GENERAL ELECTRIC

INSTALLATION INSTRUCTIONS

FOR

MODEL 820

TELEVISION-RADIO RECEIVER & PHONOGRAPH

(FOR USE BY GENERAL ELECTRIC SERVICE UNITS ONLY)

CAUTION

High voltages are used in the operation of this television receiver. The back cover with interlock receptacle, while in place over the rear of the television chassis compartment, prevents accidental contact with these high voltages and should not be removed except by a qualified television technician.

The picture tube has a high vacuum and, if it is broken, pieces of glass may fly with force in all directions. A weakening of the glass, such as may be acquired by scratching or subjection to more than moderate shock or pressure, may cause the tube to break. The use of gloves and goggles is recommended for protection when handling the tube.

RECEIVER INSTALLATION

UNPACKING AND PREPARATION—First remove the receiver compartment back and lay the cabinet on its back. The phonograph compartment drawer is fastened securely during shipment by two flat-head wood screws driven beneath the cabinet shelf, through a wood shipping bar spacer and into the rear and bottom of the drawer. Remove these screws and the two screws on the triangular shipping blocks while the cabinet is still lying on its back.

Raise the cabinet back to its upright position. Remove the tying tapes holding the cabinet doors closed, and pull the phonograph compartment drawer forward. Remove the wood shipping bar which had been loosened, and remove all tying tapes and packing from the pick-up arm and mechanism in the drawer. Loosen the round-head shipping bolts which hold the phonomotor board in shipment until screws are free and record change floats freely on springs. They are located on top of the motor board. The turntable bolted to the cabinet shipping skid is removed from skid and installed in position on the record changer. The turntable is installed by sliding it down over the spindle in the center of the phonograph compartment and, at the same time, pressing inward on the rubber rimmed wheel to make it fit inside the turntable rim. Remove the carton with the extra head assembly box from the back of the phonograph compartment and hook it onto the two screws on the back panel of the record changer drawer.

INSTALLING PICTURE TUBE—The picture tube is packed separately to prevent being damaged and must be installed into the cabinet.

Take out the screws holding the cabinet back found covering the rear of the television receiver chassis. Carefully pry off the back to separate the parts of the power interlock receptacle. The picture tube mounting harness will be found attached to the cabinet back and may be removed and set aside to be readily available when fastening the picture tube. Remove all tying tapes from the deflecting coil and yoke assembly and remove the Type 1B3-GT/8016 rectifier tube found shipped within the cavity of the deflection yoke and focus coil. Remove the deflecting coil adjustment screws and nut plate, shown in Figure 4, and set the focus coil and yoke assembly aside and upon the chassis.

Before the picture tube can be installed, the television chassis must be removed by taking out the four, self-tapping screws holding the chassis to the cabinet shelf, and disconnecting the cable and plug connections. With the television receiver chassis removed, install the picture tube into place with its face against the picture frame opening in the cabinet and the tube bell resting at the bottom on the two wood cleats. With the one hand, support the tube at the neck and place the tube harness over and past neck of tube. Secure the four mounting springs in each corner bracket inside the cabinet and at the front (first secure the top springs, rotate the tube so that the anode connection and tube base key take the position shown in Figure 4, then stretch the harness about the bell of tube and secure the bottom springs). The harness will now bear upon the picture tube bell, holding the tube to the front of the cabinet. Make certain the tube anode connection will sufficiently clear the metal harness at the nearest point for adequate high voltage isolation. With the wing nut of the deflecting yoke clamping screw loosened, replace deflecting yoke and focus coil assembly over the picture tube neck and reassemble to the metal bracket at top of cabinet with the yoke and focus coil adjusting screws and nut plate. Push the complete focus coil and deflecting yoke assembly forward as far as it will go to bear against the bell of the picture tube. Tighten the wing nut to hold the deflecting coil in place. Final yoke and picture centering adjustments will be made after the receiver is ready for operation.

Reassemble the television chassis into the cabinet, replace and tighten the self-tapping mounting screws. Install the Type 1B3-GT/8016 high voltage rectifier tube into its socket and connect the anode lead and connector to its plate cap. Connect the terminal on the harness to the ground lead on the chassis. Consult the tube label, affixed to the cabinet back, for proper tube location, and make certain that all other tubes are firmly seated in their proper places and tube caps are in place. Connect the picture tube anode lead and cap to the picture tube anode.

Reconnect cables and plugs to the television chassis. Install the knob controls onto all the front panel control shafts of the cabinet. The control knobs are packaged in two separate paper bags. The bag containing television control knobs will be found stapled on the center partition, while the bag of radio knobs is stapled within the radio chassis compartment.

The receiver should be checked for operation before the cabinet backs are permanently replaced and fastened by their screws to the cabinet, as some adjustments may be necessary to obtain correct picture centering and tilt. With the television compartment cabinet back temporarily in place so that a-c power may be connected by way of the interlock.

The cabinet backs may be fastened in place to the back of the cabinet after picture tube adjustments have been made.

LOCATION OF RECEIVER—In locating the receiver in a room, the following factors are listed in their order of importance and should be considered:

1. The antenna lead-in must be kept as short as possible. See later paragraphs on antenna and lead-in installation.
2. Accessibility to an a-c outlet.
3. Locate receiver so that the room illumination can be controlled easily. If the daylight illumination cannot be controlled easily, locate the receiver in such a position that the light from a window does not fall directly onto the face of the television picture tube. For nighttime use, it is not necessary to turn out all lights when viewing.
4. Leave about a three-inch air space between the wall and receiver. This provides essential ventilation and permits better sound reproduction.

GROUND CONNECTION—The television receiver should have a good ground connected to the "G" terminal at the antenna-ground terminal board. This is essential to carry off any static

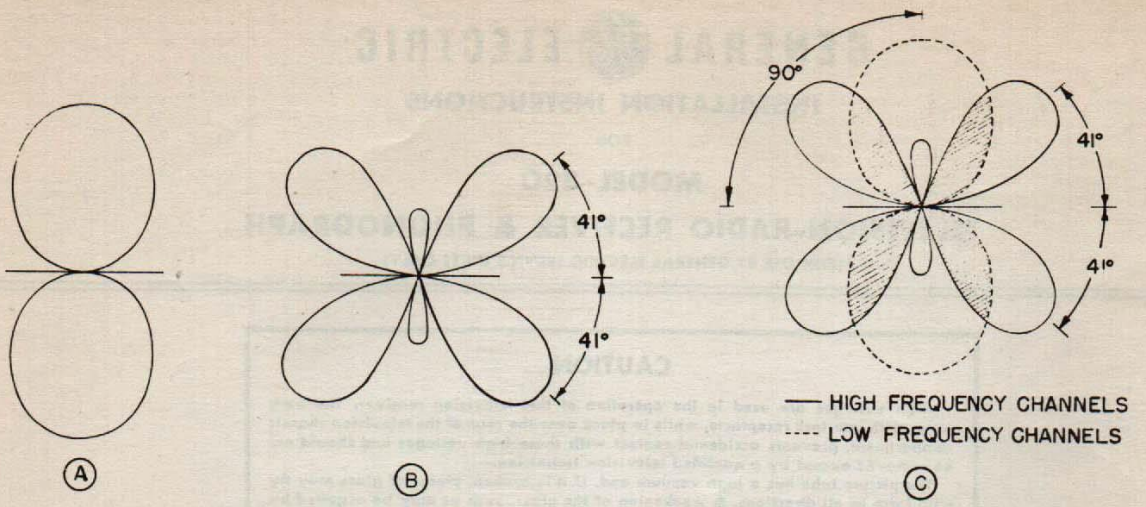


Fig. 1.

charges built up on the antenna installation. The ground wire conductor should be as short and direct as possible, and a clean metal-to-metal contact made to a cold water pipe or to a 5-foot length of pipe driven into moist ground.

ANTENNA AND TRANSMISSION LINE INSTALLATION

RADIO—The antenna terminal board for standard band is located on the left side of the receiver compartment back cover.

For the reception of local standard wave stations, advantage may be taken of the built-in antenna system in lieu of the outdoor broadcast antenna. If an outside antenna is desired for better reception of distant stations, the antenna lead-in should be fastened under the antenna terminal screw. With the outdoor antenna, a good ground wire should be connected to the "G" terminal on the right side of the television receiver back panel and to a cold water pipe. In addition, a good type lightning arrestor should be used to provide a safety measure against receiver damage from induced voltages upon the antenna system, particularly during electrical storms.

A section of 300-ohm transmission line connected from the On-Off switch in the television chassis is connected to the radio receiver antenna terminal board dipole terminals. This connection makes use of the television dipole antenna for FM reception when the television On-Off switch is at the OFF position.

TELEVISION—Unlike the ordinary broadcast receiver, the proper selection and installation of the antenna system is one of the most important items in assuring good pictures. Individual installations will differ in antenna requirements. Where certain conditions will permit the use of the more simple in antenna design, others require more elaborate systems to cope with the more comprehensive problems often experienced in reception at outlying areas and areas serviced by both high and low channel broadcasting.

DIRECTIVITY OF ANTENNAS—Television antennas have decided directional characteristics, and the following data should be studied for reference in the paragraphs on "Orienting the Antenna."

The following illustrations in Figure 1 show the properties of the conventional single ½-wave dipole. When operating on the fundamental resonant frequency, the directivity is broadside to the antenna and bi-directional, as shown in the field pattern of Figure 1, A. With the antenna operating at the higher harmonic frequencies, the lobe pattern becomes split, as shown in Figure 1, B. Figure 1, C illustrates the combined lobe patterns of Figures A and B. The shaded area is the desired lobe for a compromise in directing the antenna to both a high and low frequency channel station located in the same direction from the receiver.

Antenna arrays using reflectors produce more complex lobe patterns than the simple dipole. In general, directivity becomes sharper and appreciable signal gain can be realized from the front of the antenna and away from the reflector. Signal pickup from the back of the array (back of reflector) is decreased. This is an advantage in addition to the desired forward gain itself, in that noise and interference pickup in the unwanted direction is decreased.

ORIENTING THE ANTENNA—Each antenna installation should be oriented in such a way that it provides most efficient reception from the stations which are to be received. This problem of orientation is relatively simple if reception is to be had from only one station. With the transmitting station direction known and the antenna operating on the fundamental station frequency, the antenna is erected broadside to the direction of the station. Figure 1 shows that the reception lobes will intercept the television signal.

The same antenna mentioned above but receiving a signal at the third harmonic of its resonant frequency will have the lobe pattern shown in Figure 1, B. In general practice, television antennas are cut to operate as half-wave elements through the low-frequency Channels 2 through 6. The same antenna will operate on the third harmonic of its fundamental frequency on Channels 7 through 13. Therefore, for Channels 7 through 13, the antenna should be directed to the station at an angle of 41 degrees from either end or 49 degrees from its broadside plane.

In selecting the antenna direction, it is desirable to have a ***lobe*** point directly at the station being received although considerable tolerance is permissible. Avoid directing a node at the station to be received because when this is done, theoretical pickup is at a minimum. If several stations are to be received, a compromise will have to be made as it may not be possible to direct a lobe squarely at each station.

The necessary compromises in direction will be modified in most cases by the relative signal strength of the different stations. One station may be so strong that considerable misdirection may be permissible without objectional signal strength loss so as to obtain a maximum signal from another station which is very weak.

While the paragraphs above have been written to acquaint the technician with orientation from the standpoint of antenna theory, it is well to consider possible errors in calculation and, also, the presence of signal reflections and "ghosts." Undoubtedly, the most accurate and most practical procedure is to rotate the antenna progressively to the point of maximum signal as is evident when the television receiver is connected, the picture viewed, and television sound peaks measured. While some originality might be used in orientation procedure, one practical method requires the co-operation of two persons—one to rotate the antenna, and the other to take readings from the results viewed at the receiver. A system of communication by telephone should be established to relay results and instructions between the two operators. Adjust the antenna for maximum signal and elimination of reflections (ghosts).

REFLECTIONS (GHOSTS)—Ghost images can usually be identified by the received picture appearing to consist of two pictures, displaced in position from one another and superimposed. While one of the pictures is obtained from the direct-path reception from transmitter to receiver, the image (echo) may be the result of receiving the original signal by way of a different angle, along a longer path

intercepted by tall buildings and other structures, and reflected by the structures to the receiving antenna. Since the image signal follows a much longer path than the direct signal, it is delayed and reproduced upon the picture tube a moment later as a second picture. Ghosts are also sometimes caused by reflections set up on the antenna transmission line when an improper impedance match exists between the antenna and line or the line and receiver input. In this case the reflected image is displaced from the true picture by a lesser degree so that the original picture elements appear "smeared." This is caused by the lead or lag phase relation between image and original signal due to the capacitive or inductive reactance of antenna coupling when a mismatch is present. For the best antenna match, the antenna load to the receiver is purely resistive and ghosts from this source are eliminated.

Reflections cannot be predicted in advance of the installation. If ghosts are evident on the received picture when the antenna is oriented for maximum signal pickup, the antenna should be rotated further until this visual echo is removed from the picture without seriously affecting the true received signal. In very severe cases, the antenna may have to be removed completely and mounted at a different location. The object is to turn or erect the antenna in such a position that no reflected signals are intercepted.

CHOICE OF TELEVISION ANTENNA—In areas of good or average signal strength and favorable directivity, the General Electric dipole antenna will prove satisfactory. It consists of the single dipole, mast, and accessories.

For television service areas of less than average signal strength, the General Electric Dipole and Reflector Antenna UKR-005 is recommended. While this antenna has increased directivity, its chief advantage is a decided forward gain in a single direction and away from the reflector. Pickup from in back of the reflector is greatly reduced, aiding in the reduction of unwanted interference and noise. Since the pattern of directivity is sharper over that of a single dipole, it might not prove to be the desired choice for a compromise in orientation to low channel signals arriving from greatly different angles.

In those cases where both high and low frequency channel station signals are to be received from the same direction, the General Electric High Frequency Adapter Kit UKT-002 is recommended. This is a dipole and reflector kit cut to operate as a fundamental antenna on the high frequency Channels 7 through 13. This kit is added and installed onto the UKR-005 antenna, which results in a system whereby UKR-005 may be directed for orientation to the low channel stations, while the dipole and reflector kit UKT-002 is oriented separately for the high frequency channel stations.

Fringe areas just outside the areas of average signal strength have less to offer in the prospects of obtaining good pictures due to poor signal strength. Signal pickup in these areas can be increased over that of a single dipole antenna through the installation of the General Electric UKR-007 Television Stacked Array Antenna. This array is very suitable for the low-band channels but for the high-band channels the sensitivity is naturally down. In order to improve the reception in the high bands, a special adapter unit (UKT-003) can be added to the stacked array. This combination of two stacked arrays—one for the low, and one for the high band—provides good reception in areas where all other types fail to get a satisfactory picture.

In many areas, the simpler array UKR-008 with a low and high band antenna and reflector is very satisfactory. Each unit can be oriented independently to ensure maximum performance on all available channels.

THE TRANSMISSION LINE—A properly selected and installed transmission line is as important to the quality of the antenna system as the antenna is itself. An improperly installed line causes reflections and high losses. Reflections in the line destroy contrast, making it impossible to obtain clean, crisp pictures, and in severe cases, the reflections cause "smears" so that the picture appears out of focus, even when the receiver is focused perfectly. In general, more care is required in installation for longer transmission lines.

The Model 820 receiver is designed for an input antenna terminal impedance of 300 ohms. Similarly, the terminal impedance of the antenna should be 300 ohms. Thus, to provide optimum results, the transmission line must have a surge impedance of 300 ohms throughout its length. If it does not, two things happen: first, less energy will be delivered to the receiver, lowering the signal strength and thereby increasing the undersirable effects of noise and interference; second, the mismatch will permit energy to travel back and forth on the line because of the lack of proper termination. These reflections destroy the character of the original signal which was picked up.

Transmission line is furnished in two types—indoor (Standard) Cat. No. UWT-002, and outdoor (De Luxe) Cat. No. UWT-003. Both are 300-ohm lines, matched properly to the antenna and the receiver. The task of the installation engineer, therefore, is to install this line so as to preserve its characteristic; he must avoid those things which tend to upset the line impedance. The comments and suggestions which follow have this object in view.

1. ***Length***—The longer the line, the greater the danger of mismatch. In addition, the normal transmission line loss is reduced by keeping the length of the line at a minimum. It is, therefore, essential to keep the line as short as is practically possible. It is worthwhile expending effort in this respect if a significant saving in length can be obtained, bearing in mind the proper technique in securing, concealing, and otherwise handling the line itself. These factors are explained later, after the characteristics of the two types of lines are explained.

2. ***Outdoor Line***—This line is of heavy construction and was designed particularly for outdoor use. It is superior to the indoor line although it is more costly and harder to conceal and secure because of its greater stiffness. As might be surmised, this line may be used to good advantage as indoor line if it can be installed conveniently or concealed, or if its appearance is not objectionable.

Outdoor lines are recommended for outdoor runs which exceed about 20 feet or for even small runs if these runs are horizontal so that they can collect rain. Good practice calls for all outdoor runs to be made with the outdoor line.

3. ***Indoor Line***—Indoor line is of lighter construction and is more easily handled. It is intended particularly for indoor runs where it is protected from rain and weather. It may be used outdoors if the outdoor runs do not exceed 20 feet ***provided*** the run is ***vertical*** and is ***protected from direct rainfall*** as it would be if it ran down the side of a building below the eaves of the roof.

4. ***Splicing Line***—When splicing the indoor and outdoor lines (or any other breaks in the line), be careful to maintain the line impedance. This is done by stripping the two lines back about ½ inch and then twisting the respective conductors together so that the ***insulation of one line butts directly against the insulation of the other.*** If the splice is made with a large space between the parallel wires, the line impedance will be changed at that point and reflections may be set up. The recommended technique will avoid such an air gap. The exposed wires which stand away from the line should be twisted tightly, soldered well, and clipped short.

5. ***Installing Outdoor Lines***—The transmission line must not be permitted to bear against objects such as the side of a building (wood or otherwise). It should be suspended so that it clears such objects by at least an inch or two. Insulated eyelets, secured in a threaded support, are ideal for supporting the line. The line must be kept clear of metal objects and ***in no case*** be permitted to run against metal surfaces. Run the line as nearly vertical as possible so that rain will drain off instead of collecting in pools on the surface of the line. If horizontal lines are necessary, try to run them so that they are protected by the eaves of a roof or other cover. ***Do not run the line inside of pipes.*** Pull the line tight so that it will not be swung against walls by wind. If the line crosses a horizontal surface (a roof), make certain that it clears the surface enough to keep it above the level of the snow in winter.

6. ***Installing Indoor Lines***—The indoor line should be run out through a window or wall where the outdoor line can be spliced to it. The line can enter by crossing the windowsill so that the window closes down on it, provided the structure is wood. Do not run the line over a metal window ledge or through a metal conduit, unless the conduit is large enough to space the wire an inch or two from all sides. Never fold the line in order to force it through a narrow opening, such as a porcelain tube. All precautions relative to the handling of outside lines apply to the handling of inside lines except that in the latter case greater care must be exercised; inside lines having less insulation, are more affected by contact with objects.

Inside line should not be run for more than five feet under a carpet. This changes the capacity between lines, upsets its impedance, and causes loss and reflections. Outdoor line can be run up to 20 feet under a carpet. When running the line indoors, it may be tacked against wooden floor molding, but use only as many tacks as is absolutely necessary. The line is far superior electrically if it droops somewhat between tacks; i.e., it is better than having it pressed firmly against the wood surface.

An ideal way to run the line is across beams along a cellar ceiling and through the floor directly behind the television receiver. Do not pull the line around pipes, radiators, or other metal objects—space it away from these. Lastly, do not impro-

vise window lead-in devices or connectors for the line. Splice only as explained above and run the line directly to the terminal board on the television receiver.

SHIELDED ANTENNA LEAD-IN INSTALLATION—In many apartment house and tall building installations (where a long lead-in is required), there may be prevalent considerable noise voltage on the lead-in caused by man-made electrical disturbances. This type of interference is materially reduced by the balanced input transformer used by this receiver. To reduce this noise still further, it may be advisable to resort to shielded twin conductor cable, such as Cat. No. RWD-001. This shielded lead-in also will permit the lead-in to be installed within metal pipe or fastened to metal surfaces without upsetting the impedance of the lead-in.

This shielded cable has a characteristic impedance of approximately 100 ohms so that a special impedance matching resistance

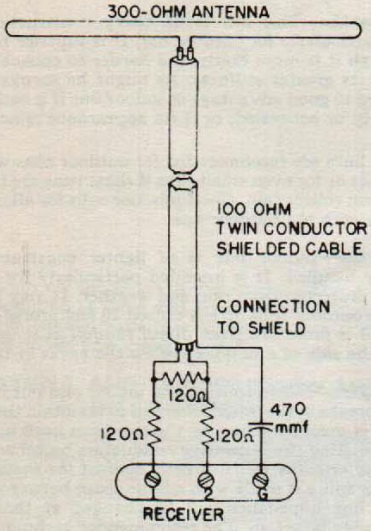


Fig. 2. Input alterations when using 100-ohm shielded cable

network must be installed at the receiver input to prevent the undesirable effects of mismatch as previously described. Figure 2 shows the resistor values and points of installation needed to match the 100-ohm transmission line to the Model 820 receiver. This resistor matching network obviously will reduce signal voltage considerably so that the application must be limited to areas only with high signal strength.

RECEIVER CONTROLS

The radio broadcast receiver controls and operating procedures are conventional. These are explained separately in publication ER-I-820 which may be found packed with each Model 820 instrument.

There are two sets of controls used for adjusting the picture details for television operation. These are the normal Television Front Panel Operating Controls, Figure 3, and the Preset Adjustment Controls, Figure 4, located at the rear of the television chassis.

TELEVISION OPERATING CONTROLS

All the operating controls necessary to tune a television program are arranged on the front panel of the cabinet behind the left-hand cabinet door. The control knobs are grouped beneath the television picture tube, as shown in Figure 3. Four of the five controls are dual, making a total of nine adjustment knobs. They are as follows:

VOLUME—The center or smaller knob at the extreme left is the volume control knob and adjusts the television sound to the required listening level. Volume is at a minimum in the counterclockwise position and increases as the control knob is advanced to maximum in the clockwise position.

FOCUS—The outside or larger knob at the left is the focus control. This control focuses the received picture on the picture tube screen. It is merely necessary to adjust this control until the picture is no longer blurred, but becomes sharp in detail.

CHANNEL SELECTOR—The center knob of the second control from the left permits selection of the desired television channel. The selector positions numbered No. 2 through No. 13 correspond to the channels assigned to television stations as they appear in the newspaper program schedule. The channel selector knob is turned so that its index is adjacent to the channel number desired.

NOTE—The three extreme clockwise positions are dual in that they will preset the tuned circuits for either of the two channels indicated. This selection of the channel adjusts the tuning circuits approximately. For fine adjustment the television tuning control, described in a following paragraph, must be properly adjusted.

The channel selector positions, assigned station channel numbers, and their frequency coverage are given below.

SELECTOR POSITION	CHANNEL	FREQUENCY BAND
2	2	54– 60 MC
3	3	60– 66 MC
4	4	66– 72 MC
5	5	76– 82 MC
6	6	82– 88 MC
7	7	174–180 MC
8–9	8	180–186 MC
8–9	9	186–192 MC
10–11	10	192–198 MC
10–11	11	198–204 MC
12–13	12	204–210 MC
12–13	13	210–216 MC

TUNING—The outside or larger knob of the second control from the left is the fine adjustment for tuning your receiver to the television frequency being received. Correct adjustment is essential for optimum picture detail and satisfactory sound reproduction. With the selector switch set to receive the desired channel and volume control advanced about half-way, the tuning control should be adjusted to that point where the sound reproduction of the program is the clearest. In general, this is the point where the program is the loudest and clearest and, also, extraneous noise is the least. This tuning point for sound automatically insures the proper adjustment of the vision channel for maximum picture detail. In many localities, three separate tuning points of maximum sound closely spaced may be heard. The center point of maximum is the correct tuning point. *Important: Never reduce sound volume by detuning your receiver. Reduce the volume control setting to the desired sound level.*

OFF-ON—The off-on power control knob is the single control located at the center of the television group. The control position is indicated by the knob index. Power is on when turned to the right and off when turned to the left.

HORIZONTAL HOLD—The smaller and center knob of the second dual control from the right "holds" or "locks in" the picture to remain stationary from left to right. It should be adjusted until the picture does not move sideways and is centered in the picture viewing frame.

VERTICAL HOLD—This is the larger and outside knob of the second dual control from the right. Its operation is similar to the horizontal hold control except that it controls the picture to lock-in vertically. The control should be adjusted until the picture no longer moves up or down.

CONTRAST—This is the larger and outside knob of the dual control on the extreme right and its adjustment is dependent upon the strength of the television program signals being received. For a weak signal, it may be necessary to operate the control nearly full clockwise, while for a strong local station the control may be set almost to fully counterclockwise or at minimum. As the name suggests, this control adjusts the black and white contrast between the various picture elements. Turn this control clockwise, after the horizontal and vertical hold controls have been correctly set, until the picture remains stationary on the screen, but not so high that the gradation between black and white is lost. Too much contrast is apparent when the picture is lacking in gradations between black and whites or the picture loses form. Too little contrast setting causes the picture to appear faded so that it seems composed entirely of grays. A properly adjusted picture is shown in the photo for a Normal Picture in the accompanying photo illustrations for Picture Defects.

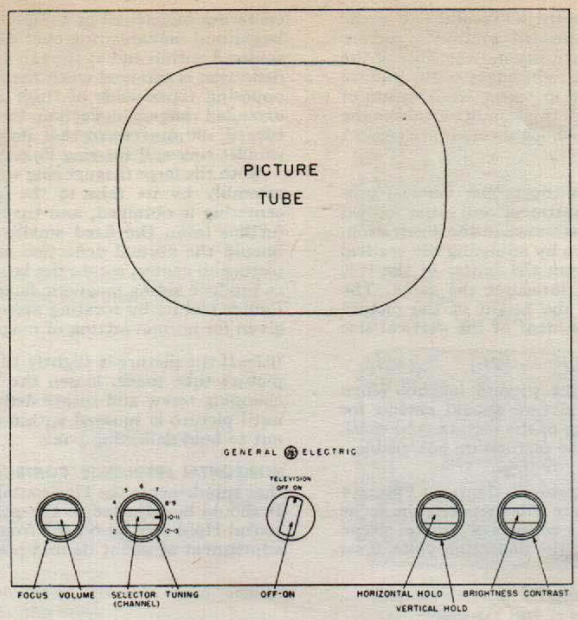


Fig. 3. Operating control location

BRILLIANCE—The center and smaller control knob of the dual control at the extreme right regulates the brilliance of the received picture. It should be adjusted simultaneously with the contrast control as too much brilliance will have the same effect as too little contrast, making it advisable to strike a proper balance between the contrast control and brilliance control settings.

PRESET CONTROLS

The preset controls are located at the rear and top of the chassis (see Figure 4). All of the controls, except for the centering and tilt, are available through holes in the back cover without removing the cabinet back.

These preset controls are adjusted at the factory and should require very little adjustment upon installation and over very long periods of operation. Study the illustrations for maladjustments and their means of remedy. These adjustments must in most cases be made during the transmission of a picture, preferably a test pattern, as shown in the illustrations.

HORIZONTAL LINEARITY AND HOR. DRIVE—These controls are used to adjust the linearity. First, adjust the Hor. Drive control to minimum capacity setting (full counterclockwise). With Horizontal Size at approximately its correct setting, adjust the Horizontal Linearity until the picture shows correct horizontal proportions. A maladjustment shows up as an elongation or crowding of either side of the picture. This is best adjusted when a test pattern is being broadcasted by adjusting the control until the distance from the center of the test pattern to the left-hand and right-hand edges measures the same. If the Horizontal Linearity control will not give the proper linearity adjustment, turn the Hor. Drive control slightly clockwise and repeat adjustment of Hor. Linearity. Always leave the Hor. Drive control at maximum counterclockwise position consistent with good linearity. If there is any fold-over of pattern at center of picture which shows up as a lighter area about ¼ to ½ inch wide running vertically on screen, the Hor. Drive control should be turned clockwise until it disappears.

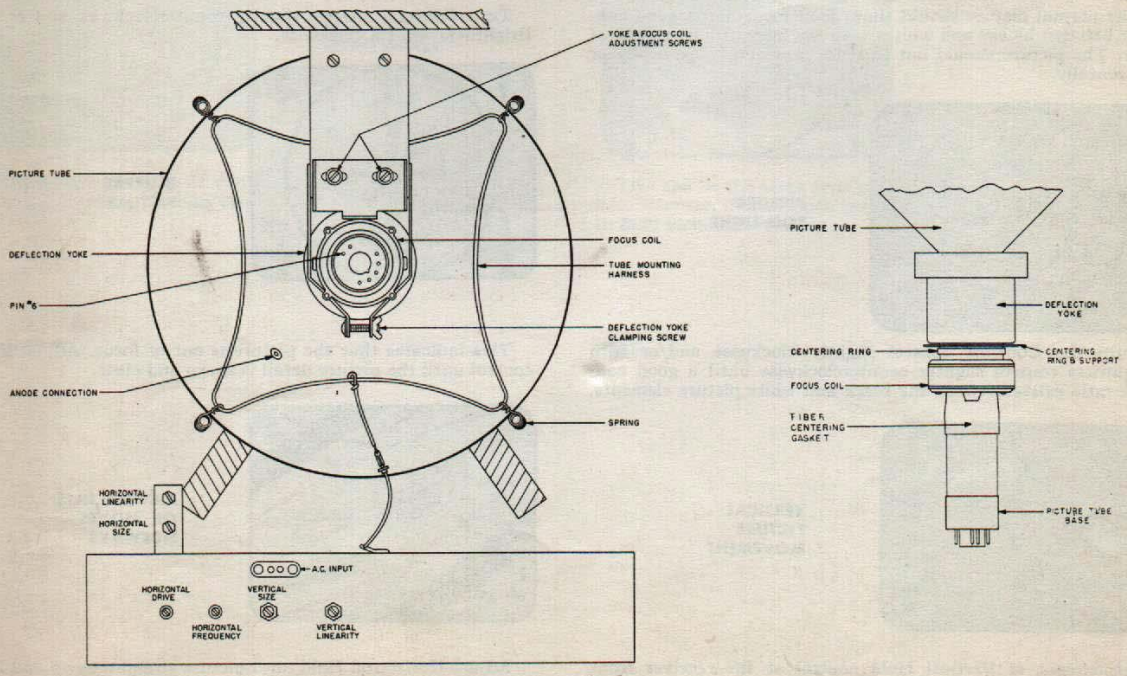


Fig. 4. Preset (occasional adjustment) controls

HORIZONTAL SIZE—This control changes the horizontal size of the picture. When adjusted to the recommended width, the picture should extend for approximately ⅛ inch beyond the edge of the picture tube mask so that the left and right edges of the picture are not visible. In the picture showing incorrect adjustments of the width control, it will be noted that this condition makes the inner circle of the test pattern an egg shape instead of a perfect circle.

VERTICAL LINEARITY—This control gives the proper vertical proportions to the picture. Improper adjustment will either crowd the lower or upper half of the picture, as shown in the illustration. This is best adjusted on the test pattern by adjusting the vertical linearity control until the distance from the center of the test pattern to the top or bottom edges measures the same. The adjustment of this control will alter the height of the picture slightly so as to necessitate the adjustment of the vertical size control simultaneously with it.

VERTICAL SIZE—This control changes the picture height. When adjusted to the correct height, the picture should extend for approximately ⅛ inch beyond the edge of the picture tube mask so that the top and bottom edges of the picture are not visible.

CENTERING—The picture centering assembly is shown in Figure 4 and is located on the neck of the picture tube between the focus coil and deflecting yoke. The assembly consists of a metal sleeve with two tabs at its end, adjacent to the deflecting yoke. Two centering magnet rings complete the assembly, one being the larger and movable ring over the sleeve while the smaller ring is soldered within and at the tab end of the sleeve. Normal range of deflection is attained when the flux fields of the two magnets are opposing (open ends of rings adjacent to each other). For an extended range in deflection, the larger and movable ring may be turned 180 degrees so that its open end is opposite that of the smaller ring and the ring fluxes are aiding.

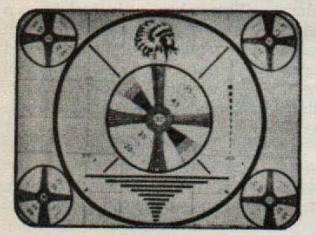
With the large magnet ring set for normal deflection, rotate the assembly by its tabs to the point where proper direction of centering is obtained, and then slide the magnet ring closer, or further from, the fixed smaller ring until picture is centered. Should the normal deflection range be inadequate to bring the picture to center, rotate the larger and movable ring 180 degrees to produce aiding magnetic fluxes and extended deflection range. Center picture by rotating assembly and sliding movable ring as given for normal setting of magnet rings.

TILT—If the picture is slightly tilted and does not square with the picture tube mask, loosen the wing nut of the deflection yoke clamping screw and rotate deflection yoke in its clamp bracket until picture is squared within the viewing mask. Tighten wing nut to hold deflecting yoke.

HORIZONTAL FREQUENCY CONTROL—This is a coarse adjustment that supplements the Horizontal Hold control on the front panel. It should be adjusted to the position which will allow the Horizontal Hold control on the front panel to go through its proper adjustment at about its mid-position.

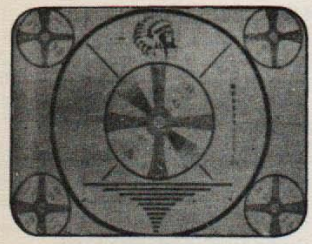
PICTURE DEFECTS

The following illustrations show picture defects which are caused by incorrect setting of the operating controls or by interference picked up by the antenna. The correction is indicated for each control maladjustment.



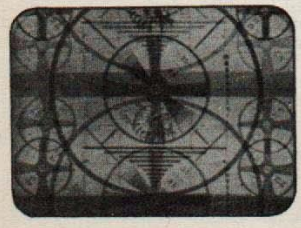
NORMAL PICTURE

The normal picture should show good focus and a good contrast between blacks and whites with the intermediate shades of gray. The picture should not tend to either move vertically or horizontally.



PICTURE TOO LIGHT

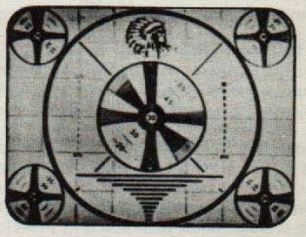
Turn the Contrast control slightly clockwise and/or turn Brightness control slightly counterclockwise until a good contrast ratio exists between the black and white picture elements.



VERTICAL PICTURE MOVEMENT

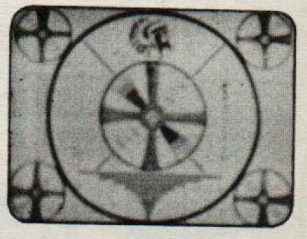
Adjustment of Vertical Hold control at the receiver front panel will stop any vertical roll of picture.

The adjustment of the controls is most efficiently accomplished by the use of a test pattern, similar to that illustrated, which is normally transmitted just prior to the scheduled program.



PICTURE TOO DARK

Turn Contrast control slightly counterclockwise and/or turn Brightness control clockwise.

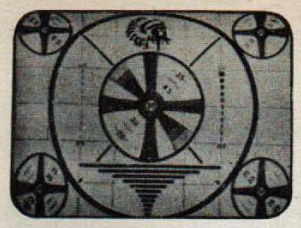


BLURRED PICTURE

This indicates that the picture is out of focus. Adjust Focus control until the picture detail is sharp and clear.

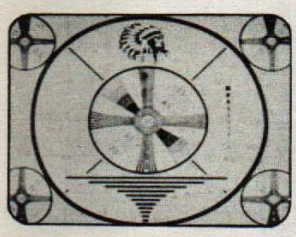
PICTURE TILTS OR MOVES SIDEWAYS

Adjust Horizontal Hold until picture straightens up and locks into position so there is no sideways motion.



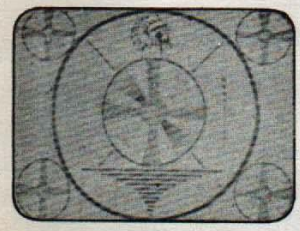
PICTURE ELONGATED VERTICALLY

Adjust Vertical Linearity control so that the vertical radius from top to center and bottom radius are equal. This adjustment may alter the vertical size.



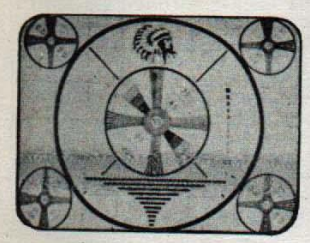
PICTURE TOO WIDE

Adjust Horizontal Width control so that the right and left picture edges are just covered by the mask.



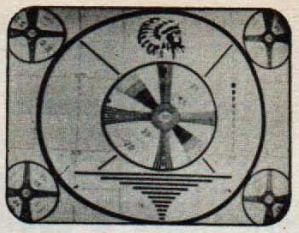
HERRINGBONE PATTERN OVER PICTURE

This is caused by r-f interference such as that created by "amateur" stations.



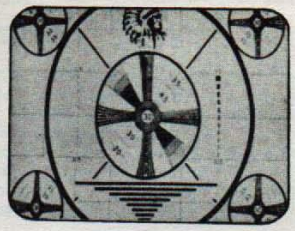
INTERFERENCE

This is representative of diathermy interference being picked up by the antenna. Nothing can be done at receiver to eliminate it.



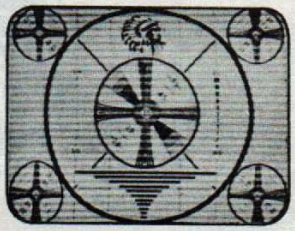
PICTURE ELONGATED HORIZONTALLY

Adjust Horizontal Linearity control so that the horizontal radius from center to left side is equal to radius from center to right side. This may alter the horizontal size.



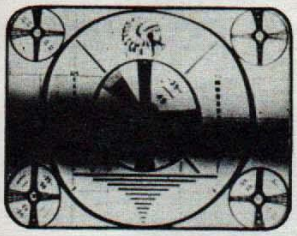
PICTURE TOO TALL

Adjust Vertical Height control so that the top and bottom picture edges are just covered by mask.



HORIZONTAL BARS ON PICTURE

This interference is caused by adjacent channel sound or microphonics in the receiver.



INTERFERENCE

This can be the same type of interference as illustrated to the left; however, it is of much greater intensity. It may also be due to hum pickup in receiver.

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