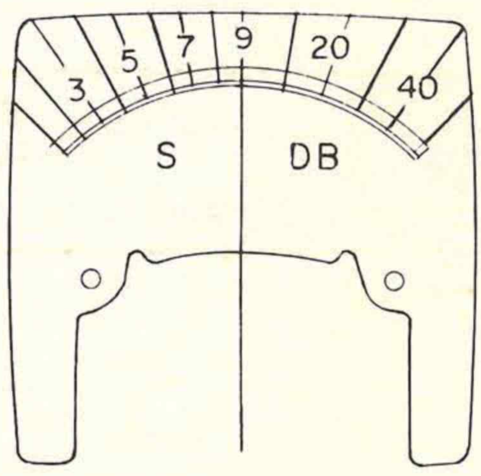


FIG. 16. CONTROL MARKINGS used on the KCS receiver, shown half size. *Halmar* Electro-Kit name plate process[2] was used to make up marking plates on the model receiver.



"S" METER SCALE

FIG. 15. "S"-METER SCALE, drawn in full size for G-E type DW-91 2½-inch square panel meter.

"— this is W4ITC saying 73."

MEET YOUR EDITOR —

During the past several years we have received many requests asking that we publish a picture of the editor, W4ITC, and a description of his own ham shack. So, we finally cornered Ed "at work" during a recent on-the-air session. His station equipment—typical of thousands of amateur stations—includes a Drake 1A receiver, a 20A SSB exciter driving a pair of GL-813's in a linear amplifier, plus assorted home-built VHF equipment. Antennas include a fan dipole for 3.5 megacycles, a rotary dipole for 7 megacycles, a 3-element triband beam, and VHF beams, all up about 50-60 feet.

It seems appropriate to show his station at this time, since W4ITC is transferring to a new assignment with General Electric's Computer Department in Phoenix, Arizona. This is the last issue he is editing, and so we wish him the best in his new location.

—Lighthouse Larry

ADDRESSES FROM WHICH TO OBTAIN INFORMATION ON GENERAL ELECTRIC PRODUCTS

When writing to large companies — such as General Electric—for information on their products, the problem of where to address the request often arises. Many major firms have plants and offices in a number of cities. Vague addresses — the company's name and a city — can result in a delay while the request is forwarded to the proper operation in that company.

With this in mind, and to help you readers send your General Electric inquiries direct to the proper locations, I've prepared a listing to which your inquiries should be addressed. For all addresses, add "General Electric Company" as the first line.

However, when you need publications on electronic components, first check with your local authorized General Electric distributor. He has a number of publications available at nominal cost, such as: Essential Characteristics on receiving, picture and industrial tubes; Industrial Tube catalogs; transistor, tunnel diode and rectifier manuals, etc. Mail requests for these books can be handled only when the *full* remittance accompanies the request.

Information on certain "war-surplus" electronic equipment which General Electric originally produced is covered quite thoroughly in several books on war surplus conversions which are available from publishers in the electronics field. No additional information is available from G.E.

—Lighthouse Larry

PRODUCT OR SERVICE	ADDRESS ("General Electric Co. &)
Appliances—Major: Ranges, washers and dryers, refrigerators, air conditioners, etc.	Customer Information Section Major Appliance Division Appliance Park, Louisville, Ky.
Appliances—Small: Toasters, Mixers, irons, vacuum cleaners, hair dryers, electric utensils, etc.	Customer Information Section Small Appliance Division 1285 Boston Avenue, Bridgeport 9, Conn.
Communication Products: G-E Two-Way radio, carrier current and microwave relay equipment, etc.	Advertising & Sales Promotion, Communication Products Department Lynchburg, Virginia
Computers: business data processing, data accumulation equipment, computing services.	Computer Department Deer Valley Park, P. O. Drawer 270 Phoenix, Arizona
High-fidelity components and stereo audio systems, etc., and service information.	Publications Section Audio Products Department 2200 No. 22nd St., Decatur, Ill.
Lamps: miniature, incandescent, fluorescent, photoflash, etc.	Product Information Section Lamp Division, Nela Park Noble Road, Cleveland, Ohio
Radios: Home, clock and portables, portable phonographs, etc., and service information.	Product Information Section Radio Receiver Department 1001 Broad St., Utica, N.Y.
Rectifiers: Germanium, silicon, Copper oxide, selenium, and silicon controlled rectifiers.	Advertising & Sales Promotion Rectifier Components Department W. Genesee St., Auburn, N.Y.
Space Systems and Vehicles.	Public Information Section Missile and Space Division P. O. Box 8555, Philadelphia 1, Pa.
Television Receivers, and Service information.	Product Information Section Television Receiver Department Electronics Park, Syracuse, N.Y.
Transistors, and Tunnel and signal diodes.	A & SP, Semiconductor Products Dept. Bldg. 7, Electronics Park, Syracuse, New York.
Tubes—Power types: UHF TV transmitting, traveling wave, magnetron, klystron, ignitron, etc.	Technical Information Section Power Tube Department, Bldg. 267, Schenectady, N.Y.
Tubes—Receiving, thyratron, ceramic and other industrial tubes, replacement capacitors and semiconductors, meters.	Technical Information & Product Service (TIPS), Receiving Tube Dept., P. O. Box 1009, Owensboro, Kentucky

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