SECTION III
OPERATION, INITIAL TEST, AND ADJUSTMENT

3.1 CONTROLS.

Figure 3-1 shows the location of the SC-101 controls on the 312A-2 Control/Speaker unit. Detailed information regarding the function of these controls is given in paragraph 4.1.

3.2 OPERATION OF KWS-1 TRANSMITTER AND 75A-4 RECEIVER.

Operation of the KWS-1 Transmitter and 75A-4 Receiver is explained in the instruction book accompanying the equipments.

3.3 INITIAL TESTS AND ADJUSTMENTS.

3.3.1 INITIAL TESTS.

Before performing the initial adjustments, the SC-101 installation should be tested as follows:

a. Apply power to the installation. Check the clock, light, 75A-4, and KWS-1 to make sure the primary power circuit is wired correctly (the speaker is connected to the 75A-4 Receiver only when the phonepatch (PH) OFF-ON switch is off). Turn the primary OFF-ON switch to ON. The pilot light should light.

b. Check the ANTENNA SELECTOR switch positions against the actuating sequence of the antenna selector relays in the 68Y-1 unit to make sure the relay actuating leads are wired correctly. Check the transmit-receive relay connections. In transmit position, the 75A-4 Receiver should be silenced, and the antenna should be connected to the KWS-1 Transmitter.

c. Check the tower rotator(s) action in both CW and CCW operation.

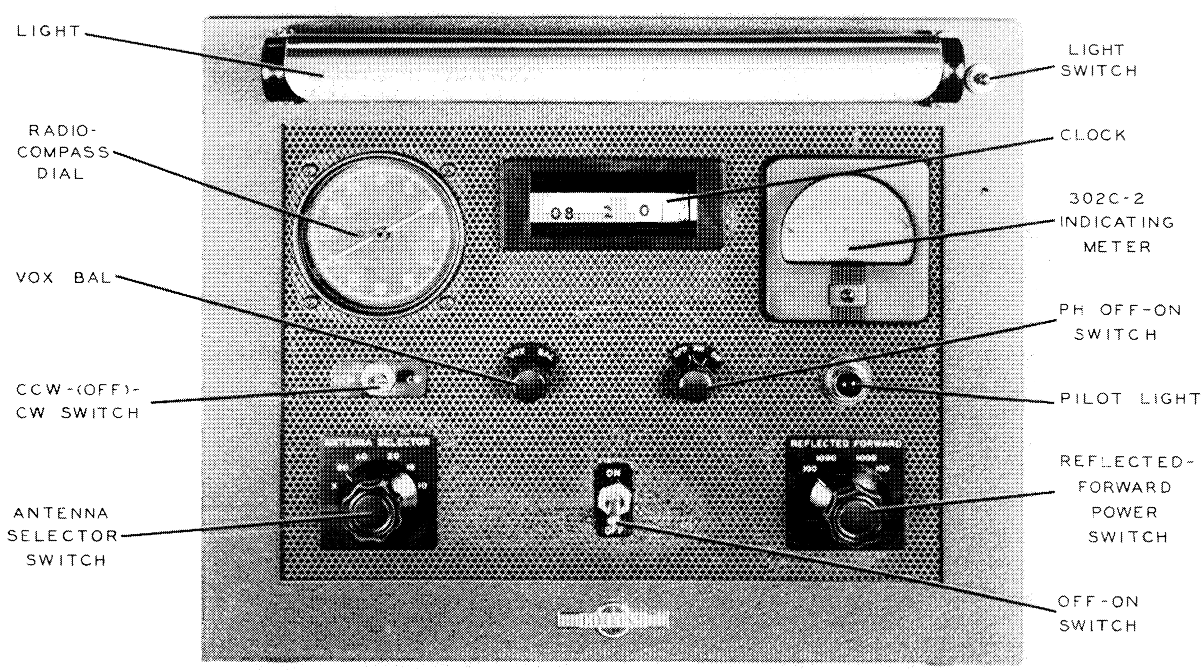


Figure 3-1. 312A-2 Control/Speaker Unit, Location of Controls

NOTE

Some rotators of the heavy-duty type normally may draw enough starting current to blow fuse F802 in the 312A-2 unit. If this occurs, replace fuse with next larger size. If rotator draws more than 5 amperes normal current, feed rotator power from a source other than the 312A-2 circuitry (see figure 2-7).

Check operation of the synchro circuit. Bearing changes should be indicated with rotation.

d. Check the antenna transmission lines and operation of the 302C-2 Directional Wattmeter as follows:

(1) Set the REFLECTED-FORWARD power switch to FORWARD 1000 scale.

(2) Tune and load the KWS-1 Transmitter into any antenna using either AM. or CW emission. The 302C-2 meter should indicate a forward power reading.

(3) Switch the REFLECTED - FORWARD power switch to REFLECTED 1000 scale. Unless the antenna is perfectly matched to the line, the meter will indicate a reflected power reading. If the reading is less than 100 watts, switch to REFLECTED 100 scale.

(4) Using the readings obtained, determine the swr as outlined in paragraph 3.4. Repeat steps (1) through (4) for all antennas and transmission lines in use. The KWS-1 Transmitter cannot load properly into 52-ohm transmission line when the swr is greater than 2.5:1.

NOTE

If extremely high reflected power readings are obtained with any transmission line, check to make sure the proper antenna is in use. Check all coaxial connectors, jumpers, etc, for possible poor connections. If the reflected power reading is higher than the forward power reading, check to make sure the coupler is wired correctly.

This completes the initial tests. If the equipment is operating properly, proceed to the Initial Adjustments in the following paragraph.

3.3.2 INITIAL ADJUSTMENTS.

Make the following initial adjustments before placing the SC-101 installation into service:

3.3.2.1 PHONE PATCH. Adjust the phone-patch equipment as follows:

NOTE

If the 75A-4 Receiver has a serial number below 2382, it should be modified as outlined in paragraph 2.2.5 before making the following adjustments.

a. Turn on the 75A-4 Receiver and KWS-1 Transmitter. Make sure the transmitter PLATE switch is in the OFF position. All the adjustments are made using the transmitter exciter only.

b. Turn on the 75A-4 crystal calibrator. Tune the receiver to the vicinity of a 100-kc dial mark to establish a beat note of approximately 500 cps (0.5 kc from zero-beat).

c. Turn to ON position the phone-patch (PH) OFF-ON switch. Lift the telephone receiver and dial any digit to remove the dial tone. Check that the 500 cps note is heard in the telephone receiver.

d. Set the speaker quieting control in the KWS-1 Exciter/Power Amplifier to full counterclockwise position. The control is located inside the cabinet above the PA PLATE meter.

e. Set the KWS-1 EMISSION switch to AM or SSB position. Set the multimeter to PA GRID position.

f. Set the VOX BAL control on the 312A-2 to full clockwise position. Advance the VOX SPEECH control on the KWS-1 until the 500-cps tone from the receiver actuates the KWS-1 carrier control relay, causing the meter to indicate PA grid current.

g. Adjust the AUDIO GAIN control until the multimeter reads 95% of full scale.

h. Slowly rotate the VOX BAL control on the 312A-2 in a counterclockwise direction. At about the midpoint of the control rotation, the grid current will show a decided dip, or null. If grid current disappears entirely as the null is approached, advance the VOX SPEECH control until a reading is again obtained.

i. Set the VOX BAL control at the null point determined in h. above (minimum grid current). Reduce the VOX SPEECH control setting until the PA grid current drops to zero.

j. Return speaker quieting control to normal setting.

NOTE

The VOX BAL control probably will have to be reset slightly on different telephone calls to keep the receiver output from triggering the voice-operate circuitry.

k. This completes the initial balancing of the phone-patch circuitry. When using the phone patch during actual conversations, the VOX SPEECH and AUDIO GAIN controls on the KWS-1 should be adjusted so that the party on the other end of the telephone line operates the transmitter normally. Do not advance the VOX SPEECH control farther than necessary, as this will cause sluggish operation of the voice-control circuitry. The 75A-4 AF GAIN control should be adjusted to comfortable level for the other party when receiving. Do not raise receiver audio output farther than is necessary for a comfortable telephone listening level. If audio output is too large, it is likely to feed through to the transmitter,tripping the voice-operate circuit. Control the audio level on the station end of the line by maintaining an appropriate distance from the telephone mouth piece.

3.3.2.2 SYNCHRO SYSTEM. Adjust the synchro transmitter(s) as follows:

a. Apply power to the rotator with the actuating switch in CCW position until the limit switch is actuated, stopping rotation.

b. At the top of the tower, adjust the rotary beam antenna(s) to an exact direction (due north, for example) with a magnetic compass or by reference to a local map.

c. Decouple the synchro transmitter from the antenna drive shaft. Apply power in the CCW (limited) position so that the synchro circuit is actuated. This can be done by a second person in the operating location.

d. Turn the synchro transmitter shaft manually until the radio-compass dial (on the 312A-2 panel) indicates the exact direction set in step b. Sound-powered telephones or other temporary communication with the operating location is desirable when making this adjustment.

e. Repeat steps a. through d. at the second tower in two-tower installations. This completes the initial tests and adjustments. The system installation is now ready for service.

3.4 SWR AND TRANSMITTER POWER OUTPUT.

To determine transmission line swr, refer to figure 3-2. Locate the point on the graph corresponding to the indicated values of forward and reflected power. If the point falls on one of the swr lines, transmission line swr is the value labeled on the line. For example, if forward power is 100 watts and reflected power is 4 watts, the point is on the 1.5 line, and swr is 1.5:1. If the point falls between two lines, transmission line swr is between the values labeled on the lines. Interpolate as necessary. For example, if the forward power is 500 watts and the reflected power is 6 watts, the corresponding point falls midway between the 1.2 and 1.3 lines so the swr is 1.25:1. Transmitter power output (sometimes called real or net power) is determined by subtracting the reflected power reading from the forward power reading:

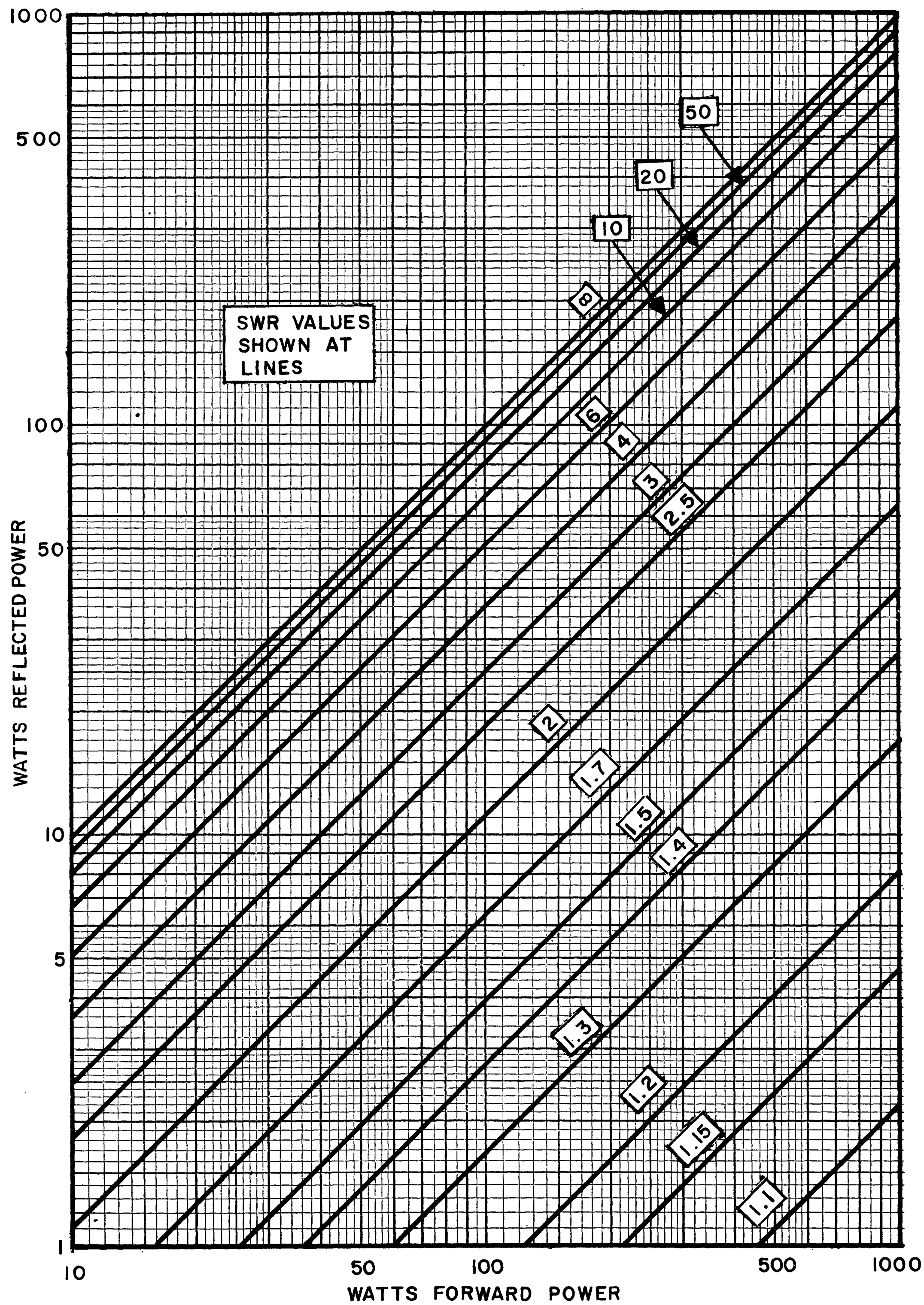
TRANSMITTER POWER OUTPUT = FORWARD POWER - REFLECTED POWER

Under good antenna match conditions, reflected power is quite small in comparison to forward power (with a correspondingly low swr), and the forward power reading is approximately equal to transmitter power output. For example, if forward power is 500 watts and reflected power is 4 watts, transmitter power output is 496 watts, which is only slightly less than the forward power reading. The swr (from figure 3-2) is about 1.2:1. Under poor antenna match conditions, reflected power is large in comparison to forward power, and transmitter power output may be quite small in comparison to either reading. The swr is correspondingly high. For example, if forward power is 700 watts and reflected power is 650 watts, transmitter power output is only 50 watts, which is considerably less than either recorded value. The swr (from figure 3-2) is 50:1.

3.5 MONITORING R-F OUTPUT.

During operating periods, the directional wattmeter forward power scale readings provide a convenient monitor of KWS-1 performance in various types of emission. For example, during SSB transmissions, the upward kick in forward power is an indication of signal level, while the rest level (which should be too small to read) is an indication of the degree of carrier suppression. With a two-tone test signal, a peak envelope power of one kw causes an average power output (as determined from the wattmeter) of about 450 watts. In a similar manner, output indications during CW, AM., and other types of emission give valuable information on KWS-1 performance.

The reflected power scale readings provide an indication of antenna match during operating periods. When the approximate reflected power level is known, any sudden or gradual changes in antenna impedance (such as those caused by faulty connections, icing, etc.,) are quickly evident as changes in the normal reflected power reading.



C189-01-1X

Figure 3-2. Graph: SWR Corresponding to Various Values of Forward and Reflected Power

SECTION IV
PRINCIPLES OF OPERATION

4.1 CONTROLS AND FUNCTIONS.

The following table gives a detailed description of the SC-101 controls and meter and their functions:

TABLE 4-1. CONTROLS AND FUNCTIONS

CONTROL	FUNCTION
OFF-ON switch	Controls application of a-c primary power to all circuits of the 312A-2 units except the station clock and light. Power is applied continuously to the clock, and the light is controlled by a switch mounted on the light bracket.
ANTENNA SELECTOR switch	This switch has six positions as follows: X (EXTRA), 80 METER, 40 METER, 20 METER, 15 METER, and 10 METER. The switch has two functions, as follows: (1) Controls application of energizing voltage to two coaxial relays in the 68Y-1 Antenna Selector unit. The relay contacts are series connected so that any one of three different antenna transmission lines may be selected corresponding to any three of the six switch positions. Up to three relays may be added, so that all six positions connect lines to the equipment. When the switch is set to any unused position, the highest frequency antenna is connected to the equipment. (2) Controls application of rotator power, rotator control, and synchro power and control voltages to either of two rotary beam antenna tower installations. One rotator/synchro installation is selected in the 20 METER position, the other in both the 15 METER and 10 METER position. In other positions (80 METER, 40 METER, and EXTRA), rotator/synchro voltage is not applied. The connections can be modified if desired.
CCW-(off)-CW switch	Applies power to the rotator(s) and synchro circuit(s), and controls direction of rotation, counterclockwise or clockwise, of selected tower rotator.
RADIO COMPASS	Indicates position of synchro transmitter on either of two-tower installations. The RADIO COMPASS dial is part of the synchro azimuth indicator unit. The synchro system is synchronized as explained in paragraph 3.3.2.2. When properly synchronized, the dial indicates the horizontal direction bearing of the rotary beam antennas mounted on the tower(s).
PH OFF-ON switch	Places the phone-patch unit in operation. When the switch is actuated, the 75A-4 Receiver output is disconnected from the speaker and applied to the telephone. The telephone line is also connected to the KWS-1 PHONE PATCH input jack.
VOX BAL	Balances the telephone line in a hybrid transformer so that the receiver output does not actuate the transmitter. Isolation resulting from the balance assures proper operation of the voice-operate circuits in the

TABLE 4-1. CONTROLS AND FUNCTIONS (Cont)

CONTROL	FUNCTION		
VOX BAL (Cont)	KWS-1 Transmitter during phone-patch conversations. Instructions for adjusting the control are given in paragraph 3.3.2.1.		
REFLECTED - FORWARD power switch	This switch determines the scale and direction of the reading on the 302C-2 indicating meter. The switch has four positions as follows:		
	POSITION and SCALE		FUNCTION
	REFLECTED	1000	Connects indicating meter to read reflected power on the transmission line, using the 1000 watt (1K) scale.
		100	Connects indicating meter to read reflected power on the transmission line, using the 100 watt scale.
	FORWARD	1000	Connects indicating meter to read forward power on the transmission line, using the 1000 watt (1K) scale
		100	Connects indicating meter to read forward power on the transmission line, using the 100 watt scale.
METER 302C-2 indicating meter	Reads forward or reflected power in watts as selected by the REFLECTED-FORWARD power switch.		

4.2 BLOCK DIAGRAM.

The SC-101 Station Control is shown in block form on figure 4-1.

4.2.1. PRIMARY POWER DISTRIBUTION.

A 115 v a-c primary power lead connects the primary power source to the utility outlets on the 534A-1 cable duct. One utility outlet is used for the power plug from the 75A-4 Receiver,and another is used for the power plug from the 312A-2 Control/Speaker unit. Four spare outlets are available for auxiliary equipment.

In the 312A-2 Control/Speaker unit, primary power is fed directly to the station clock and light and through the main OFF-ON toggle switch to the 115 v d-c relay power supply and the rotator/synchro switching components.

4.2.2 ANTENNA SWITCHING.

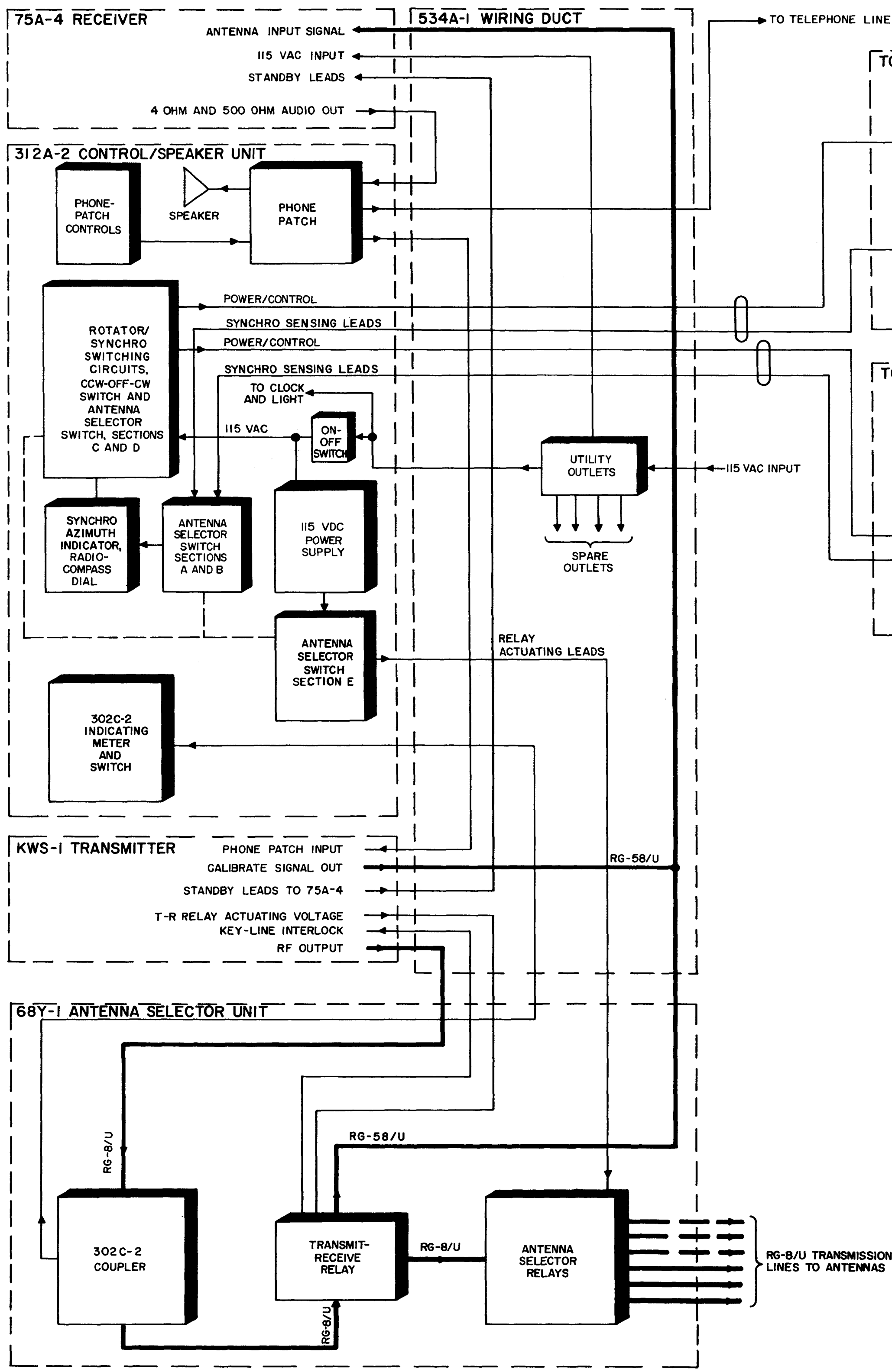
The 115 v d-c output of the relay power supply is fed through section E of the ANTENNA SELECTOR switch to any one of the antenna selector relays in 68Y-1 Antenna Selector unit. The selected relay is energized by this voltage, connecting one of the antenna RG-8/U transmission lines to the main relay feed from the transmit-receive (T-R) relay. When de-energized, the T-R relay connects the main feed and the selected transmission line to the 75A-4 Receiver ANTENNA INPUT through RG-58/U coaxial cable. A coaxial tee connector, located in the RG-58/U cable, connects to the CALIBRATE lead from the KWS-1 Transmitter. When the T-R relay is energized by the KWS-1 circuitry, the main relay feed and the selected transmission line are lifted from the RG-58/U lead and connected to the RG-8/U r-f output lead from the KWS-1 Transmitter. This RG-8/U coaxial cable feeds the T-R relay via the 302C-2 coupler. In addition,when the T-R relay is energized, a second set of contacts on the relay close the key-line interlock leads from the KWS-1 Transmitter. The interlock circuit in turn silences the 75A-4 Receiver through the standby leads.

4.2.3 PHONE PATCH.

The phone-patch subassembly is interconnected with the speaker, the audio output from the 75A-4 Receiver (both 4 ohm and 500 ohm), the KWS-1 phone-patch input, the telephone line, and the phone-patch controls mounted on the front panel of the 312A-2 unit.

4.2.4 302C-2 DIRECTIONAL WATTMETER.

The 302C-2 coupler, mounted in the 68Y-1 unit, develops d-c sensing voltages that are fed to the



C183-09-5

Figure 4-1. SC-101 Station Control, Block Diagram indicating meter and selector switch mounted in the 312A-2 unit.

4.2.5 ROTATOR/SYNCHRO.

The 115 v a-c rotator/synchro voltages are routed to the tower installations and to the synchro azimuth indicator through the CCW-(off)-CW switch and the ANTENNA SELECTOR switch, sections C and D. Sensing leads from the synchro transmitters are connected to the synchro azimuth indicator through the ANTENNA SELECTOR switch, sections A and B. The power/control and sensing leads are connected to the towers through common multiwire cables.

4.3 CIRCUIT THEORY.

Special circuits used in SC-101 Station Control are described in the following paragraphs. Other circuitry can be understood by reference to the over-all schematic diagram in section VII, the supplementary diagrams in section II, or the block diagram. Internal circuitry of the KWS-1 Transmitter and 75A-4 Receiver is explained in the instruction books supplied with these equipments.

4.3.1 ANTENNA SELECTOR RELAY CIRCUIT.

A typical antenna selector relay circuit is shown schematically in figure 4-2. The circuit uses 6 antennas and 5 selector relays. The extra antenna is assumed to be a second antenna on the 80-meter band.

The relays are arranged with the highest frequency antenna connected to the bottom relay, and the other antennas are connected in descending order with the lowest frequency antenna connected to the first relay in line. Transmitter r-f output is thus present in all relays above the one actuated but not below it. This arrangement reduces harmonic transfer to unused antennas through stray coupling in the relays, because all antennas resonant at harmonic multiples of the antenna in use are connected to a relay that is out of the series circuit. For example, if the 40-meter relay (K904) on figure 4-2 were actuated through S801E, 40-meter r-f output from the transmitter would pass through the X relay (K902) 80-meter relay K903 but not through the 20 and 15-10 meter relay contacts. Second, third, and fourth harmonic energy (on 20, 15, and 10 meters) would thus be

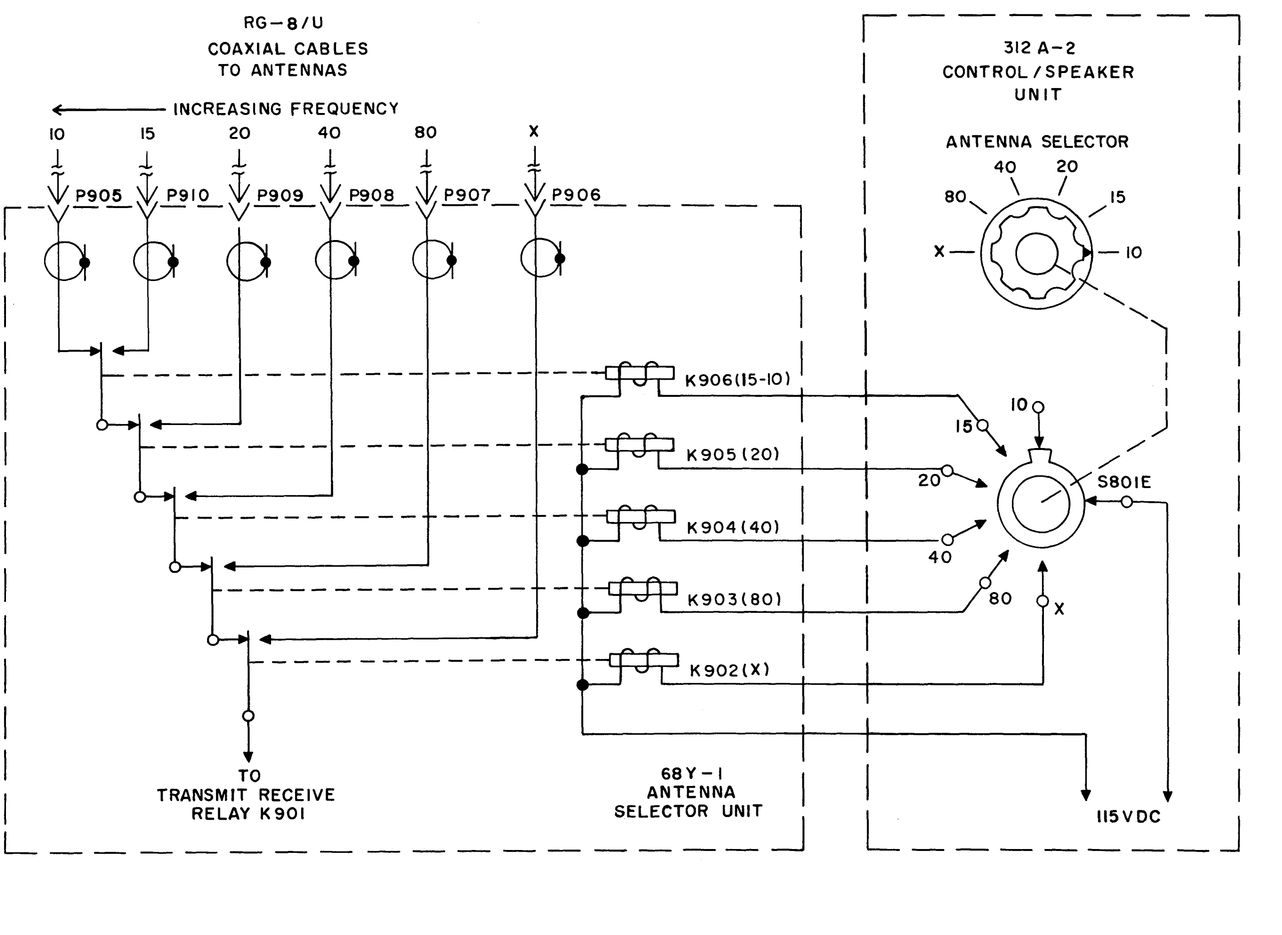


Figure 4-2. SC-101 Station Control, Antenna Selector Relay Circuit, Simplified Schematic Diagram

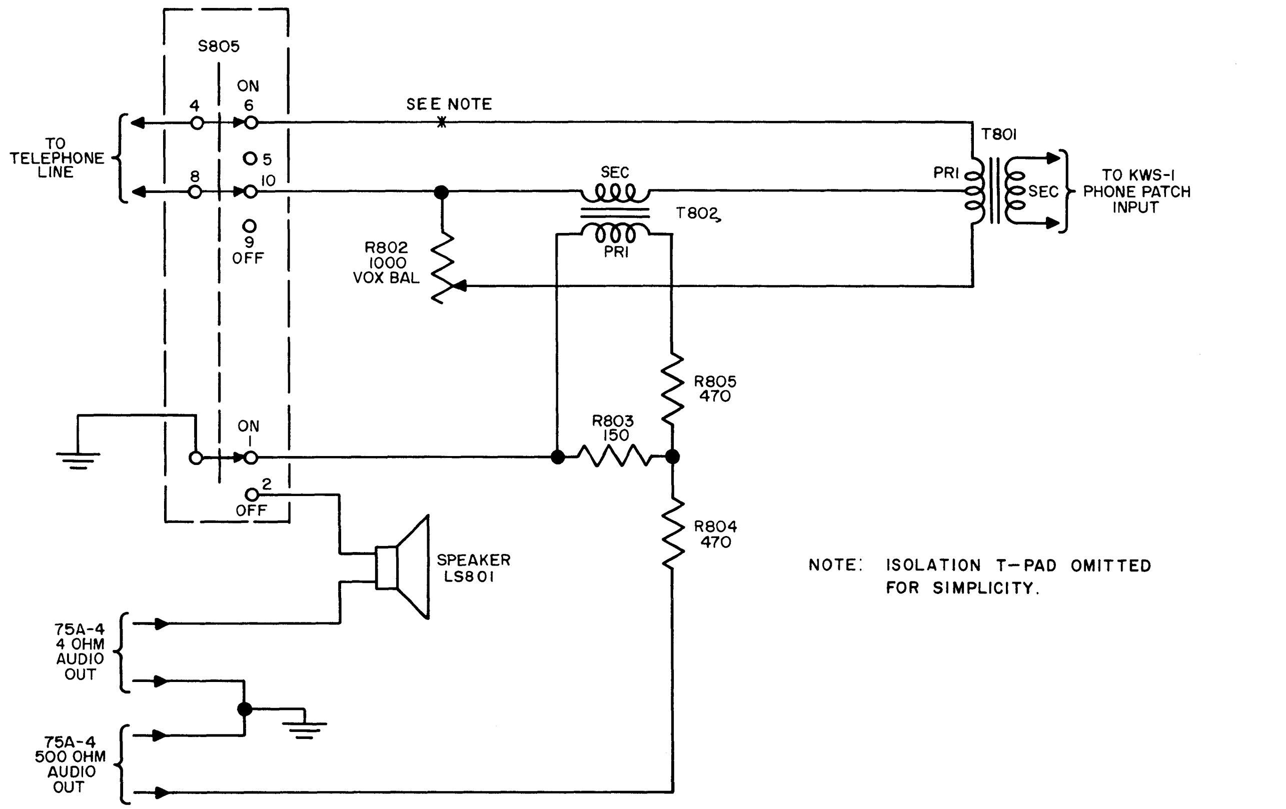


Figure 4-3. SC-101 Station Control, Phone-patch Circuit, Simplified Schematic Diagram

effectively isolated from the corresponding transmission lines. When S802 E is in the 10-meter position (as shown), none of the relays are energized, and the series connection is complete to the 10-meter transmission line. In systems using fewer than five selector relays, the highest frequency antenna is always connected to the circuit when S801 is in an unused position.

4.3.2 PHONE-PATCH CIRCUIT.

Figure 4-3 shows the phone-patch circuit schematically. The operation is clarified by tracing the audio signal voltages from the receiver to the line and from the line to the transmitter as follows: When phone-patch switch S805 is set to ON as shown, 500-ohm audio output voltage from the 75A-4 Receiver passes through an attenuating pad (R803, R804, and R805) and appears across the primary winding of T802. Corresponding audio voltage appearing across the secondary of T802 also appears across terminals 6-10 of S802, although one leg of this path passes through 1/2 of the secondary of T801. When S805 is set to ON, this audio voltage appears across the telephone line. Incoming audio voltage from the telephone line similarly appears across terminals 6-10 on S805. This audio voltage also appears across 1/2 the primary of T801 although one leg of the path passes through the secondary of T802. Corresponding incoming audio voltage appears across the secondary of T801 and is fed to the KWS-1 Transmitter phone-patch input.

The arrangement of T801, T802, and the VOX BAL control R802 prevents audio output voltage from the 75A-4 Receiver from appearing at the phone-patch input to the KWS-1 Transmitter, where it would operate the voice-operate circuit. This isolation is accomplished as follows: R802 is adjusted so that its resistance is exactly equal to the impedance of the telephone line (approximately 600 ohms). Receiver output audio voltage appears across the secondary of T802. Since R802 equals the telephone line impedance, this voltage is equally divided across the primary of T801. The equal voltages are opposite in phase, however, so the net receiver output voltage across the primary of T801 is zero, and no voltage is induced across its secondary to appear at the KWS-1 phone-patch input terminals. The VOX BAL control and the arrangement of the transformers thus effectively isolate the 75A-4 output from the KWS-1 input.

When S805 is set to OFF, the following circuit conditions occur: The telephone line is disconnected from the transformers; the 500-ohm 75A-4 output is disconnected from the primary of T802 when terminal 1 is lifted above ground; the speaker is energized when the 4-ohm speaker lead is grounded through terminals 2-12.

The audio pad (R803, R804, and R805) attenuates the 75A-4 output audio so that a comfortable speaker level corresponds with a comfortable telephone level. Thus, the audio gain of the receiver is approximately correct when the phone patch is placed in operation.

4.3.3. 302C-2 DIRECTIONAL WATTMETER CIRCUIT.

Refer to figure 4-4. Transmission line current, I, flows through the line center conductor and through the center of a toroid coil. The conductor forms the primary, and the coil the secondary, of a toroidal transformer, T901. Induced toroid current produces a voltage that divides equally across series resistors R901 and R902. This results in two equal voltages, E_1 and E_2, across the resistors. Since the junction of the R901 and R902 is grounded, E_1 and E_2 are opposite in phase and proportional to line current, I. Line voltage, E, is applied across two capacity dividers, C901-C903 and C902-C904, resulting in two equal voltages of the same phase, E_3 and E_4, across capacitors C903 and C904.

When the transmission line is mismatched (terminated in an impedance other than to 52 ohms), E_1 and E_2 represent the vector sum of two components, one proportional to the current of the forward wave and the other proportional to the current of the reflected wave. Similarly, E_3 and E_4 represent the vector sum of forward and reflected wave voltage components. Capacitors C901 and C902 are factory adjusted so that the magnitude of the forward voltage and current components are identical; the reflected components are then equal. The settings of C901 and C902 are correct for 52-ohm transmission line only.

The phase relationship between the various components is such that the r-f voltage across rectifier CR901 (E_f) is equal to the arithmetic sum of the two equal forward components, while the r-f voltage

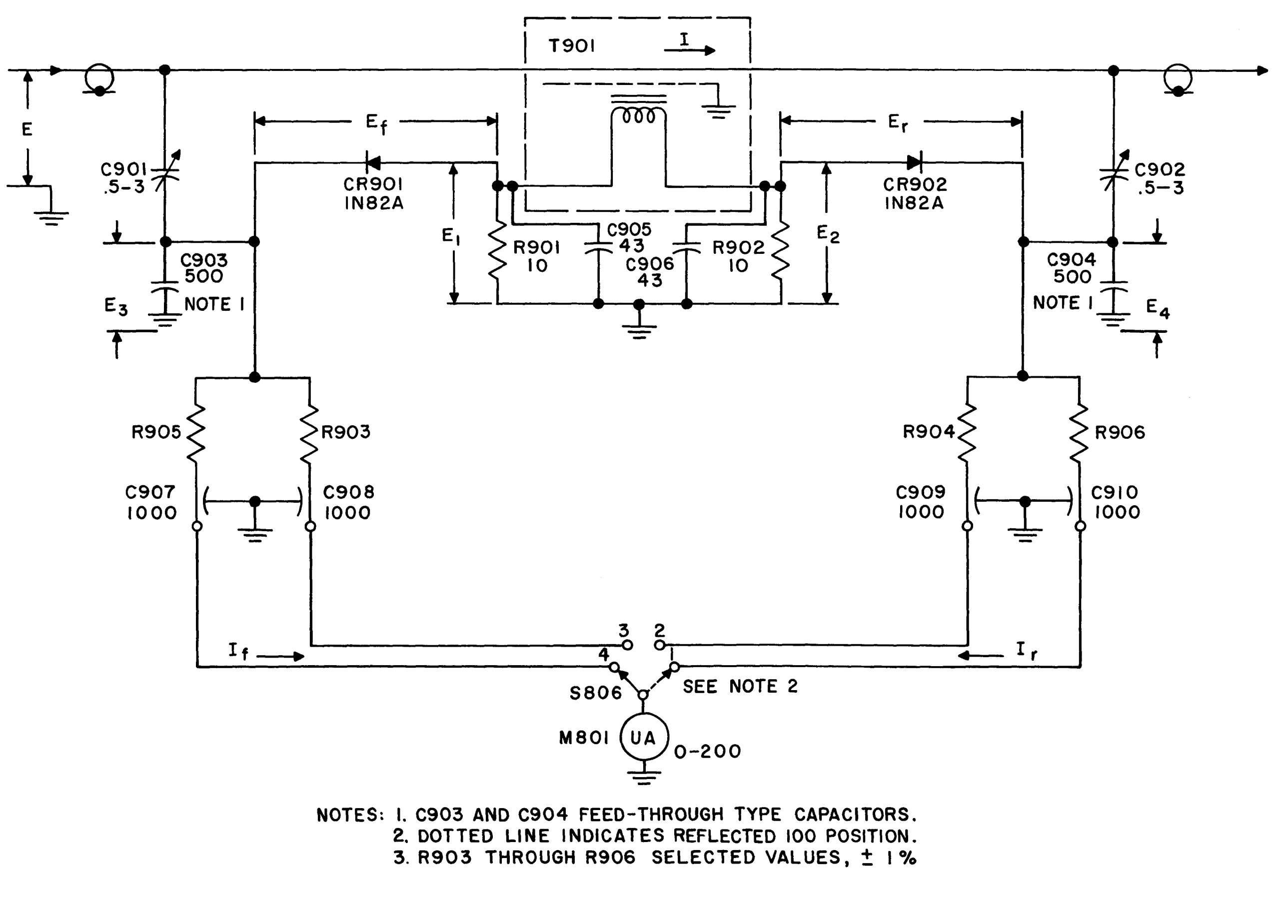


Figure 4-4. 302C-2 Directional Wattmeter, Simplified Schematic Diagram

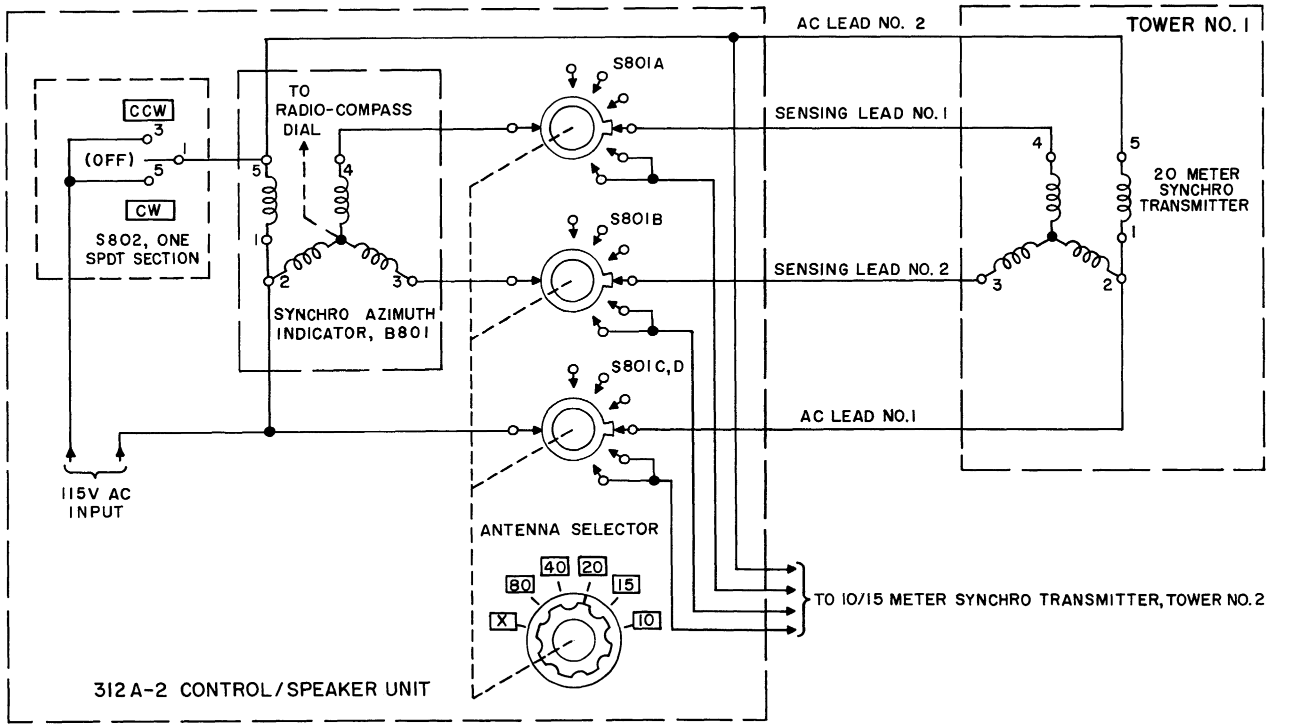


Figure 4-5. SC-101 Station Control, Synchro Circuit, Simplified Schematic Diagram

across rectifier CR902 (E_r) is equal to the arithmetic sum of the two equal reflected components.

When the transmission line is perfectly matched (terminated in a resistive load of 52 ohms), E_1 is equal in magnitude to E_3 and opposite in phase, E_f is the sum of E_1 and E_3 or twice the value of either. Also, E_2 and E_4 are equal in magnitude and of the same phase, and E_r is zero volts. These relationships are used for adjusting C901 and C902 under laboratory conditions.

Derived r-f voltages E_f and E_r are rectified and filtered by CR901, CR902, C903, and C904 to produce d-c currents, I_f and I_r, through meter M801. The meter scale is calibrated in such a way that I_f produces a scale reading proportional to forward power, while I_r produces a scale reading proportional to reflected power.

Calibrating resistors R903, R904 (1000 watt scales), R905 and R906 (100 watt scales) are selected so that I_f and I_r give accurate indications of the two power levels.

Accuracy of the r-f wattmeter is maintained over a frequency range of 2 to 30 mc in both the inductively coupled (T901) and the capacitively coupled (C901-C903, C902-C904) elements. In T901, the increase with frequency of the induced voltage is canceled by the voltage drop in the toroidal coil due to the increase with frequency of the inductive reactance when the coil is loaded with R901 and R902. In the directly coupled capacitive element, the ratio of the capacitive reactances in the voltage divider remains constant even though the reactance varies with frequency. Capacitors C905 and C906 compensate for the residual series inductance of resistors R901 and R902.

4.3.4 ROTATOR/SYNCHRO CIRCUITS.

The synchro circuit used with the SC-101 is shown in figure 4-5. One side of the 115 v a-c line connects to terminals 1 and 2 of synchro azimuth indicator B801, and also passes through sections C and D of ANTENNA SELECTOR switch S801 where it is connected to terminals 1 and 2 of one synchro transmitter, as selected. The other side of the 115 v a-c line passes through the CW-(off)-CCW switch and connects to terminal 5 of B801 and to terminal 5 of both synchro transmitters. Primary a-c power is thus applied to the synchro circuit only when the CW-(off)-CCW switch is actuated, i.e., when the rotator is running. Sections A and B of S801 connect the sensing leads from terminals 3 and 4 on B801 to the corresponding terminals on one transmitter synchro, as selected.

Rotator circuitry varies with the type of rotator used. Relay control is recommended for rotators used with SC-101 installations. Limit switches may be inserted in the relay coils to stop rotation in a given direction at some predetermined limit of travel.

Figure 2-7 in section II shows a typical complete rotator and synchro circuit at the tower.

SECTION V
MAINTENANCE

5.1 GENERAL.

The SC-101 Station Control consists mainly of inter-unit wiring circuits with only a few components that require maintenance after the installation of the equipments. The following paragraphs describe the few electrical and mechanical maintenance procedures necessary with this equipment. Many apparent troubles in the SC-101 circuitry may actually be traced to trouble in the KWS-1 Transmitter or 75A-4 Receiver circuitry. Check operation as outlined in the instruction books supplied with the equipment.

5.2 TROUBLE SHOOTING AND REPAIR.

5.2.1 GENERAL.

If trouble is experienced with the SC-101 circuitry, proceed with the initial test and adjustment procedure outlined in section III until the circuit or unit causing trouble is isolated.

5.2.2 TROUBLE SHOOTING AND REPAIR OF THE PRIMARY POWER DISTRIBUTION CIRCUIT.

Trouble in the primary power distribution circuit is usually the result of faulty a-c plugs, fuses, utility outlets, switches, or solder lug connections. If isolated to the above components, replace the faulty component or resolder the faulty joint. Refer to figure 7-11 as necessary. If F801 or F802 are blown, replace with the same value fuse after the trouble is repaired.

5.2.3 TROUBLE SHOOTING AND REPAIR OF THE ANTENNA SWITCHING CIRCUIT.

Trouble in the antenna switching circuitry can usually be traced to faulty transmission line connector joints, dirty or pitted relay contacts, open relay coils, or faulty parts in the antenna switching relay power supply. To clean relay contacts in the coaxial relays in the 68Y-1 Antenna Selector unit, proceed as follows:

a. Remove the snap button in the end of the coaxial relay.

b. Clean the four relay contacts (two on the actuating arm and one on each of the opposed jacks) with crocus cloth.

CAUTION

Do not use sandpaper or emery cloth on relay contacts. The abrasive will remove the contact plating.

c. Replace the snap button.

If trouble is traced to faulty coaxial joints, remake the joint as detailed in figure 2-5 (type N) or figure 2-6 (type BNC), section II.

If trouble is traced to the power supply, remove the faulty component and replace with an identical type.

If trouble is traced to an open relay coil, replace the entire relay with a new one.

Components can be ordered from Collins Radio Company by part number, as listed in the Parts List, section VI.

5.2.4 TROUBLE SHOOTING AND REPAIR OF THE 302C-2 DIRECTIONAL WATTMETER.

Unusual readings for forward and reflected power do not necessarily indicate a faulty instrument. The wattmeter may be reading the true conditions resulting from a faulty transmission line, antenna, or transmitter. If a fault in the instrument is suspected, switch the coupler into a transmission line that feeds a known good antenna, excite the antenna with the KWS-1 on the proper band, and compare with previous results. Check the main RG-8/U line from the KWS-1 to the coupler. If these checks prove the instrument faulty, the trouble is probably within the instrument circuitry.

Wattmeter performance can be checked further by connecting a 52-ohm nonreactive load to the patch panel in place of the antenna in use. The load must be capable of dissipating approximately 500 watts. When r-f output is fed into the load via the coupler, the forward power reading should be consistent with the KWS-1 power output (in the type of service used), and the reflected power reading should be quite small or zero, depending on the tolerance of the load. If the load is somewhat reactive, test the instrument on the 75-80 meter band.

Wattmeter calibration and accuracy can be checked by reversing the coupler in the line and comparing the power readings on corresponding scales. The coupler is reversed by removing the transmission line connectors from the coupler and replacing them on opposite ends; i.e., the antenna is connected to the input and the line from the KWS-1 to the output side of the coupler. Under these conditions, forward power will be read when the switch is set to the REFLECTED positions, and vice versa. Corresponding readings in the normal and reversed positions should be within ±10% of each other.

The value and placement of most of the parts in the coupler are critical. Replacement components must have the same tolerance, be of the same type, and be in exactly the same position as the original parts. Accuracy and calibration will be impaired if improper parts and placement are used. The types of parts and their tolerances are specified in the Parts List, section VII. Figure 7-10 can be used as a guide to parts placement. If any one of the selected resistors (R903 through R906) must be replaced, use the exact value (±1%) of the original resistor.

Faulty instruments can be returned to the factory for service, calibration, and adjustment at any time. If the indicating meter is not faulty, only the coupler unit need be returned.

CAUTION

When packing the indicating meter for shipment, pad the shipping container with abundant packing material to avoid shipping damage.

5.2.5 TROUBLE SHOOTING AND REPAIR OF THE PHONE PATCH.

If the phone-patch unit is not functioning properly, carefully check all adjustments as outlined in section III. Check all connections, plugs, etc. for open or shorted conditions. If the VOX BAL control does not yield sufficient isolation, check to make sure the telephone line is properly connected. If all connections are satisfactory, isolate and replace the faulty component. Replacement components can be ordered from the factory by part number, as listed in the Parts List, section VI.

5.2.6 TROUBLE SHOOTING AND REPAIR OF THE ROTATOR CONTROL AND SYNCHRO CIRCUIT.

Trouble in the rotator control and synchro circuit can usually be traced to improper circuit wiring, poor or broken solder connections, or frayed or shorted cables. Check and repair or replace faulty wiring as necessary using the wiring information in sections II, III, and VII as a guide. If the synchro azimuth indicator, B801, or the synchro transmitter(s) are faulty, remove them and return to the factory for repair or replacement.

CAUTION

Do not attempt to repair the synchros. They are precision units that can be properly repaired only at the factory.

5.3 PREVENTIVE MAINTENANCE.

Trouble in the SC-101 units can often be anticipated and avoided by a regular checking procedure. The installation should be checked periodically as follows:

a. Inspect the rotator/synchro cables for signs of wear or deterioration.

b. Check the operation of all antenna switching relays, especially those that are used infrequently.

c. Check the operation and alignment of the synchro circuits, especially those connected to a tower installation that is used infrequently.

d. Check all coaxial connectors for signs of mechanical strain. Apply power to the line in question, and move the connector and/or the line to several positions, observing the wattmeter indicator for erratic movement.

e. Inspect all solder lugs and terminals for signs of strain, wear, or breaking.

f. Check all conduit connectors to make sure they are tight. Any trouble discovered while performing these checks usually can be quickly repaired, resulting in efficient operation of the system with a minimum of maintenance time.