BROADCAST TRANSMITTING EQUIPMENT

RCA

Instructions

RADIO CORPORATION OF AMERICA, Industrial Electronic Products

Hootan

BTR-11A
BTR-20A
REMOTE CONTROL SYSTEMS

IB-30258-P

BROADCAST TRANSMITTING EQUIPMENT

INSTRUCTIONS

REMOTE CONTROL SYSTEMS

TYPE BTR-11A

MI-27537

MI-27538

TYPE BTR-20A

MI-27539

MI-27526

RADIO CORPORATION OF AMERICA
INDUSTRIAL ELECTRONIC PRODUCTS
CAMDEN, N. J.

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BTR-11A Studio Control Unit, MI-27537
and
BRT-20A Studio Control Unit, MI-27539

Power Input

105-125 v, ac, 50/60 cps, 25 watts

Relay

1K1 - Fail-Safe, meets FCC requirements

Fuses

1F1 - 1 amp, 105-125 v input

1F2 - 1 amp, 105-125 v input

Telephone Line

Two dc pairs maximum loop resistance 5000 ohms

Dimensions

BTR-11A
Height - 8 3/4 inches
Width - 19 inches
Depth - 6 inches

BTR-20A
Height - 8 3/4 inches
Width - 19 inches
Depth - 8 7/8 inches

Weight

18 pounds (approximately)

Panel Mounting

Standard ElA slots

Finish

Light umber gray

BTR-11A Transmitter Control Unit, MI-27538
and
BTR-20A Transmitter Control Unit, MI-27526

Power Input

105-125 V ac, 50/60 cps, 25 watts

Relays

2K1 - Stepping/Homing Control

2K2 - On-Raise/Off-power Control

2K3 - Fail-Safe Control

2K4 - On-Raise

2K5 - Off-Lower

2K6 - Homing

2K7 - Stepping

2K8 - Fail-Safe

Fuses

2F1 - 1 amp, 105-125 v input

2F2 - 1 amp 105-125 v input

Dimensions

BTR-11A

Height - 8 3/4 inches
Width - 19 inches
Depth - 11 3/4 inches

BTR-20A

Height - 8 3/4 inches
Width - 19 inches
Depth - 12 7/8 inches

Weight

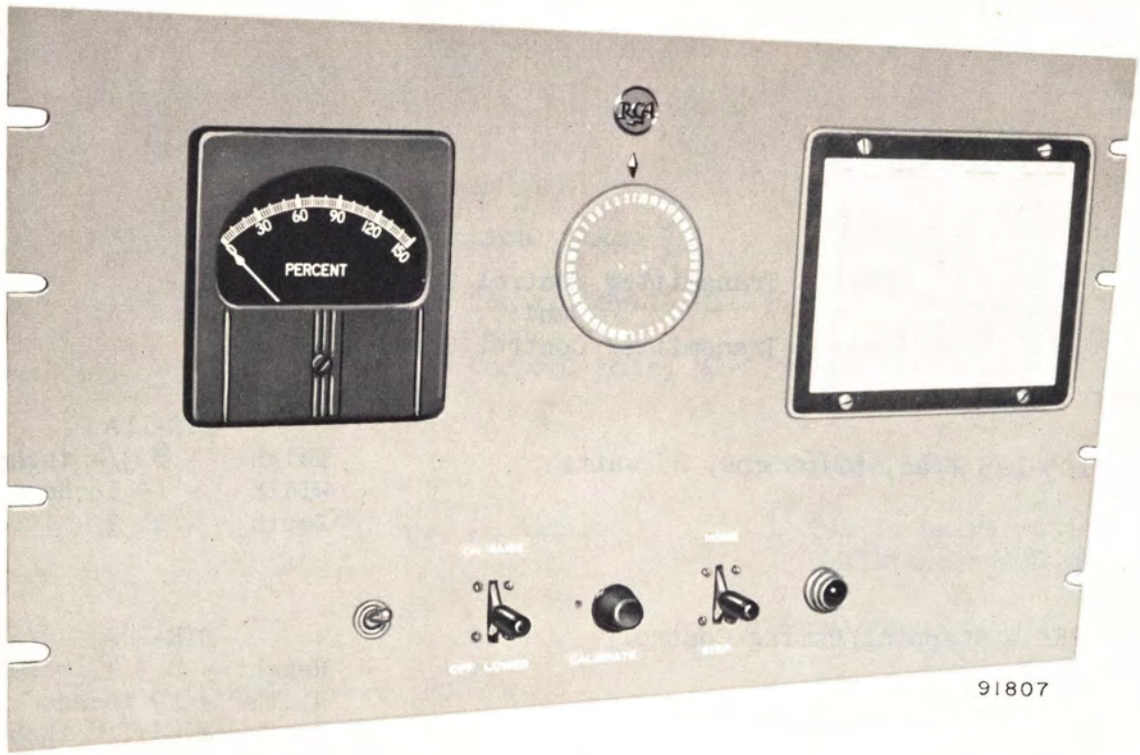
20 pounds (approximately)

Panel Mounting

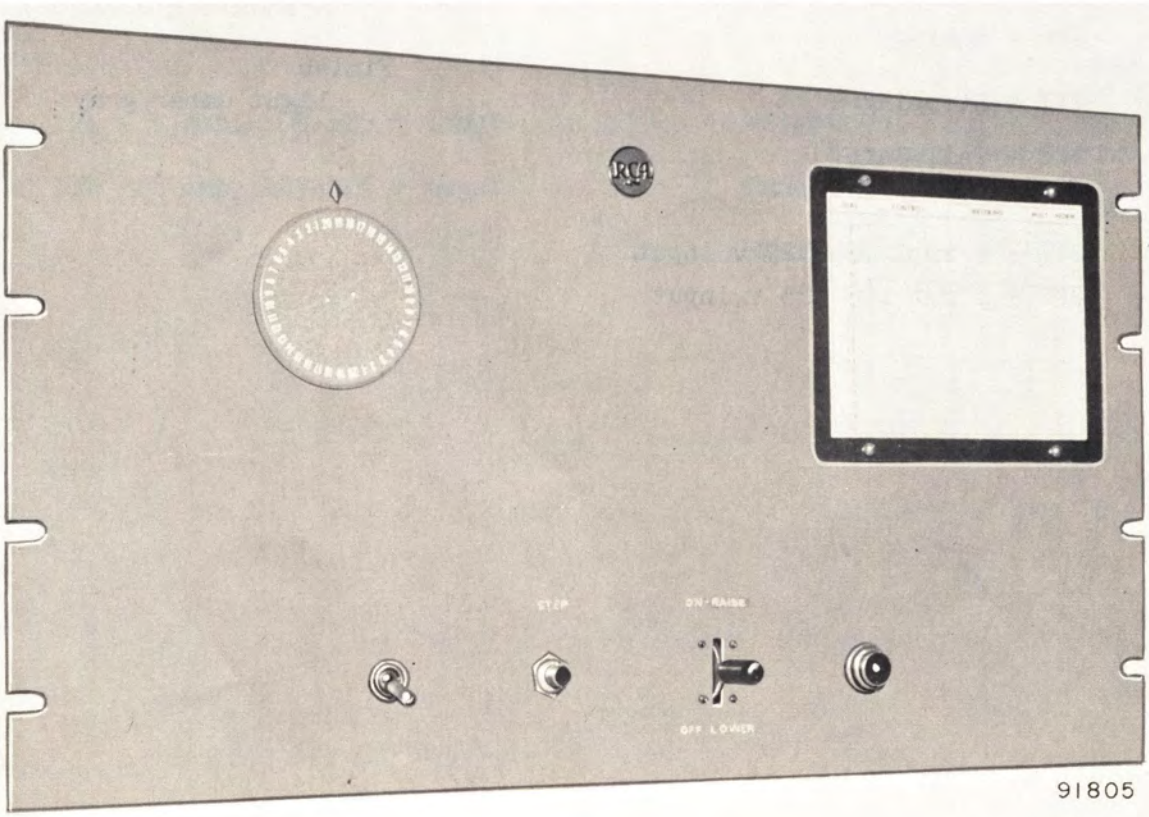
Standard E1A slots

Finish

Light umber gray

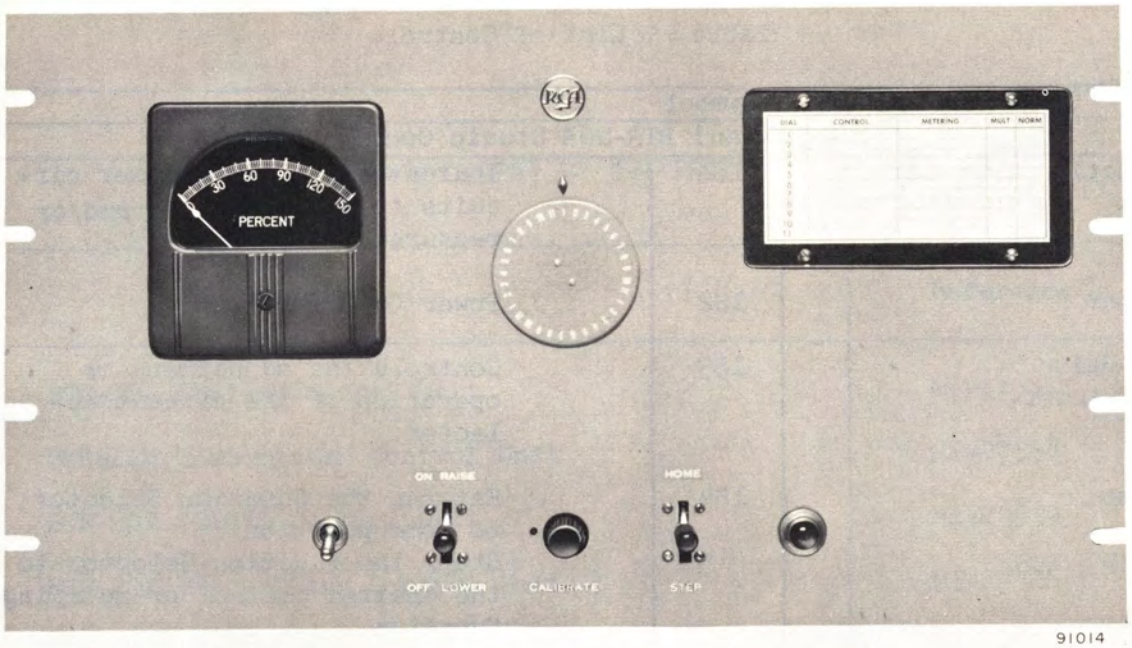


BTR-20A Studio Control Unit

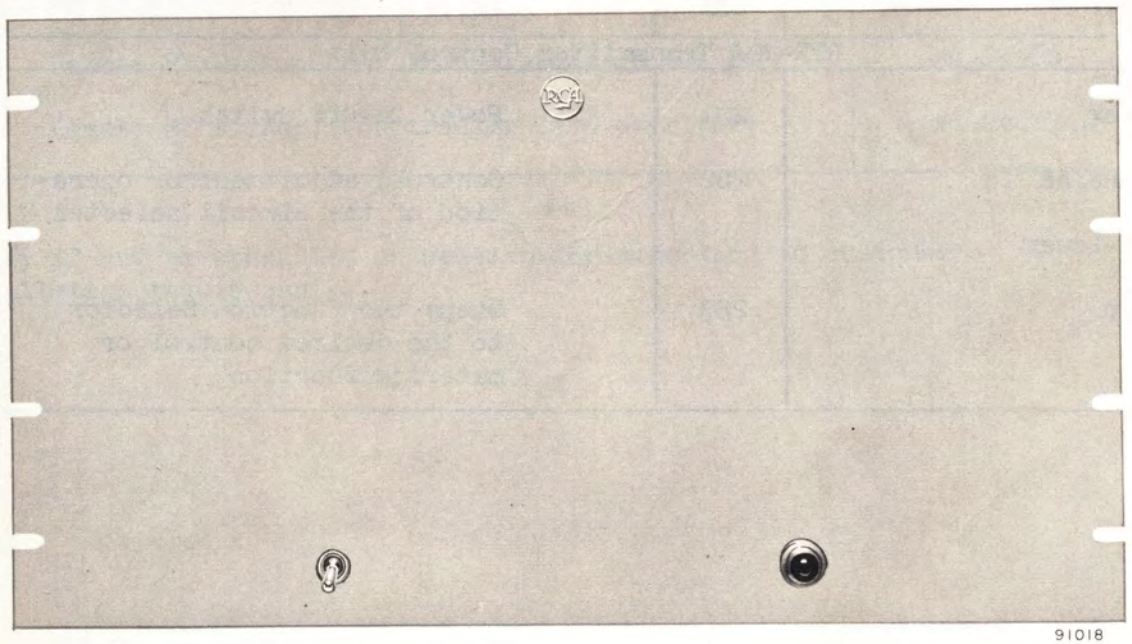


BTR-20A Transmitter Control Unit

Figure 1 - BTR-20A Remote Control System



BTR-11A Studio Control Unit



BTR-11A Transmitter Control Unit

Figure 2 - BTR-11A Remote Control System

Table 1. List of Controls

Control	Symbol	Purpose
BTR-11A and BTR-20A Studio Control Units		
Function Selector	1S1	Indicates the transmitter circuits to be controlled and/or measured
Power	1S2	Power On-Off switch
On-Raise Off-Lower	1S3	Controls the adjustment or operation of the circuit selected
Home	1S4	Returns the Function Selector to home position
Step		Steps the Function Selector to the desired control or metering function
Calibration	1R7	Calibrates panel meter
	1R8	Adjusts resistance of control telephone line
BTR-11A Transmitter Control Unit		
Power	2S1	Power On-Off Switch
BTR-20A Transmitter Control Unit		
Power	2S1	Power On-Off Switch
On-Raise Off-Lower	2S2	Controls adjustment or operation of the circuit selected
Step	2S3	Steps the function Selector to the desired control or metering function

Table 2. List of Equipment

Quantity	Description	Reference
1	BTR-11A Studio Control Unit	MI-27537
1	BTR-11A Transmitter Control Unit	MI-27538
1	BTR-20A Studio Control Unit	MI-27539
1	BTR-20A Transmitter Control Unit	MI-27526
*	Latching Relay Panel	MI-27509
*	AC Voltage Pickup	MI-27516
*	Tower Lighting Unit	MI-27519
*	Meter Panel (AM Monitoring)	MI-27527
*	Meter Commutator	MI-27541
*	Remote RF Pickup (for transmitters up to 5kv)	MI-27966
*	Remote RF Pickup (for transmitters over 5kv)	MI-28027-A

* Supply if and as specified on sales order according to customer's installation requirements.

DESCRIPTION

General

The RCA Type BTR-11A and Type BTR-20A Remote Control Systems, shown in figures 1 and 2, are designed for remote operation of an AM, FM, or TV transmitter. Use of these systems, in conjunction with a number of auxiliary units, permits complete operation of a station from the studio, without the presence of an operator at the transmitter.

The Type BTR-11A consists of a Studio Control Unit, MI-27537, and a Transmitter Control Unit, MI-27538, and is capable of remotely controlling and/or measuring up to ten transmitter functions. This number includes several spare metering and control facilities.

The Type BTR-20A consists of a Studio Control Unit, MI-27539, and a Transmitter Control Unit, MI-27526, and is capable of remotely controlling and/or measuring up to nineteen transmitter functions. The extended control range of the BTR-20A makes possible the remote control of a second or standby transmitter. Facilities for spare metering and control functions are also provided.

The operation of both remote systems and the transmitter functions each will control are essentially the same. The major difference between the two systems is the wider range of transmitter functions possible to control with the BTR-20A. An additional feature of the BTR-20A is that the transmitter control unit has all the controls necessary to operate the transmitter locally.

The number of auxiliary units required for use with either system is determined by the number of transmitter functions to be measured and/or controlled.

The transmitter control unit and most of the auxiliary units are installed at the transmitter. The studio control unit may be conveniently mounted in a standard rack at the station's studio.

Transmitter control and circuit measurement information is via two telephone lines and a ground return with maximum loop resistances of 5000 ohms.

CIRCUIT DESCRIPTION

In the following circuit description, the BTR-20A will be discussed. Except for the differences previously pointed out, the description applies to both types of remote controls.

This instruction book contains illustrations and schematic diagrams for both types.

Studio Control Unit MI-27539

The studio control unit (see schematic, figure 22) remotely operates the transmitter control unit which in turn controls the designated transmitter functions. It also monitors the operating condition of the designated transmitter circuits.

The unit consists of a function switch, 1S1; an on-raise/off-lower function control switch, 1S3; a power switch, 1S2; a home-step switch, 1S4; a calibration control, 1R7; a dual potentiometer, 1R8; a meter, 1M1; a relay, 1K1; two fuses, F1 and F2; an indicator light, 1I1; a battery, 1BT1; and a power supply consisting of transformer 1T1, rectifier diode 1CR1, and filter capacitor 1C1.

The power supply furnishes +50 v dc or -50 v dc power for energizing polarized relays 2K1 and 2K2 in the transmitter control unit. Relay 1K1 is the studio control unit fail-safe control device of the remote control system fail-safe circuit. Fuses 1F1 and 1F2 protect transformer 1T1 in the 105-125 v ac power input circuit.

Controls

1. The HOME-STEP switch, 1S4, when operated in the "STEP" position rotates the function selector switches, 2S4, of the transmitter unit, and 1S1 of the studio control unit to the desired function. Each time the HOME-STEP switch, 1S4, is operated in the "STEP" position, the FUNCTION SELECTOR switches move forward one step. When the HOME-STEP switch, 1S4, is held in HOME position the FUNCTION SELECTOR switches will step rapidly and without interruption until they reach HOME, position 20.

2. The ON-RAISE/OFF-LOWER switch, 1S3, when operated connects 50 v dc through resistors 1R2, 1R3, and 1R8 to relays 2K1 and 2K2 of the transmitter control unit. 1R2 and 1R3 drop the voltage so that 2K1 will not operate.

3. The POWER switch, 1S2, connects and disconnects 105-125v ac to the primary of power transformer 1T1.

4. LIGHT 1I1 when illuminated indicates that 105-125 v ac power is being supplied to the unit.

5. The CALIBRATE control, 1R7, is used to adjust meter 1M1 to 100% on the meter scale when connected across the standard mercury battery, 1BT1. This is done with the function selector and switches 1S1 and 2S4 on position 1. 100% is the nominal reading across the shunts of properly operating metered circuits. It is necessary to do this each time meter readings are taken for the log.

6. Control 1R8 is for adjusting the loop resistance of the telephone line to 5000 ohms for proper operation of the control functions.

Connections

All external connections are made to terminal board 1TB1. Terminals 1TB1 - 11, -12 are for connections to the 105-125 v ac power source. Terminals 1TB1 -1, -2, -3, -4 are for the telephone line connections to terminals 2TB2 -1, -2, -3, -4 respectively of the transmitter control unit.

Terminals 1TB1-5 is the ground connection for the ground circuit return from the transmitter control unit. It is important that the ground resistance be at a minimum, therefore 1TB1-5 should be connected to the station ground.

Terminal 1TB3 -1, -2, -3 and 1TB1 -6, -7, -8 are for connecting auxiliary meters to function selector switch 1S1 for monitoring frequency, modulation or other transmitter characteristics. Terminal board 1TB3 is located under the cover over 1S1 FUNCTION SELECTOR switch.

Terminals 1TB1 -14, -15 are for opening the telephone control circuit; and terminals 1TB1 -13, -14 are for connecting an ohm meter when adjusting 1R8.

TRANSMITTER CONTROL UNIT, MI-27526

The transmitter control unit (see schematic, figure 23) provides the means of connecting the various transmitter circuits and functions to be measured and/or controlled, to the meter and the operating controls of the studio control unit.

The unit consists of 8 relays, 2K1 through 2K8, function selector stepping switch 2S4, power switch 2S1, on-raise/off-lower function control switch 2S2, step pushbutton 2S3, indicator light 2I1, fuses 2F1 and 2F2 and a power supply consisting of transformer 2T1, rectifier 2CR1, and filter capacitor 2C7.

The power supply furnishes dc for energizing relays 2K3 through 2K8 and function selector stepping switch 2S4. Fuses 2F1 and 2F2 protect transformer 2T1 in the 105-125 v ac power input circuit.

Relays

Polarized relays 2K1 and 2K2 are energized by a dc voltage from the studio control unit. The polarized relays are single pole double throw normally open units. When d c voltage is applied in one polarity one set of contacts close. When the polarity is reversed the other set of contacts close. In this discussion, the polarity of the voltage to terminal 1 of the relay coil will be given. Terminal 2 of the relay coil will of course, get a voltage of opposite polarity. These two relays are connected in parallel so relay 2K2 is energized each time the studio control unit sends a voltage to operate relay 2K1, but any action normally resulting from the operation of 2K2 is prevented by opening the energizing circuit to relays 2K4 and 2K5 when relays 2K6 or 2K7 operate. 2K4 and 2K5 are time delay closing relays to insure this interlock operation.

When the lower voltage is sent from the studio unit to operate relay 2K2, relay 2K1 is prevented from energizing by resistor 2R3 in its circuit which makes 2K1 effectively less sensitive than 2K2. Relays 2K3 through 2K8 are energized by a dc voltage from the transmitter control unit power supply.

Relay 2K1 is energized by positive or negative dc voltage. It is energized each time HOME-STEP switch 1S4 is depressed or raised. A positive voltage will close contacts 6-8 energizing stepping relay 2K7; and a negative voltage will close contacts 2-8 energizing homing relay 2K6.

Relay 2K2 is energized by positive or negative dc voltage. It is energized when on-raise/off-lower switch 1S3 in the studio unit is closed. A positive voltage will close contact 6-8 energizing on-raise relay 2K4; and a negative voltage will close contact 2-8 energizing off-lower relay 2K5.

Relay 2K3 is normally always energized and will remain energized as long as operating power is supplied to both control units. Closed contacts 2-8 of 2K3 hold fail-safe relay 2K8 energized.

Relay 2K4 is energized when a positive voltage from the studio control unit operates relay 2K2 (contacts 6-8 closed) or when switch 2S2 is moved to the on-raise position. Closing the contacts of 2K4 connects the contact arms of sections "A" and "B" of function selector stepping switch 2S4.

Relay 2K5 is energized when a negative voltage from the studio control unit operates relay 2K2 (contacts 2-8 closed) or when 2S2 is moved to the off-lower position. Closing the contacts of relay 2K5 connects the contact arms of section "C" and "D" of function selector stepping switch 2S4.

Relay 2K6 is energized when a negative voltage from the studio control unit operates relay 2K1 (contacts 2-8 closed). Closing 2K6 contacts 6 and 7 connects power to the solenoid of 2S4 to quickly move switch 2S4 to "home", position 20. Contacts 4 and 5 open the energizing circuit to relay 2K5 before it can operate (2K5 is time delay close relay).

Relay 2K7 is energized when a positive voltage from the studio control unit operates relay 2K1 (contacts 6-8 closed). When 2K7 operates, one contact is opened and another contact is closed. The open contact, 7, breaks the energizing circuit to relay 2K4 so that it cannot operate. The time delay in 2K4 insures this. The closed contacts, 5 and 6, connect power to the solenoid of 2S4. On removal of power, the spring return of the armature moves switch 2S4 forward one step. Switch 2S4 moves forward one step each time 2K7 is energized and de-energized. Relay 2K7 is energized when HOME-STEP switch 1S4 of the studio unit is depressed to the step position.

Relay 2K8 is normally energized and remains so as long as relay 2K3 is energized. The power supply circuit for the transmitter is completed through the closed contacts 3-4 of relay 2K8.

Function Selector Stepping Switch 2S4

The switch consists of a solenoid stepping and homing mechanism and 6 switch sections alphabetically marked. Each section has 20 contacts, all 20 of sections "A" thru "D" and 19 of the contacts of sections "E" and "F" of 2S4 are connected to the same numbered contact of a correspondingly marked row of 2TB3. Connections from the transmitter circuits to be measured and from the auxiliary equipment, which actually does the controlling, are made to identical numbered terminals of sections "A" and "B" or "C" and "D" or "E" and "F".

Section "A" and "B" The contact arms of sections "A" and "B" of 2S4 are connected to the normally open contacts of relay 2K4. The switch contact of sections "A" and "B" are connected to the controlled functions or circuits of the transmitter or transmitter accessories. With some transmitters and accessories, auxilliary equipment is necessary. These two sections are concerned with the control operations associated with the ON-RAISE position of the function control switch 1S3 of the studio control unit or the ON-RAISE position of switch 2S2 of the transmitter control unit.

Sections "C" and "D" The movable contact arms of section "C" and "D" of 2S4 are connected to the normally open contacts of relay 2K5. The switch contacts (1 through 20) of sections "C" and "D" are connected to the controlled functions or circuits of the transmitter or transmitter accessories. With some transmitters and accessories, auxilliary equipment is necessary. These two sections are concerned with the control operations associated with the OFF-LOWER position of the function control switch 1S3 of the studio control unit or the OFF-LOWER position of switch 2S2 of transmitter control unit. Position 1 may be used in emergency for an additional control function only. It is normally reserved for calibration.

Section "E" and "F" The movable contact arm of sections "E" and "F" are connected to meter 1M1 on the studio unit through the contacts of 1S1 of the studio control unit via the telephone line. The switch contacts (2 through 20) of sections "E" and "F" are connected to the circuits to be monitored. These circuits are connected between identical numbered terminals of sections "E" and "F" of 2TB3. Connections to the transmitter circuits are made to meter shunts having a normal voltage of .67 v. This voltage will produce a reading of 100% on meter 1M1. Switch contacts of sections "E" and "F" in position 1 are connected together for calibrating 1M1 for telephone line variations.

Stepping

Each time stepping relay 2K7 operates, the solenoid of function selector switch 2S4 is energized. When 2K7 drops out, switch 2S4 moves forward one step. Relay 2K7 is energized each time HOME-STEP switch 1S4 in the studio unit or the STEP button in the transmitter unit is depressed. Thus, 2S4, in the transmitter unit, moves forward a single step each time switch 1S4, in the studio unit, is depressed and released. 1S1 moves in synchronism only when 1S4 is depressed and released.

Homing

When the homing relay, 2K6, is energized (the HOME-STEP switch, 1S4, in HOME position) the solenoid of 2S4 is energized through contacts 21-22 and 23-24 of 2S4. 2S4 will quickly step forward through the interrupter action of contacts 23 - 24 until contacts 21 - 22 is opened by the revolving cam. This breaks the solenoid energizing circuit and 2S4 stops at HOME, position 20, ready for the next selection of switch 1S4 of the studio control unit.

Controls

1. The POWER switch, 2S1, connects and disconnects the 105-125 v ac input to the primary of power transformer 2T1.

2. The ON-RAISE/OFF-LOWER switch, 2S2, when moved to the ON-RAISE position energizes relay 2K4; and when moved to the OFF-LOWER position energizes relay 2K5. This switch is for controlling the operational functions of the transmitter from the transmitter location.

3. The STEP pushbutton 2S3 is for manually stepping the FUNCTION SELECTOR switch, 2S4, from the transmitter location. Switch 2S4 moves one step each time 2S3 is pressed and released.

4. Lamp 2I1 when illuminated indicates that operating power is being supplied to the unit.

Connections

Terminal Board 2TB2

Connections to the studio control unit and power source to the transmitter control unit are made to terminal board 2TB2. Terminals 2TB2 -8, -9 are for connecting the 105-125 v ac power source. Terminals 2TB2 -1, -2, -3, -4 are for connecting the telephone line from terminals 1TB1 -1, -2, -3, -4 of the studio control unit. Terminal 2TB2 -5 is the ground connection for the ground circuit return from the studio control unit terminal 1TB1-5 and should be connected to the station ground. Terminals 2TB2 -6, -7 are for connection in series with the control circuit of the transmitter for fail-safe operation.

Terminals 2TB2 -13, -14, -15, -16 and 2TB2 -17, -18, -19, -20 are provided for making wiring connections when 1S1 of the studio control unit is utilized for special applications.

Terminal Block 2TB3 is for making connections to the circuits or functions to be controlled and the circuits to be monitored. The terminals of sections "A"-"B" and "C"-"D" are for making connections to the functions or circuits to be controlled. These terminals are connected to relays or other control components which perform the desired function. The terminals of sections "E" - "F" are connected to the circuits that are to be monitored. These connections are to meter shunts in the circuits of the transmitter or associated equipment. The use of shunts permits meter 1M1 to register readings over the wide range of transmitter circuit values. The meter shunts are designed to provide one volt for a full scale reading or .67 volts for a nominal reading of 100%.

FUNCTIONAL ANALYSIS

Stepping Function

By means of the stepping switch in the transmitter control unit, the desired circuit can be selected through the HOME-STEP switch, 1S4, of the studio control unit. Each time the HOME-STEP switch, 1S4, of the studio control unit is depressed (STEP) and released, the FUNCTION SELECTOR switch, 1S1, of the studio control unit and 2S4 of the transmitter control unit advance one position in synchronism. FUNCTION SELECTOR switch 1S1 of the studio control unit is used to switch the studio end of the meter circuit and as an indication of the function position to which the system has been switched. Each time HOME-STEP switch 1S4 is depressed a positive voltage is applied to the transmitter control

relay, 2K1-1, closing contacts 6-8 which energizes stepping relay 2K7. Relay 2K7 in turn closes the circuit to the solenoid of 2S4. The actual switching of the circuit does not occur until 1S4 is released as the stepping is done by the spring return of the armature of the FUNCTION SELECTOR switch. A separate set of contacts on the HOME-STEP switch, 1S4, simultaneously operate the studio control unit FUNCTION SELECTOR switch, 1S1. Each time HOME-STEP switch 1S4 is depressed and released the FUNCTION SELECTOR switches 1S1 and 2S4 advance one step.

When HOME-STEP switch 1S4 is raised to the HOME position, both FUNCTION SELECTOR switches immediately go to HOME, position 20. When HOME-STEP switch 1S4 is raised to the HOME position a negative voltage is applied to the transmitter control unit relay 2K1-1. Relay 2K1 is energized and closes contacts 2-8. This completes the energizing circuit to homing relay 2K6. Relay 2K6 operates, energizing the circuit of the solenoid of 2S4 through contacts 21-22 and 23-24. Switch 2S4 moves one step forward as contacts 23-24 open. This breaks the circuit to 2S4 solenoid and contacts 23-24 close, energizing the solenoid again. The successive opening and closing of the circuit at contacts 23-24 occurs at a rapid rate, quickly stepping 2S4 forward until the stop cam opens the circuit at contacts 21-22. This permanently opens the stepping circuit and 2S4 stops at HOME, position 20. Another set of contacts on 1S4 causes FUNCTION SELECTOR switch 1S1 to also HOME to position 20 in a similar manner.

Control Circuits

The desired remote control function is selected by operating the HOME-STEP switch 1S4 on the studio unit. After FUNCTION SELECTOR switches 1S1 and 2S4 have been stepped to the desired position, by the HOME-STEP switch, the control operations are performed by operating the ON-RAISE/ OFF-LOWER switch, 1S3.

On-Raise Control

When switch 1S3 is moved to the ON-RAISE position the positive dc source is applied to the transmitter unit control relay, 2K2. This energizes 2K2, closing contacts 6-8 which in turn energizes the circuit to the ON-RAISE relay, 2K4. Relay 2K4 operates, connecting contact arms "A" and "B" of 2S4 together. This completes a circuit which starts the auxiliary control function operation which will continue as long as switch 1S3 is held in the ON-RAISE position. When switch 1S3 is released, relays 2K2 and 2K4 are released and the control process stops.

Off-Lower Control

When switch 1S3 is moved to the OFF-LOWER position the negative dc source is applied to relay 2K2. Relay 2K2 is energized, closing contacts 2-8 which in turn close the circuit of the OFF-LOWER relay, 2K5. This starts the auxiliary equipment operating to perform a control function in the opposite manner to that produced by relay 2K4. The control function operation will continue as long as switch 1S3 is held in the OFF-LOWER position. Releasing switch 1S3 stops the control process.

Metering

The transmitter circuits selected for metering are connected from sections E-F of 2S4 to identically numbered terminals of section E-F of terminal block 2TB3. From 2TB3 the circuits are connected to meter 1M1, on the studio unit, through the contacts on 1S1. The meter will show, in percentages, the condition of the circuit connected to that particular selection but not the actual current or voltage values. For a circuit functioning normally, the meter indication will be approximately 100%. A chart can be made to convert the percentage readings into the actual circuit values.

Fail-Safe Circuit

The purpose of this circuit is to disable the transmitter if the operator at the studio loses control of the transmitter due to failure of the telephone line or the studio or the transitter unit. This circuit consists of control relay 2K3 and FAIL-SAFE relay 2K8 in the transmitter control unit, FAIL-SAFE relay 1K1 in the studio control unit, the telephone line and the ground between the transmitter and studio. Normally 2K3, 2K8 and 1K1 are energized, holding the contracts connected to terminals 2TB2 -6, -7 closed. These terminals are in series with the transmitter control circuit. The closed contact of 1K1 of the studio control unit completes the circuit that holds 2K3 energized. If the 105-125 v ac supply of either the transmitter control unit or studio control unit should fail, relay 2K3 will be de-energized releasing relay 2K8. When 2K8 releases, the transmitter operating control circuit is opened at 2TB2 -6, -7 disabling the transmitter.

NOTE: This Fail-Safe circuit is also used in the BTA-500R and the BTA-1R transmitters and others using a temporarily opened circuit for turning off the plate voltage. Connect 2TB2-11 and 2TB2-12 to the "C" and "D" section of 2TB3 corresponding to the PLATE VOLTAGE OFF function. Connect 2TB2-6 and 2TB2-7 in the interlock circuit to be temporarily interrupted (10B and 11B in the BTA-500R and BTA-1R transmitters). When 2TB2-11 and 2TB2-12 are shorted together, relay 2K3 drops out. The opening of contacts 2 and 8 of 2K3 drops out fail safe relay 2K8. Contacts 3 and 4 of 2K8 open the interlock circuit causing the plate voltage to be removed from the transmitter.

Metering and Control Options

This equipment is capable of accommodating up to 19 metering and 20 control functions. The actual number of functions used will vary; however there are certain control and metering functions which are standard requirements for most installations. The functions shown in table 3, Typical Meter and Control Functions, are representative of the functions normally employed. The circuits and functions listed there will serve as an example of a typical installation.

Telephone Circuits

The system requires two pairs of telephone wires and a ground return. These lines are sufficient to serve a system in which the loop resistance between studio and transmitter may be a maximum of 5000 ohms.

TABLE 3 TYPICAL CONTROL AND METERING FUNCTIONS
FOR MULTI-TOWER ARRAY

FUNCTION	CONTROL	METERING	AUXILIARY CONTROL EQUIPMENT		2TB3 CIRCUIT CONNECTIONS			
					Control		Metering	
			Control	Metering	On-Raise	Off-Lower	+	-
1		Calibrate						
2	Transmitter On-Off	Filament Voltage	*MI-27509A	MI-27516	A2 - B2	C2 - D2	E2	F2
3	Plate On-Off	Plate Voltage		----	A3 - B3	C3 - D3	E3	F3
4	Overload Reset	Plate Current	**	**	A4 - B4		E4	F4
5	Power Output	Antenna Current-Common Point	Motorized Actuator	MI-28027A # or MI-27966	A5 - B5	C5 - D5	E5	F5
6		Antenna Current 1		#			E6	F6
7		Antenna Current 2		#			E7	F7
8		Antenna Current 3		#			E8	F8
9		Frequency Monitor		MI-27527			E9	F9
10		Modulation Monitor †		MI-27527			E10	F10
11	Tower Light On-Off	1 Tower Light Current		MI-27519	A11-B11	C11-D11	E11	F11
12		2 Tower Light Current		MI-27519			E12	F12
13		3 Tower Light Current		MI-27519			E13	F13
14	Conelrad		**		A14-B14	C14-D14	E14	F14
15 (††)					A15-B15	C15-D15	E15	F15
16 (††)					A16-B16	C16-D16	E16	F16
17 (††)					A17-B17	C17-D17	E17	F17
18 (††)					A18-B18	C18-D18	E18	F18
19 (††)					A19-B19	C19-D19	E19	F19
20	Home				A20-B20	C20-D20	E20	F20

* Not needed with the "R" line of RCA transmitters.
** Special for each transmitter.
\# Use MI-27966 for AM transmitters less than 5 kw; for 10kw and higher use MI-28027-A.
† It is usually convenient to connect the Modulation Monitor in the Function Position following the last of the most frequently used functions.
†† Spare control and metering accommodations.
NOTE: If the station's requirements exceed the number of spares available, the MI-27541 Meter Commutator may be utilized in the antenna current circuits or the tower lighting circuits to gain additional function selection positions.

AUXILIARY EQUIPMENT

The following is a list of the auxiliary equipment intended for use with the remote control equipment. These units are necessary in order to make possible certain control and metering functions. Some of these auxiliary units in some cases are included as part of the transmitting equipment.

Meter Panel (AM Monitoring) MI-27527, shown in figure 3 , provides the means of monitoring the output frequency and modulation of an AM transmitter from the remote location. The station control unit has provisions for connecting the meter panel to the meter circuit (figure 9) of the function selector switch, 1S1. (Refer to table 3 , metering functions 9 and 10.). The unit contains a separate frequency meter and modulation meter mounted on a standard 19" panel. It includes a step-down transformer to supply voltage for illiminating the meter lamps.

Figure 3 - Meter Panel (AM Monitoring)

AC Voltage Pickup MI-27516, shown in figure 4 , is installed at the transmitter and is connected to the transmitter control unit metering section (figure 10). It provides an indication of the transmitter filament or line voltage on meter 1M1 of the studio control unit (table 3, metering function 2).

Tower Lighting Unit MI-27519, shown in figure 5, is connected in the transmitter antenna tower lighting circuit (figure11) and provides both metering and control connections to the transmitter control unit. It supplies dc voltage to meter 1M1 for indicating tower light current and has a relay control circuit which enables the antenna tower lights to be turned "ON" and "OFF" from the studio control unit (table 3 , control and metering function 11). It has a current capability of 20 anperes.

On tower lighting installations using a photo electric cell device to operate the tower lights, the MI-27519 should be connected in parallel with the photo electric cell contacts.

Latching Relay Panel MI-27509-A shown in figures 6 and 12, is installed in the transmitting equipment and its function is to turn the transmitter "on" and off". It contains two relays which perform this control function

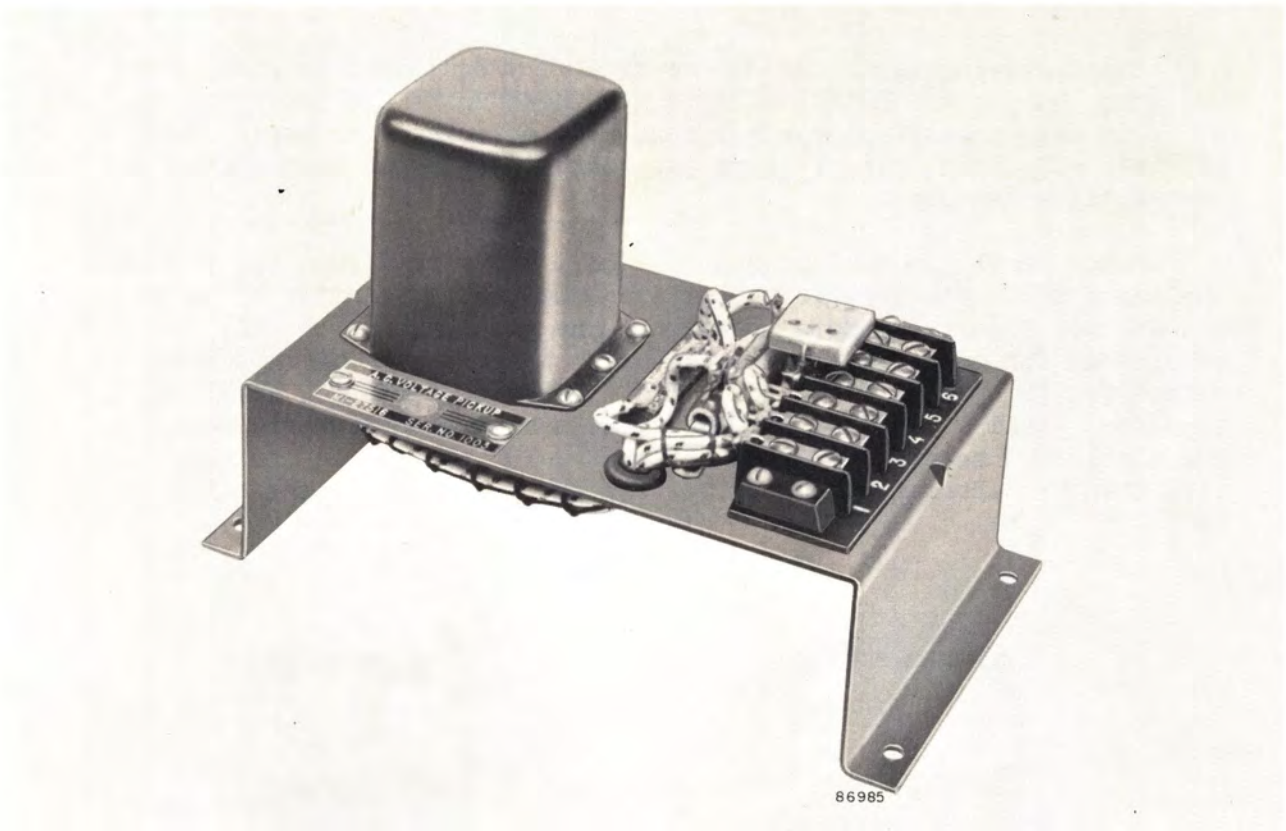


Figure 4 - AC Voltage Pickup

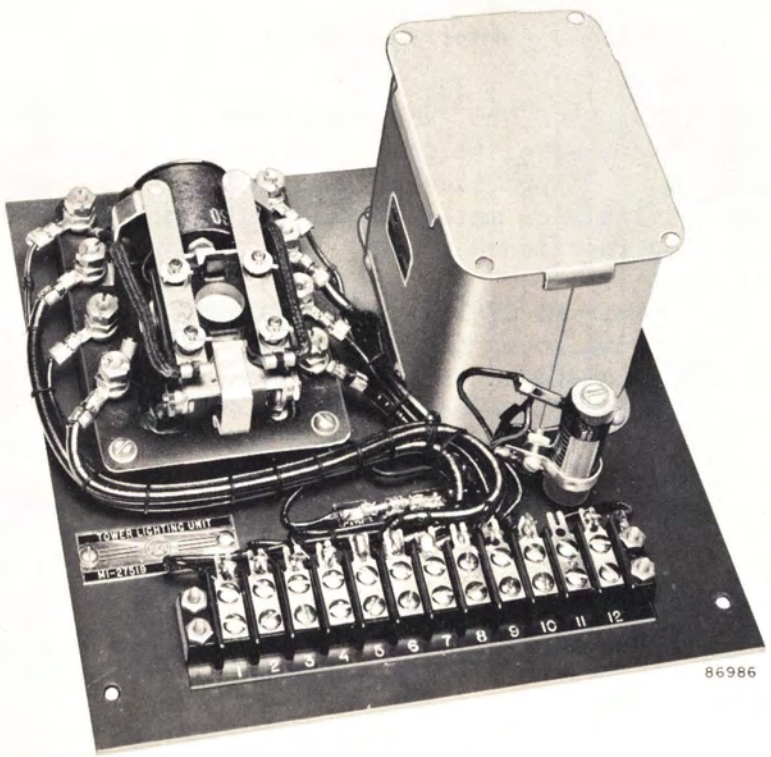


Figure 5 - Tower Lighting Unit

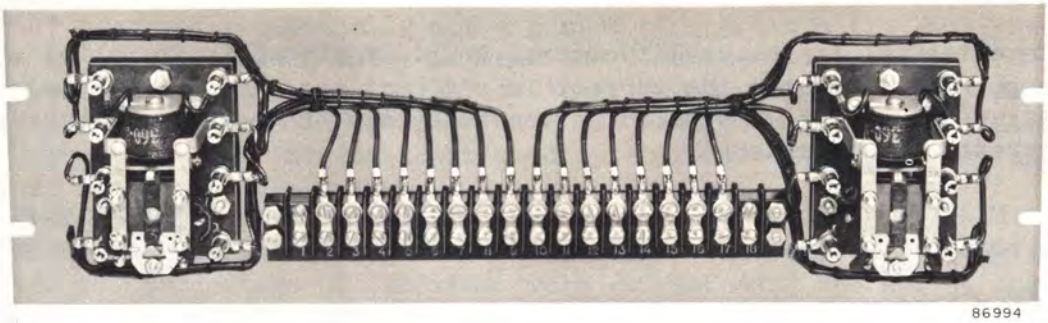


Figure 6 - Latching Relay Panel

when activated by the studio control unit. The relays are of special construction with a mechanical latch holding the contacts in the "operate" position after the "operate" coil has been momentarily energized, until the mechanical latch is released by energizing the "release" coil. Normanlly the "operate" coil is connected to the "on" or "raise" circuit and the "release" coil connected to the "off" or "lower" circuit. One relay turns the filament supply "on" or "off" and the other relay turns the plate voltage "on" or "off" (table 3, control functions 2 and 3).

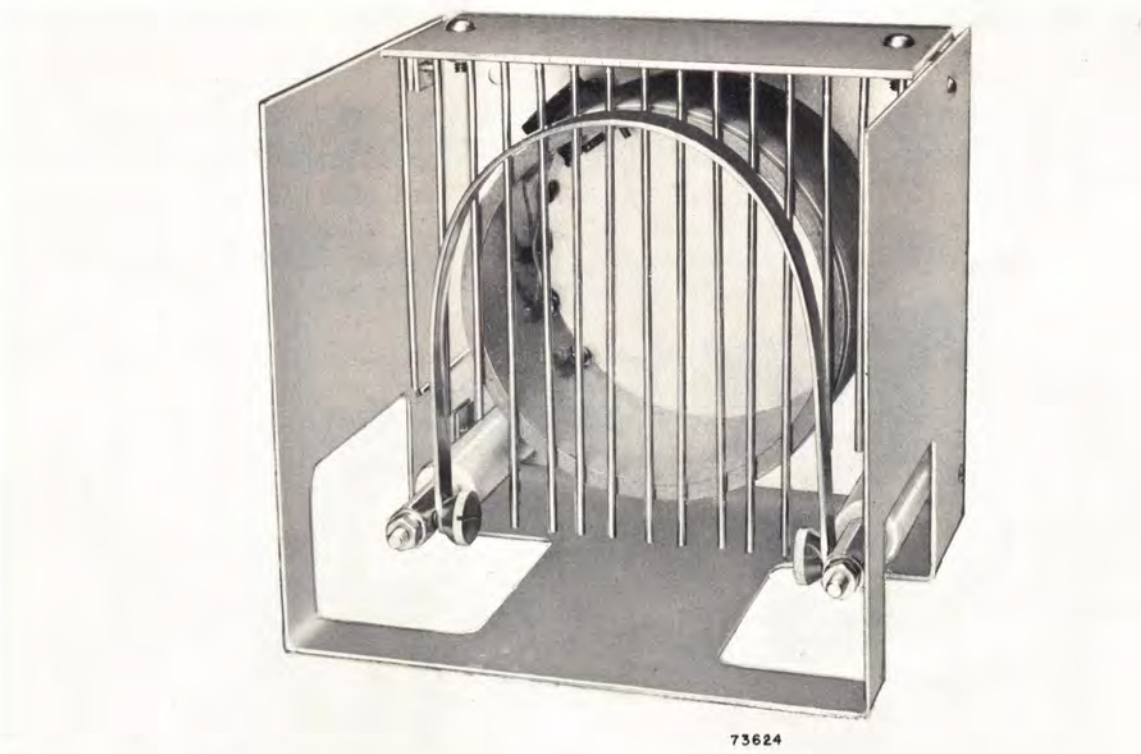


Figure 7 - Remote RF Pickup

Remote RF Pickup MI-28027-A or MI-27966 provides the means of observing the antenna or common point current at the studio control unit. The loop (primary) is connected in series with the antenna lead to absorb a sample of the transmitter r-f output. A diode rectifier system supplies dc to

operate meter 1M1 in the studio control unit. A pickup is installed at a common point to register the current in a directional array. The Remote R-F Pickup can also be installed at the individual antennas to register the current of each antenna.

The MI-28027-A is shown in figure 7; figure 13 shows a Remote R-F Pickup connected for use in conjunction with the Meter Commutator.

The MI-27966 may be used for the antenna current of transmitters up to 5 KW. For the antenna current of transmitters greater than 5 KW, the MI-28027-A is required.

Meter Commutator MI-27541, shown in figure 8 , enables measuring the antenna currents or the tower lighting currents of up to six antennas on a single meter. A motor driven shaft rotates cams that are adjusted to sequentially open and close micro-switches, which are connected in series between the antenna current sampling circuits or the tower lighting sampling circuits and the remote control equipment.

Detailed instructions for adjusting the cams and facing drums are given in the installation information drawing, 8973335, which is packed with the Meter Commutator. After making these adjustments, the switching sequence will be in accordance with the timing described in the following paragraphs.

The Meter Commutator consists of a motor driven shaft with six cams and facing drums, six single pole single throw switches, a motor interlock snap switch and a starting coil.

92025

Figure 8 - Meter Commutator

The duty cycle of complete rotation is 60 seconds with the cams opening and closing the six switches in sequence. During this cycle, each switch circuit operates sequentially for a period of approximately 7 1/2 seconds. There is a 1 1/2 second delay between the time one switch opens and the next one closes, resulting in all switches being open for a very short interval. This short interval permits the needle on the meter indicating the current of a particular tower to drop to zero before the next antenna circuit is switched in.

Each cam and each facing drum has a dial. The dial on the cam indicates the percentage of the time cycle (60 seconds) the switch operated by the cam is closed. This percentage may be varied by loosening the hex-head locking screw in the slot on the cam, and then re-positioning the cam.

The dial on the facing drum is scaled from 0 to 100. The setting of this dial determine the sequential order in which the switch operates. The drum is friction held and may be adjusted by holding the shaft firmly while rotating the drum.

The switches will operate in sequence, beginning with the first switch next to the stop-start switch. The cam of each switch is set for 12 1/2% of the cycle time.

This switching sequence and timing adjustment will meet most metering requirements. However, as previously explained, they may be varied to suit the user's application if desired.

Figure 13 shows the Meter Commutator connected to meter the antenna current or the lighting current of six towers when operated through the BTR-11A or the BTR-20A Remote Control. The diagram also shows a method of connecting the Meter Commutator for manual operation, as well as automatic, by making and additional connection on one side of the input line in series to the motor through 2TB3 sections "C" and "D".

This latter connection will permit the operator to use the OFF-LOWER switch to start the motor and stop it at any point in its travel. When the Meter Commutator is operated manually, the time interval each switch circuit, or a particular switch circuit, is under control is at the discretion of the operator.

A remote rf pick up loop, such as the RCA Remote Pick Up, MI-28027-A or MI-27966, is required at each antenna tower to couple the antenna current to the Meter Commutator. A tower lighting unit, such as the RCA MI-27519, is required for each tower lighting circuit. The dc output of a remote rf pick up unit or a tower lighting unit is connected with shielded cable to the input terminal of an individual switch on the Meter Commutator. The output terminals of the switchs are connected together and to a contact on sections "E" and "F" of 2TB3. Each antenna circuit to be metered is connected in like manner.

The 105-125v ac input line to the Meter Commutator starting coil and the motor is connected in series to a contact on sections "A" and "B" of 2TB3.

INSTALLATION

Take all the remote control equipment including the auxiliary units to the transmitter site. Mount the Transmitter Control Unit MI-27526 in a suitable rack space and place the Studio Control Unit MI-27539 so that it can be conveniently connected for temporary operation.

1. Connect terminals 1, 2, 3 and 4 of 1TB1 on the Studio Unit to like terminals of 2TB2 on the Transmitter Unit and ground, terminals of both units.

2. Install the auxiliary units in the appropriate locations and make the necessary connections. Consult the applicable diagrams and table 3, Typical Metering and Control Functions, for wiring information.

3. Plug the line cord of each unit into 105-125 v ac power source and turn on the POWER switches of both units.

4. Push up the HOME-STEP switch, 1S4 on the Studio Unit to the "HOME" position. Release after both function selector switches, 1S1 on the Studio Unit and 2S4 on the Transmitter Unit have "HOMED", position 20. Depress 1S4 once and release; both function selector switches will advance to position 1 (calibrate). Adjust CALIBRATE control 1R7 for a reading of 100% on meter 1M1.

5. Remove the link at 1TB1-14 -1TB1-15 of the Studio Control Unit, connect an ohmmeter between 1TB1-13 and 1TB1-14 and adjust 1R8 for a 5000 ohm reading. Restore connections when completed.

6. Test the entire system, checking the operation of all relays, motorized actuators and the fail-safe circuit.

7. Check the operation of each metering and control function at the Studio Control Unit.

8. Check the operation of STEP switch 2S3 and the ON-RAISE/OFF-LOWER switch 2S2 of the Transmitter Control Unit.

9. After thoroughly testing the equipment and becoming familiar with its operation, move the studio control unit to the remote control location, mount and connect it to the proper power source. Make the telephone lines and the ground connections. The telephone lines must be properly polarized. Mark the lines at both ends using the ground return to check continuity.

10. Turn on the unit and readjust 1R7 and 1R8 according to the instructions in steps 4 and 5.

11. Check the operation of each metering and control function and enter the data in the appropriate column of the panel card.

NOTE: It is advisable to HOME the Remote Control equipment before making function selections. This will insure synchronism between the Studio Unit and the Transmitter Unit.

Select the circuit to be checked from the panel card and step the HOME-STEP switch until the function selector dial indicates the position selected. To make a remote control adjustment, place and hold the ON-RAISE OFF-LOWER lever switch in the position required to obtain the desired result. Observe the meter indication, and when the circuit under control has reached its proper operating level release the ON-RAISE/OFF-LOWER switch.

Read the meter for all measurements and control functions levels, except frequency and modulation which appear on the auxiliary meter panel.

The transmitter can be controlled locally through the Transmitter Control Unit. If it is planned to operate the transmitter locally, leave the power on the Studio Control Unit and the function selector switch in HOME position. Selection of the transmitter function to be measured and/or controlled is made by pressing and releasing the STEP switch on the Transmitter Unit until the function selector dial indicates the designated function. No panel meter is required on the Transmitter Unit since the transmitter meters can be used to monitor circuit adjustments or measurements.

When the transmitter is controlled in this manner, the transmitter unit is independent of the studio unit. Therefore, when local control is completed it is recommended that the Transmitter Unit be stepped to HOME, position 20.

At the studio, synchronism between the two units can be insured by placing the HOME-STEP switch on the studio unit in the HOME position.

Table 4 is a typical precedure that might be followed for controlling and monitoring a transmitter with the BTR-20A. The same procedure would apply to the BTR-11A, limited, of course, to 11 function selections.

TABLE 4. TYPICAL OPERATING PROCEDURE

FUNCTION	SWITCH OR CONTROL	POSITION	OPERATION	METER READING	PROCEDURE
PUTTING THE TRANSMITTER ON-THE-AIR					
	POWER	ON			
20	HOME-STEP	HOME			SYNCHRONIZE STUDIO AND TRANSMITTER UNIT
1	CALIBRATE			100%	ADJUST METER 1M1 FOR 100% TO COMPENSATE FOR TELEPHONE LINE VARIATION
2	ON-RAISE/OFF-LOWER	ON-RAISE	FILAMENT VOLTAGE ON		
3	ON-RAISE/OFF-LOWER	ON-RAISE	PLATE VOLTAGE ON	PLATE VOLTAGE	CHECK FOR EXCESSIVE DEVIATION
4				PLATE CURRENT	CHECK FOR EXCESSIVE DEVIATION
5	ON-RAISE/OFF-LOWER	ON-RAISE OR OFF-LOWER	POWER OUTPUT LEVEL	ANTENNA OR COMMON POINT CURRENT	ADJUST TO PROPER LEVEL AS REQUIRED AND LOG
6				ANTENNA #1 CURRENT	LOG METER READING
7				ANTENNA #2 CURRENT	LOG METER READING
8				ANTENNA #3 CURRENT	LOG METER READING
20	HOME-STEP	HOME			SYNCHRONIZES STUDIO AND TRANSMITTER UNITS
3				PLATE VOLTAGE	LOG PLATE VOLTAGE
4				PLATE CURRENT	LOG PLATE CURRENT
9				FREQUENCY	CHECK FOR DEVIATION; LOG FREQUENCY MONITOR READING
10				MODULATION	LEAVE ON THIS POSITION TO OBSERVE MODULATION DURING PROGRAMMING
TO LOG METER READINGS					
20	HOME-STEP	HOME			
1	CALIBRATE			100%	ADJUST 1M1 FOR 100% TO COMPENSATE FOR TELEPHONE LINE VARIATION
5	ON-RAISE/OFF-LOWER	ON-RAISE OR OFF-LOWER	POWER OUTPUT LEVEL	ANTENNA OR COMMON POINT CURRENT	CHECK TO SEE IF WITHIN FCC LIMITS IF OUT OF LIMITS ADJUST LOG METER READING
20	HOME-STEP	HOME			
3				PLATE VOLTAGE	LOG METER READING
4				PLATE CURRENT	LOG METER READING
6				ANTENNA #1 CURRENT	LOG METER READING
7				ANTENNA #2 CURRENT	LOG METER READING
8				ANTENNA #3 CURRENT	LOG METER READING
9				FREQUENCY	LOG METER READING
10				MODULATION	LEAVE ON THIS POSITION TO OBSERVE MODULATION DURING PROGRAMMING
TAKING THE TRANSMITTER OFF-THE-AIR					
20	HOME-STEP	HOME			
3	ON-RAISE/OFF-LOWER	OFF-LOWER	PLATE VOLTAGE OFF	ZERO	
20	HOME-STEP	HOME			
2	ON-RAISE/OFF-LOWER	OFF-LOWER	FILAMENT VOLTAGE OFF		
20	HOME-STEP	HOME			OPENS METER CIRCUITS
	POWER	OFF			

MAINTENANCE

Maintenance Notes

General

1. The transmitter should be visited as specified by FCC regulations and the remote meter readings checked against the transmitter site meter reading.

2. Periodically check the setting of 1R8.

3. Be sure to observe the correct polarity if any rectifiers are replaced and the correct telephone line polarity if lead lines are disconnected from the terminals.

4. Do not oil the stepping switches or contacts. The switch will not require lubrication until after long service, and then lubricate very sparingly.

5. Normally the remote control equipment will be used frequently enough to keep the relay and switch contacts wiped clean. However it is recommended that regular inspection periods should be established. All relays and switches should be operated at periodic intervals and then checked and serviced to keep the equipment in good operating condition.

Care and Servicing of Relays and Switches

1. Trouble free relay and switch operation depends upon keeping contacts clean and free of dust, lint, grease, paint, oil or other similar material. These are common sources of arcing, pitting and burning of the contact surfaces.

Contacts should be cleaned with carbon tetrachloride only. Burnishing tools used to touch the relay contacts should first be wiped clean with a cloth dampened in carbon tetrachloride.

2. Clean contacts once every three months burnishing all contacts lightly with a contact cleaning tool, usually about four strokes of the burnisher across the contact suffices. Never use a file or other rough tools or materials. Clean burnisher blade with carbon tetrachloride before using.

Normally-closed relay contacts will exert enough pressure if the burnisher is worked between them, but normally-open contacts should be pressed together against the burnisher blade by operating the relay armature manually with power removed.

If burnishing does not clear operational trouble in a set of contacts, they should be cleaned with carbon tethrachloride. Use one drop on the flat end of a tooth-pick. Separate the contacts enough to permit spreading

the fluid across the contact surfaces. Then, with a second drop of of cleaning fluid, flush the contact surfaces and the side of the contacts as well. Do not let the fluid touch any bushings, spoolheads, or insulators.

When the contacts have dried thoroughly, burnish them as described previously. Even badly pitted contacts can be made serviceable with this routine and it is usually unnecessary to remove the pits or built up surfaces. However, when contacts are so badly burned as to indicate the likehood of relay failure, they should be replaced and the cause of the burning determined and corrected.

3. The following is a list of conditions to watch for when making routine relay maintenance checks.

a. Improperly adjusted residual screws on relays.
b. Arcing contacts caused by defective spark suppressors.
c. Spring and contact assemblies which show evidence of tampering.
d. Contacts out of alignment more than 1/3 of their diameter at the base of the contact points.
e. Loose screws and nuts.
f. Insecurely mounted coils, contacts and other parts.
g. Multilated or defective screws, nuts or other parts.
h. Sharp bends or kinks in springs. The free length of relay-spring can have only a gradual bow.
i. Bushings not in the approximate center of the springs they strike.

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or if evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt.

Report all shortages and damages to RCA, Broadcast and Television Department, Camden 2, N. J.

Radio Corporation of America will file all claims for loss and damage on this equipment so long as the inspection report is obtained. Disposition of the damaged item will be furnished by RCA.

REPLACEMENT PARTS AND ENGINEERING SERVICE

RCA field engineering service is available at current rates. Requests for field engineering service may be addressed to your RCA Broadcast Field Representative or the RCA Service Company, Inc., Broadcast Service Division, Camden, N. J. Telephone: WOodlawn 3-8000.

When ordering replacement parts, please give symbol, description, and stock number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

The following tabulations list service parts and electron tube ordering instructions according to your geographical location.

SERVICE PARTS

LOCATION	ORDER SERVICE PARTS FROM:
Continental United States, including Alaska and Hawaii	RCA Electron Tube Division, Parts and Equipment, P.O. Box 654. Camden, New Jersey or through your nearest RCA Regional Office. Emergency orders may be telephoned, telegraphed, or teletyped to RCA Emergency Service, Bldg. 60, Camden, N. J. (Telephone: WO 3-8000).
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec or through your local Sales Representative or his office.
Outside of Continental United States, Alaska, Hawaii and the Dominion of Canada	RCA International Division, Clark, N. J., U.S.A. or through your local Sales Representative.

ELECTRON TUBES

LOCATION	ORDER ELECTRON TUBES FROM:
Continental United States, including Alaska and Hawaii	Local RCA Tube Distributor.
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec or through your local Sales Representative or his office.
Outside of Continental United States, Alaska, Hawaii and the Dominion of Canada	Local RCA Tube Distributor or from: Tube Department RCA International Division 30 Rockefeller Plaza New York 20, New York, U.S.A.

RETURN OF ELECTRON TUBES

If for any reason, it is desired to return tubes, please return them through your local RCA tube distributor, RCA Victor Co. Ltd., or RCA International Div., depending on your location.

PLEASE DO NOT RETURN TUBES DIRECTLY TO RCA WITHOUT AUTHORIZATION AND SHIPPING INSTRUCTIONS.

It is important that complete information regarding each tube (including type, serial number, hours of service and reason for its return) be given.

When tubes are returned, they should be shipped to the address specified on the Return Authorization form. A copy of the Return Authorization and also a Service Report for each tube should be packed with the tubes.

LIST OF RCA REGIONAL OFFICES

Atlanta 3, Georgia
1121 Rhodes-Haverty Bldg.
134 Peachtree St. N.W.
JAckson 4-7703

Boston 16, Mass.
Room 2301, John Hancock Bldg.
200 Berkley St.
HUbbard 2-1700

Chicago 54, Ill.
1186 Merchandise Mart Plaza
DElaware 7-0700

Cleveland 15, Ohio
1600 Keith Bldg.
CHerry 1-3450

Dallas 35, Texas
7901 Empire Freeway
FLeetwood 2-3911

Hollywood 28, Calif.
RCA Bldg., 1560 N. Vine St.
HOllywood 9-2154

Kansas City 6, Missouri
340 Home Savings Bldg.
HArrison 1-6480

New York 20, New York
36 W. 49th St.
JUdson 6-3800

Branch—San Francisco 2, Calif.
420 Taylor St.
ORdway 3-8027

Seattle, Washington
2250 First Ave., S.
MAin 2-8350

PARTS LIST

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
BTR-IIA STUDIO CONTROL UNIT, MI-27537			
1BT1	216184	8929985-1	Battery: mercury type "A", capacity 1000 M.A.H.
1C1	56234	442901-16	Capacitor: electrolytic, 10 μf, 150 v
1C2	73787	735715-83	Capacitor: paper, .47 μf, ±10%, 200 v
1C3	56234	442901-16	Capacitor: electrolytic, 10 μf, 150 v. Same as C1
1CR1	216177	8941134-1	Rectifier: germanium disc
1F1,1F2	14133	55544-14	Fuse: 1.0 amp. 250 v
1I1	216158	849546-23	Lamp: 55 v, .05A
1K1	216178	627511-44	Relay: telephone type
1M1	216176	477919-1	Meter: 0-200 microamp DC
1R1	216166	867972-331	Resistor: fixed, wire wound, 5.1 ohm, ±10%, 2 w
1R2,1R3		90496-76	Resistor: fixed, composition, 15,000 ohm, ±10%, 1 w
1R4	216194	8871557-50	Resistor: fixed, precision, 5000 ohm, ±1%, 1 w
1R5,1R6		90496-76	Resistor: fixed, composition, 15,000 ohm, ±10%, 1 w Same as R2
1R7	216163	746088-23	Resistor: variable, 5000 ohm, ±10%, 2 w
1R8	216164	737825-12	Resistor: variable, 2500 - 2500 ohm, 2 w
1R9		90496-50	Resistor: fixed, composition, 100 ohm, ±10%, 1 w
1S1	216160	8430313-2	Switch: stepping
1S2	216162	449661-102	Switch: power
1S3	216168	8854080-53	Switch: raise-lower
1S4	216169	8854080-54	Switch: step-home
1T1	216174	486171-1	Transformer: plate
1XF1,1XF2	99218	8928580-1	Holder: fuse
1XI1		477926-2	Socket: lamp, green
	56100		Socket only
	56101		Jewel only, green
	4323	69916-3	Knob: for R7
BTR-IIA TRANSMITTER CONTROL UNIT, MI-27538			
2C1 to 2C4	73787	735715-83	Capacitor: paper, .47 μf, ±10%, 200 v
2C5,2C6	98209	735721-37	Capacitor: paper, 1 μf, ±10%, 200 v
2CR1	216177	8941134-1	Rectifier: germanium disc
2F1,2F2	14133	55544-14	Fuse: 1.0A, 250 v
2I1	216158	849546-23	Lamp: 55 v., .05A
2K1	216182	8412140-1	Relay: stepping
2K2	216182	8412140-1	Relay: raise-lower. Same as K1
2K3	216182	8412140-1	Relay: fail-safe. Same as K1
2K4	216180	627511-48	Relay: raise
2K5	216180	627511-48	Relay: lower. Same as K4
2K6	216178	627511-44	Relay: homing
2K7	216178	627511-44	Relay: stepping. Same as K6
2K8	216178	627511-44	Relay: fail-safe. Same as K6
2R1,2R2		90496-76	Resistor: fixed, composition, 15,000 ohm, ±10%, 1 w
2R3		90496-153	Resistor: fixed, composition, 560 ohm, ±5%, 1 w
2R4		90496-52	Resistor: fixed, composition, 150 ohm, ±10%, 1 w
2R5		90496-50	Resistor: fixed, composition, 100 ohm, ±10%, 1 w
2R6,2R7		90496-52	Resistor: fixed, composition, 150 ohm, ±10%, 1 w
2R8,2R9		90496-48	Resistor: fixed, composition, 68 ohm, ±10%, 1 w
2S1	216162	449661-102	Switch: power
2S2	216161	8430313-1	Switch: stepping
2T1	216174	486171-1	Transformer: plate
2XF1,2XF2	99218	8928580-1	Holder: fuse
2XI1		477926-2	Socket: lamp, green
	56100		Socket only
	56101		Jewel only, green
2XK1 to 2XK3	208505	99393-1	Socket: relay

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
			BTR-20A STUDIO CONTROL UNIT, MI-27539
1BT1	216184	8929985-1	Battery: mercury, type "A" capacity 1000 M.A.H.
1C1	56234	442901-16	Capacitor: electrolytic, 10 μf, 150 v
1C2	73787	735715-83	Capacitor: fixed, paper, 0.47 μf ±10%, 200 v
1C3	56234	442901-16	Capacitor: electrolytic, 10 μf, 150 v. Same as C1
1CR1	216177	8941134-1	Rectifier: germanium disc
1F1,1F2	14133	55544-14	Fuse: 3AG, 1.0 A, 250 v
1I1	216158	849546-23	Lamp: 55 v, 0.05A
1K1	216178	627511-44	Relay: telephone type
1M1	216176	477919-1	Meter: 0-200 microamp DC
1R1	216166	867972-331	Resistor: fixed, wire wound, 5.1 ohm ±10%, 2 w
1R2,1R3		90496-76	Resistor: fixed, composition, 15,000 ohm, ±10%, 1 w
1R4	216194	8871557-50	Resistor: fixed, wire wound, 5000 ohm, ±1%, 1 w
1R5,1R6		90496-76	Resistor: fixed, composition, 15,000 ohm, ±10%, 1 w Same as R2
1R7	216163	746088-23	Resistor: variable, 5000 ohm, ±10%, 2 w
1R8	216164	737825-12	Resistor: variable, 2500/2500 ohm, ±10%, 2 w
1R9		90496-50	Resistor: fixed, composition, 100 ohm, ±10%, 1 w
1S1	216654	8411072-2	Switch: stepping
1S2	216162	449661-102	Switch: power
1S3	216168	8854080-53	Switch: raise - lower
1S4	216169	8854080-54	Switch: step - home
1T1	216174	486171-1	Transformer: plate
1XF1,1XF2	99218	8928580-1	Fuseholder:
1XI1,1XI2		477926-2	Socket: lamp, green
	56100		Socket - only
	56101		Jewel - only, green
			MISCELLANEOUS
	4323	69916-3	Knob: (for R7)
			BTR-20A TRANSMITTER CONTROL UNIT, MI-27526
2C1 to 2C4	73787	735715-83	Capacitor: fixed, paper, 0.47 μf, ±10%, 200 v
2C5,2C6	98209	735721-37	Capacitor: fixed, paper, 1 μf, ±10%, 200 v
2C7	91391	442901-34	Capacitor: electrolytic, 10 μf, 450 v
2CR1	216177	8941134-1	Rectifier: germanium disc
2F1,2F2	14133	55544-14	Fuse: 3 AG, 1.0 A, 250 v
2I1	216158	849546-23	Lamp: 55 v, 0.05 A
2K1	216182	8412140-1	Relay: stepping
2K2	216182	8412140-1	Relay: raise-lower. Same as K1
2K3	216182	8412140-1	Relay: fail-safe. Same as K1
2K4	216180	627511-48	Relay: raise
2K5	216180	627511-48	Relay: lower. Same as K4
2K6	216178	627511-44	Relay: homing
2K7	216620	8415074-1	Relay: stepping
2K8	216178	627511-44	Relay: fail-safe. Same as K6
2R1,2R2		90496-76	Resistor: fixed, composition, 15,000 ohm, ±10%, 1w
2R3		90496-153	Resistor: fixed, composition, 560 ohm, ±5%, 1 w
2R4		90496-52	Resistor: fixed, composition, 150 ohm, ±10%, 1 w
2R5		90496-50	Resistor: fixed, composition, 100 ohm, ±10%, 1 w
2R6,2R7		90496-52	Resistor: fixed, composition, 150 ohm, ±10%, 1 w Same as R4
2R8,2R9		90496-48	Resistor: fixed, composition, 68 ohm, ±10%, 1 w
2R10		99126-58	Resistor: fixed, composition, 470 ohm, ±10%, 2 w
2R11		99126-56	Resistor: fixed, composition, 330 ohm, ±10%, 2 w
2R12	216166	867972-331	Resistor: fixed, wire wound, 5.1 ohm, ±10%, 2 w
2S1	216162	449661-102	Switch: power
2S2	216167	8854080-52	Switch: raise, lower
2S3	59509	8941133-1	Switch: push button
2S4	216621	8411072-1	Switch: stepping
2T1	216174	486171-1	Transformer: plate
2XF1,2XF2	99218	8928580-1	Holder: fuse
2XI1		477926-2	Socket: lamp, green
	56100		Socket - only

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
2XK1 to 2XK3	56101 208505 216619	 99393-1 8411050-1	Jewel - only, green Socket: relay Terminal Block: 6 rows, 20 terminals per row
METER PANEL (AM MONITORING), MI-27527			
M1 M2 T1	93688 213239 65613	739266-1 739235-5 949113-1	Meter: 100-0-100 microamperes Meter: 0-300 MA Transformer: filament
A-C VOLTAGE PICK-UP, MI-27516			
C1 CR1 R1 T1 XCR	92036 59395 216165 204545 95470	727866-171 882018-5 992023-1 8837869-1	Capacitor: fixed, mica, 10,000 $\mu\mu$f ±5%, 300 v DC Crystal: diode, 1N34A Resistor: adjustable, wire wound, 3000 ohm, 10 w Transformer: filament Holder: crystal
TOWER LIGHTING UNIT, MI-27519			
C1 CR1 K1 R1 T1 XCR1	92036 59395 216181 17688 216172 95470	727866-171 480070-1 449665-2 992022-1 8837869-1	Capacitor: fixed, mica, 10,000 $\mu\mu$f, ±5%, 300 v DC Crystal: diode, 1N34A Relay: latching Resistor: adjustable, wire wound, 15 ohm, ±10%, 25w Transformer: filament Holder: crystal
LATCHING RELAY PANEL, MI-27509			
K1,K2	216991	480003-4	Relay: latching
REMOTE R-F PICK-UP, MI-28027-A			
	39652 211449 59395 211785	727861-47 426768-14 990187-409	Capacitor: fixed, mica, 1000 $\mu\mu$f, ±20%, 500 v Insulator: Rectifier: 1N34A Resistor: fixed, composition, 12,100 ohm, ±1%, 1 w

* REMOVE CONNECTIONS FROM CONTACTS 9 & 10 OF 1S1 TO THE COMMON CONTACT BUSS AND CONNECT 9 & 10 TO 1TB3-1,2. 1TB3 IS UNDER THE COVER OF 1S1.

CONTACTS 9 & 10 WERE SELECTED TO CORRESPOND WITH THE FREQUENCY AND MODULATION MONITORING POSITIONS IN THE CONTROL AND METERING FUNCTION TABLE.

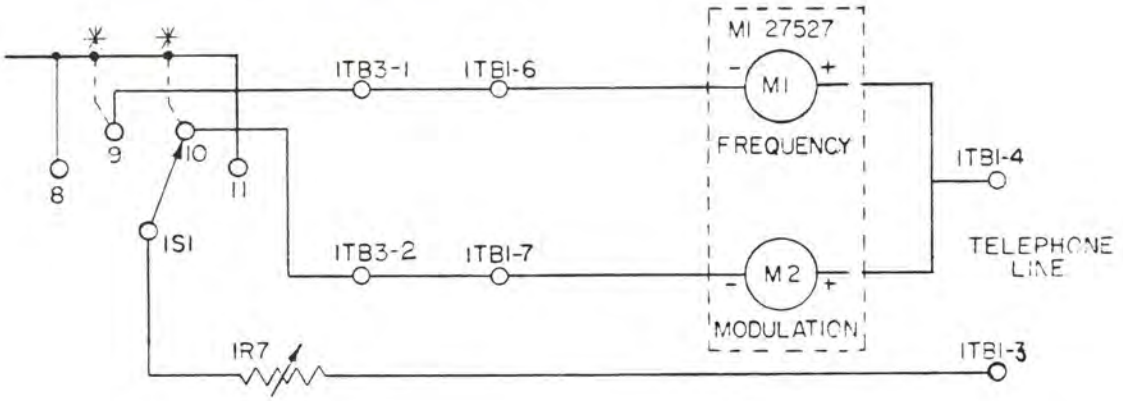


Figure 9 - Interconnection Diagram, Meter Panel (AM Monitoring)

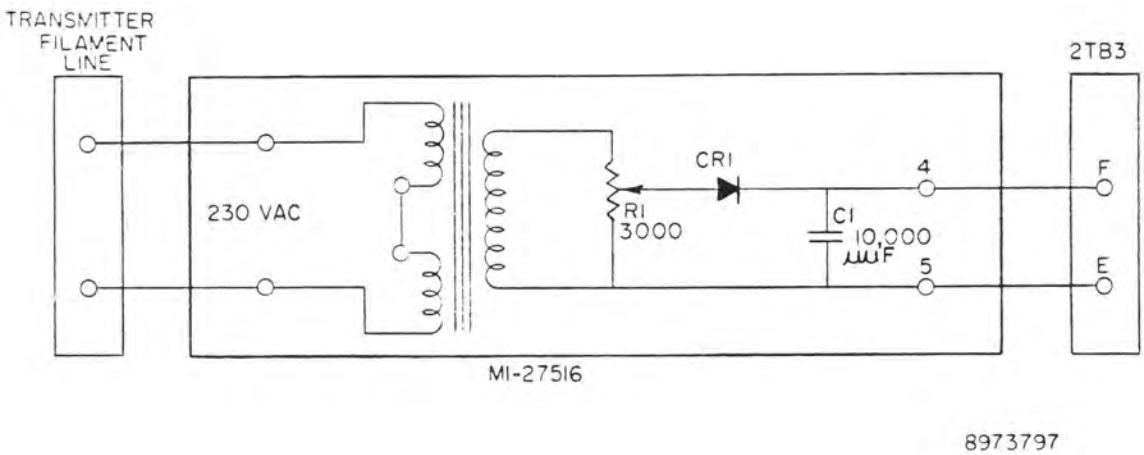


Figure 10 - Interconnection Diagram, AC Voltage Pickup

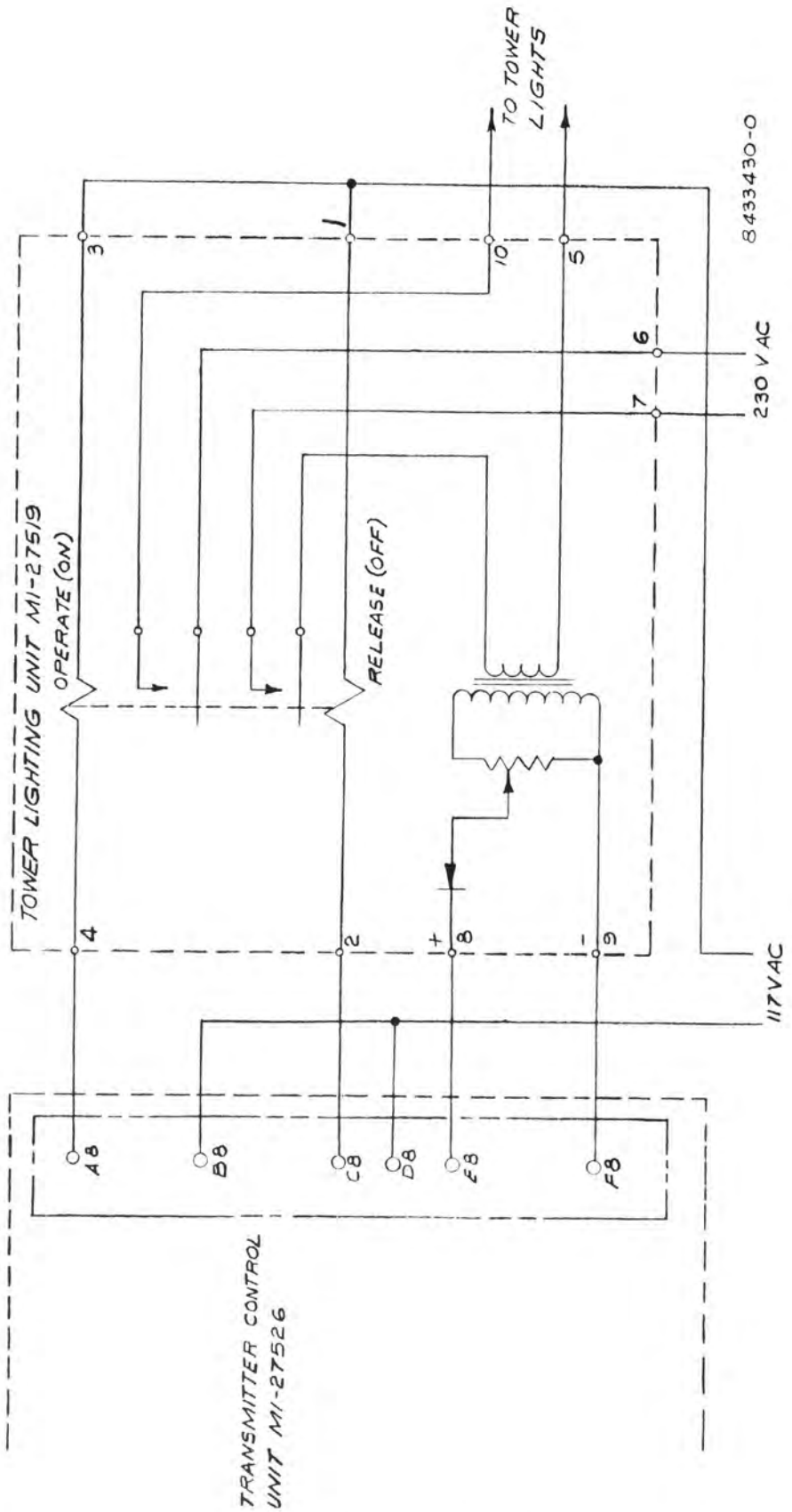


Figure II - Interconnection Diagram, Tower Lighting Unit

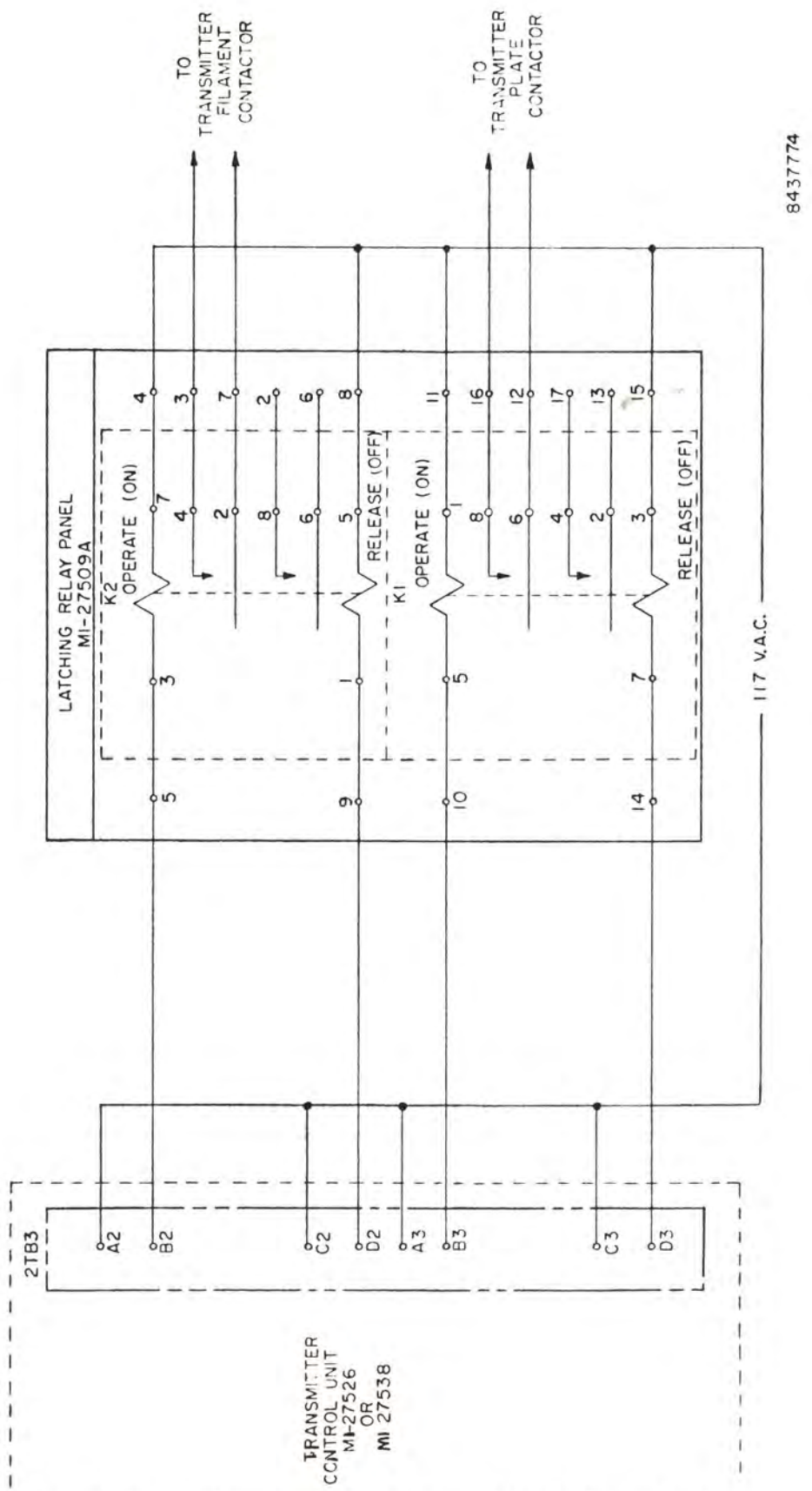


Figure 12 - Interconnection Diagram, Latching Relay Panel

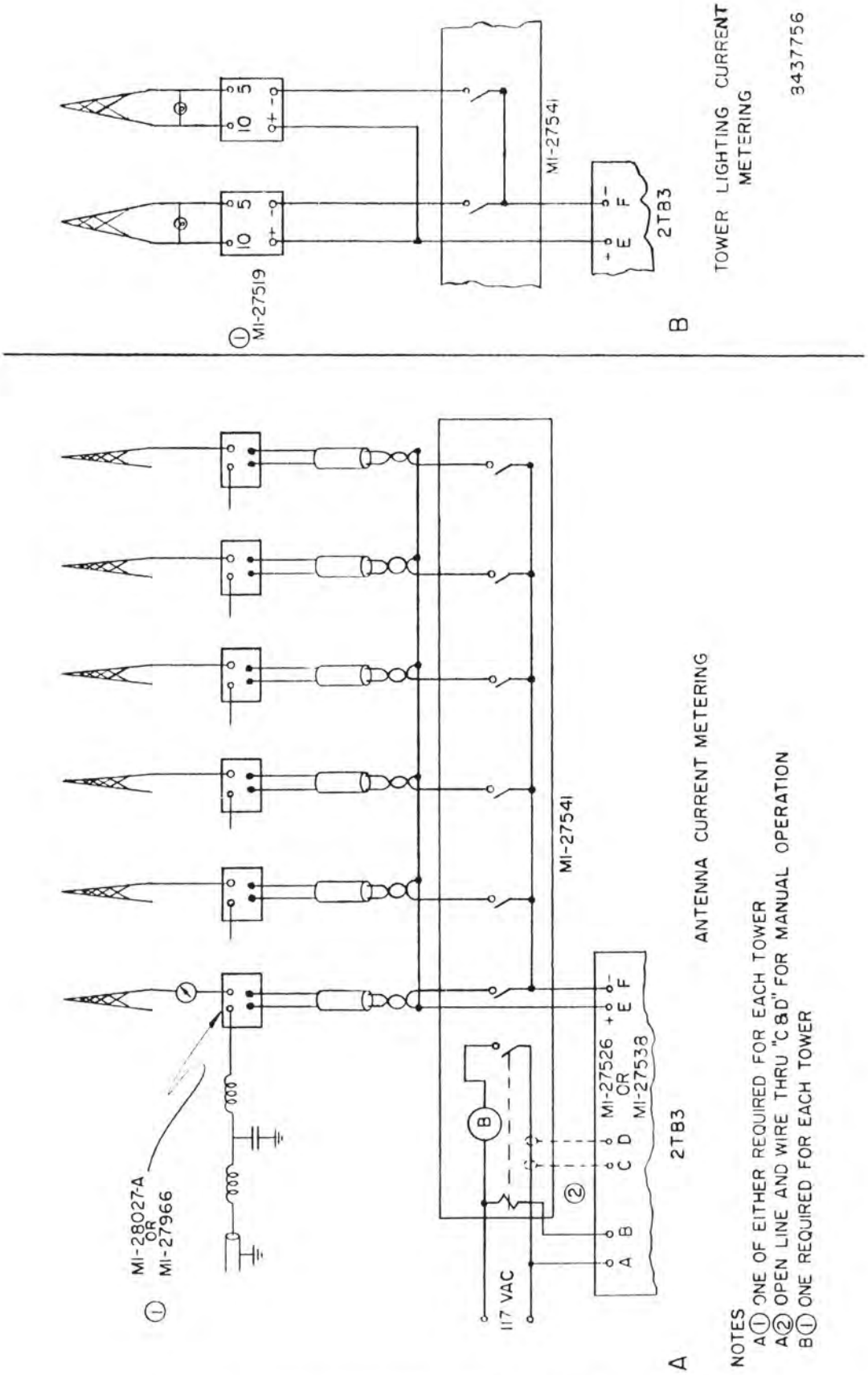


Figure 13 - Interconnection Diagram, Meter Commutator

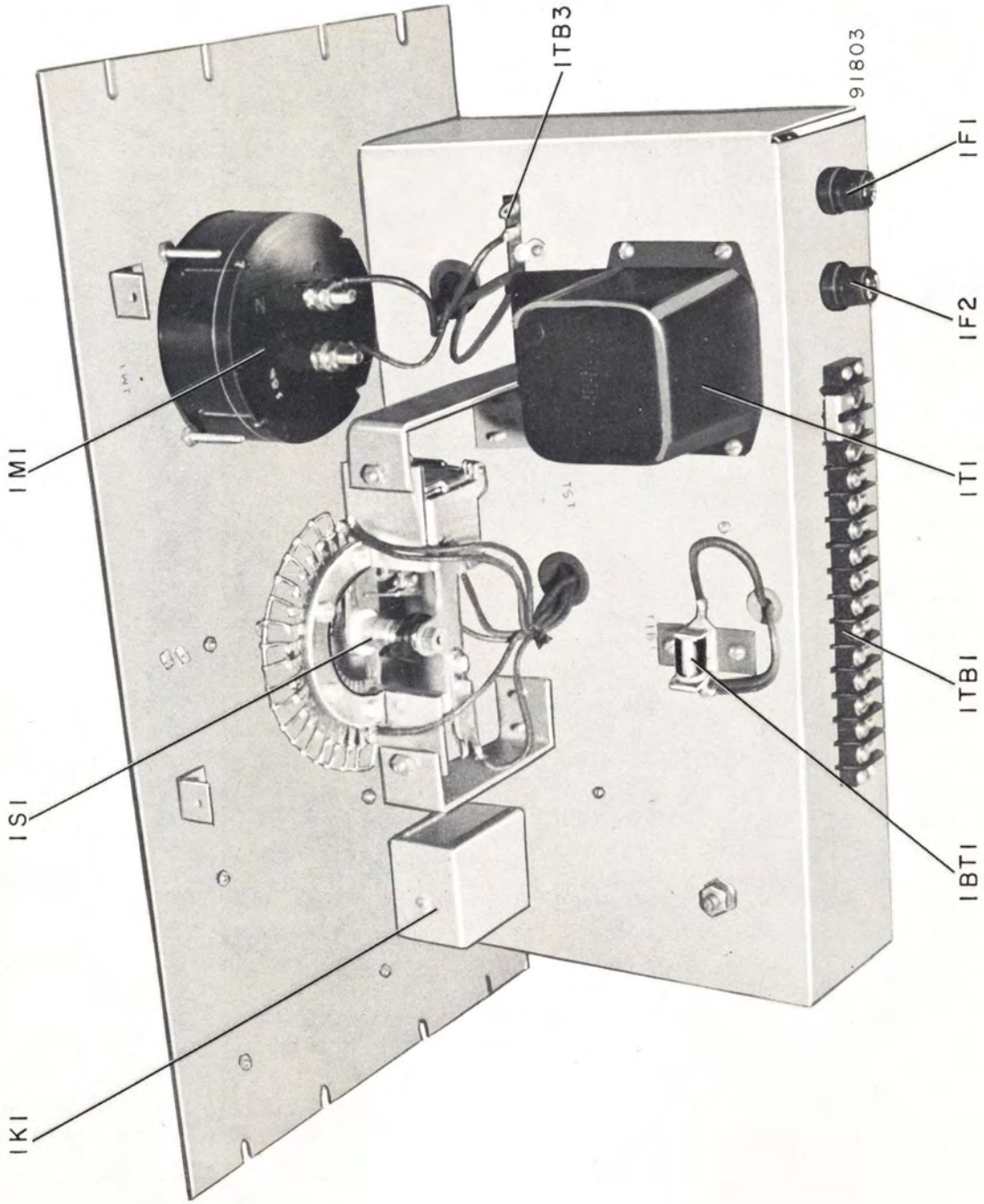


Figure 14 - Top View, BTR-20A Studio Control Unit

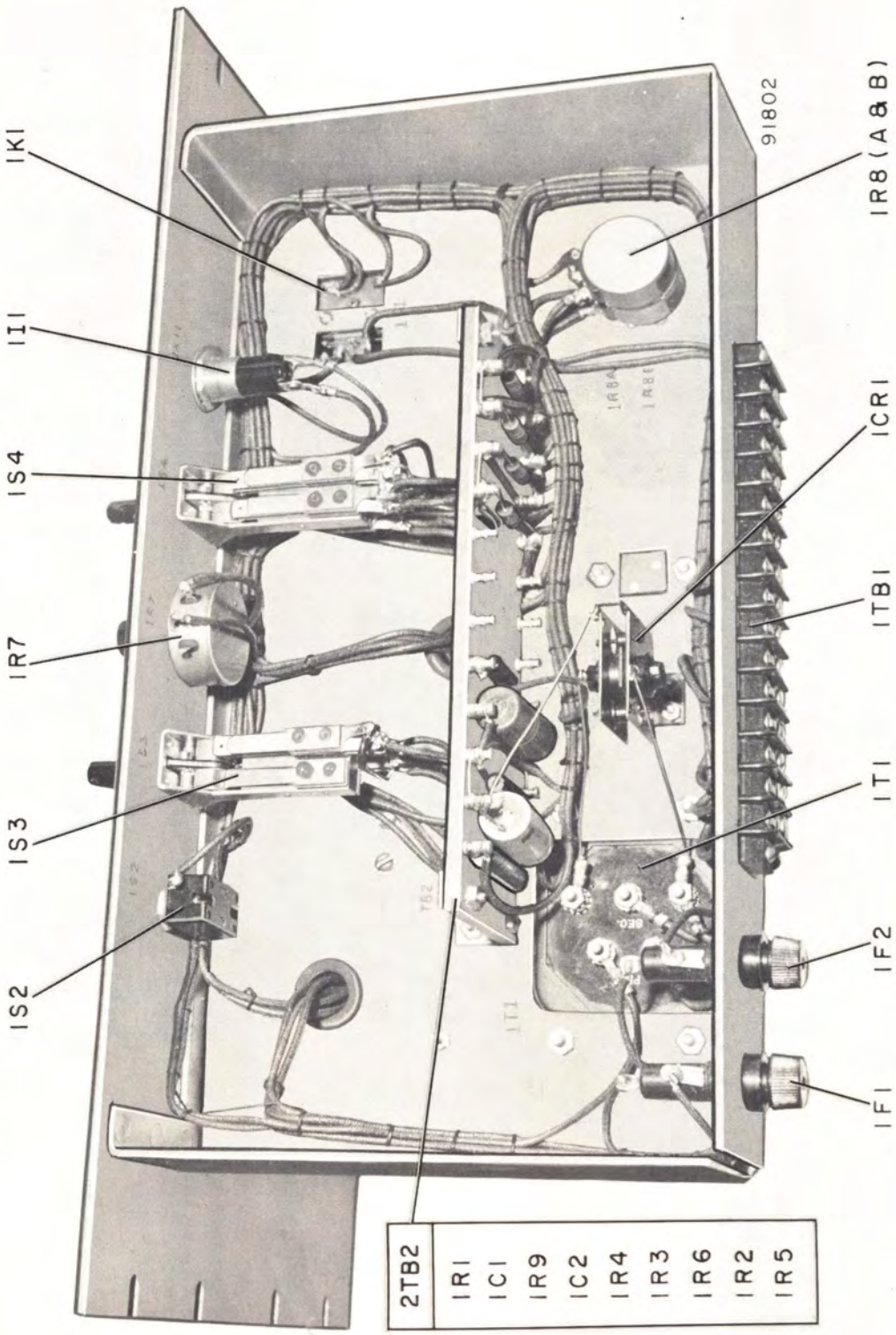


Figure 15 - Bottom View, BTR-20A Studio Control Unit

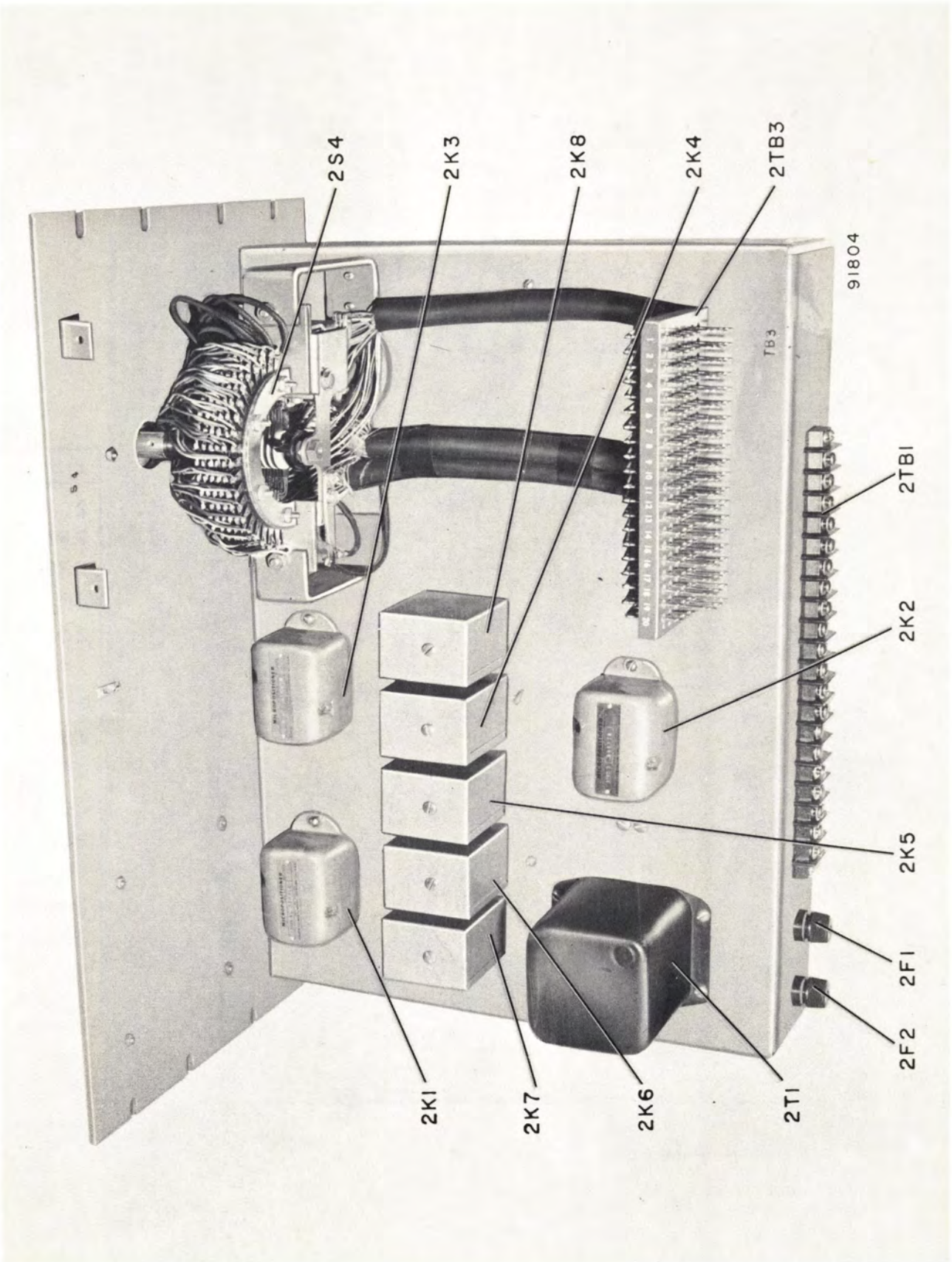


Figure 16 - Top View, BTR-20A Transmitter Control Unit

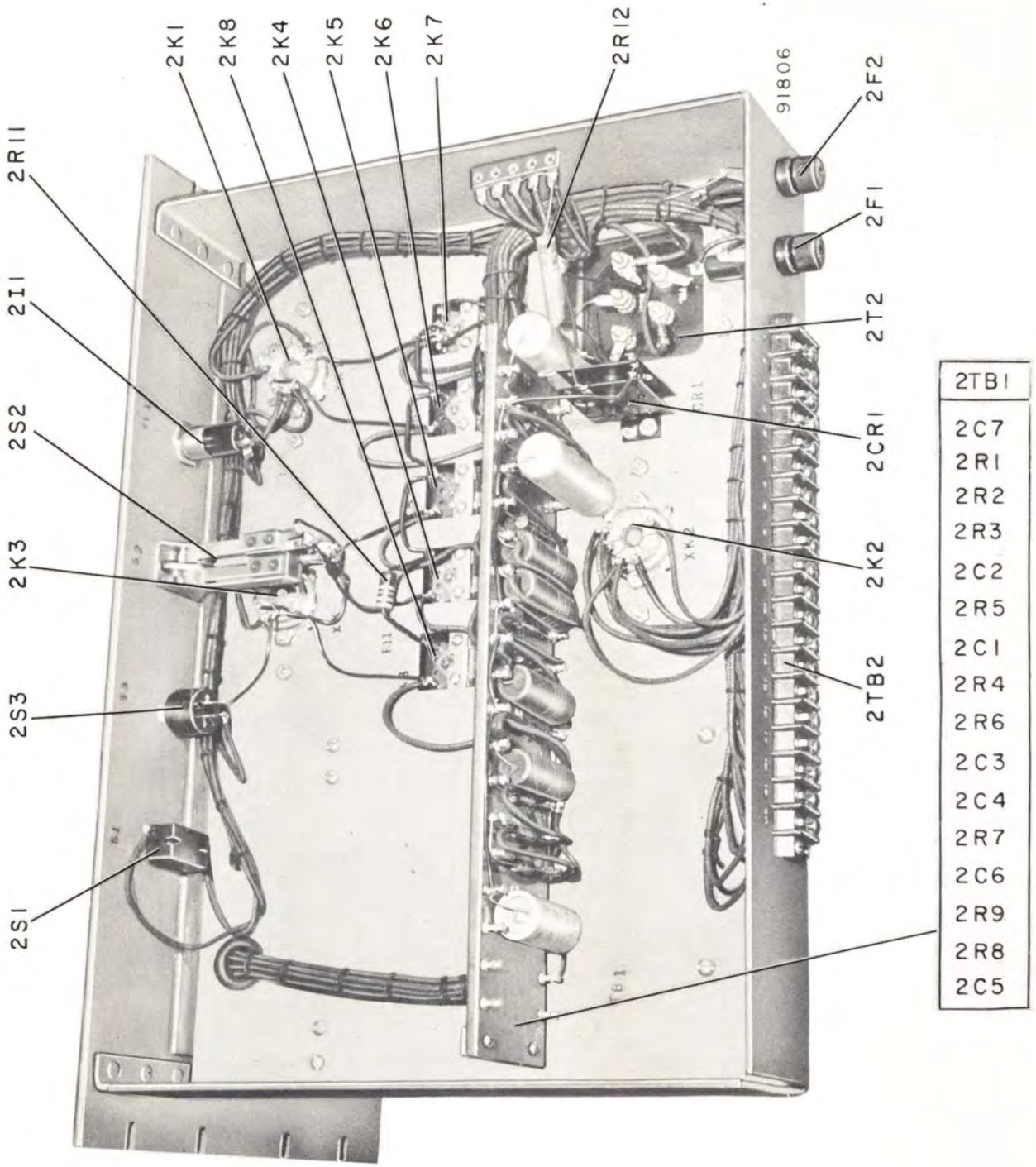


Figure 17 - Bottom View, BTR-20A Transmitter Control Unit

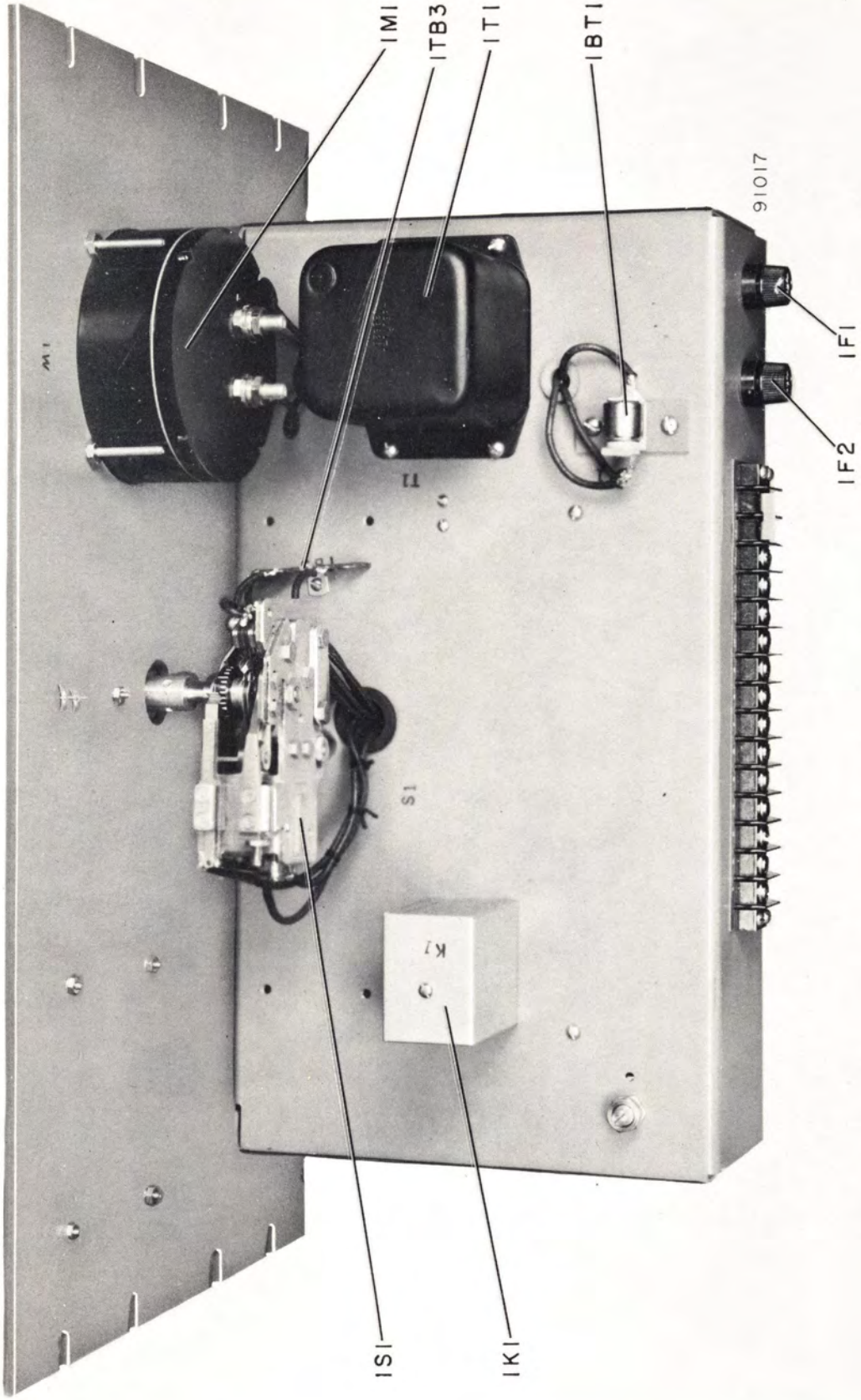


Figure 18 - Top View, BTR-11A Studio Control Unit

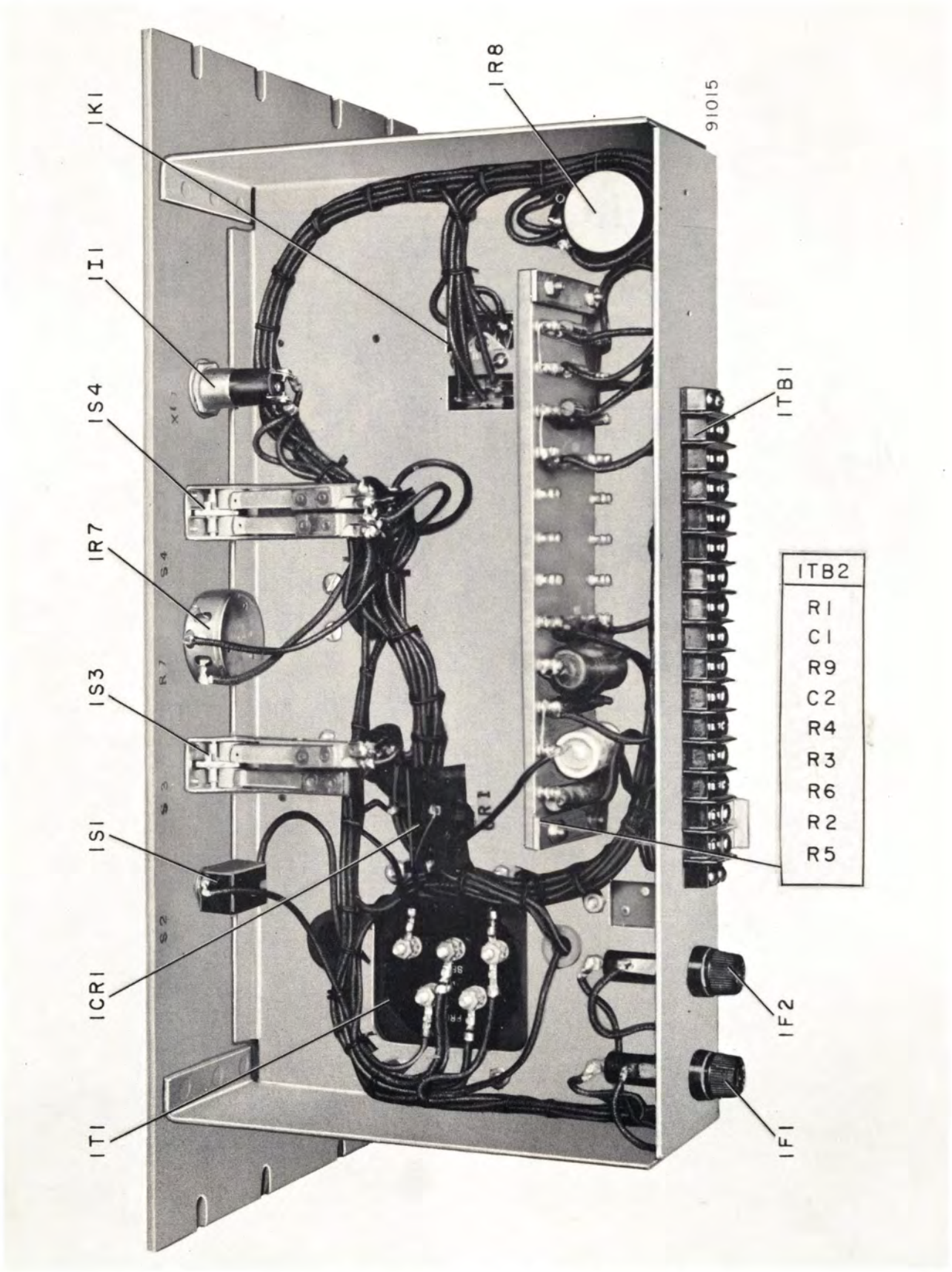


Figure 19 - Bottom View, BTR-11A Studio Control Unit

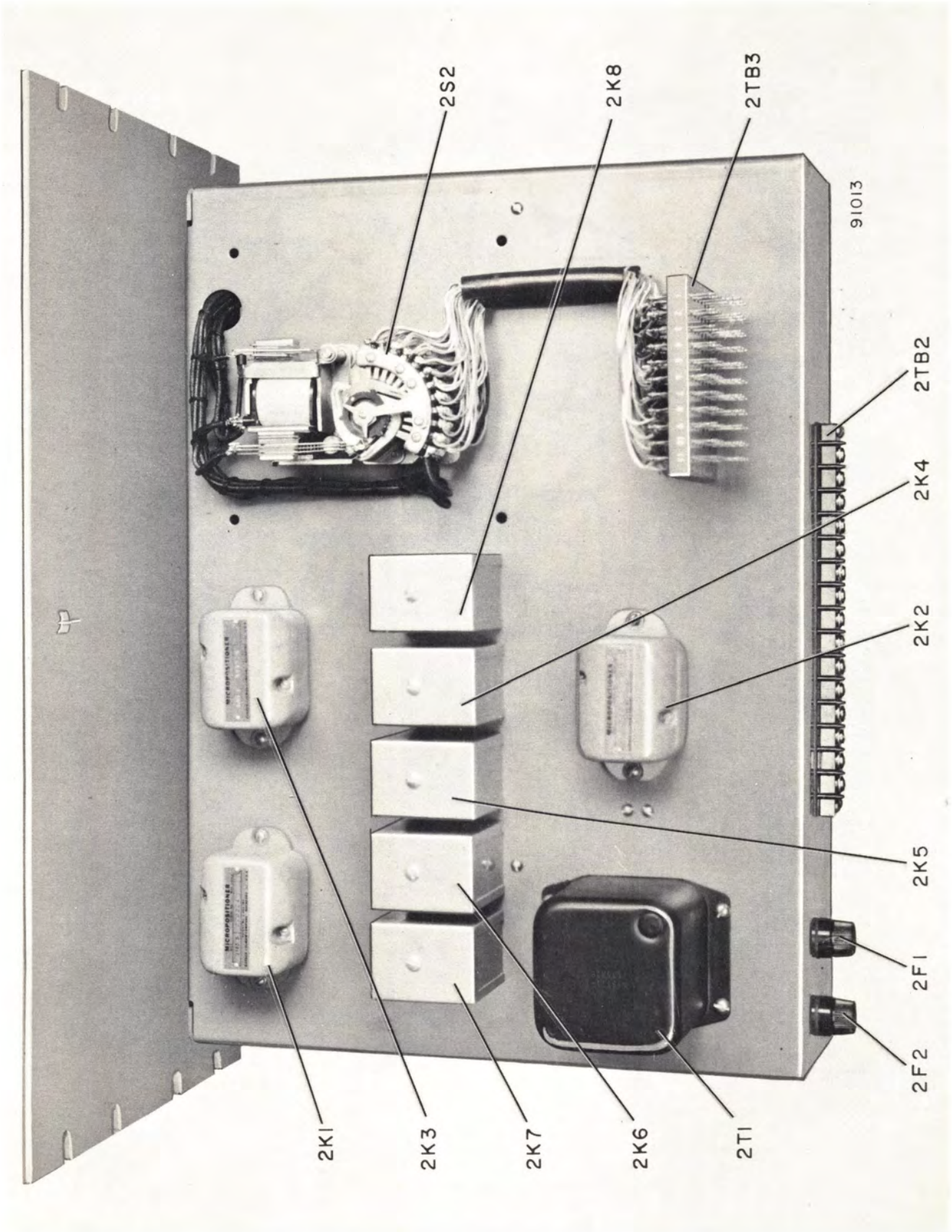


Figure 20 - Top View, BTR-11A Transmitter Control

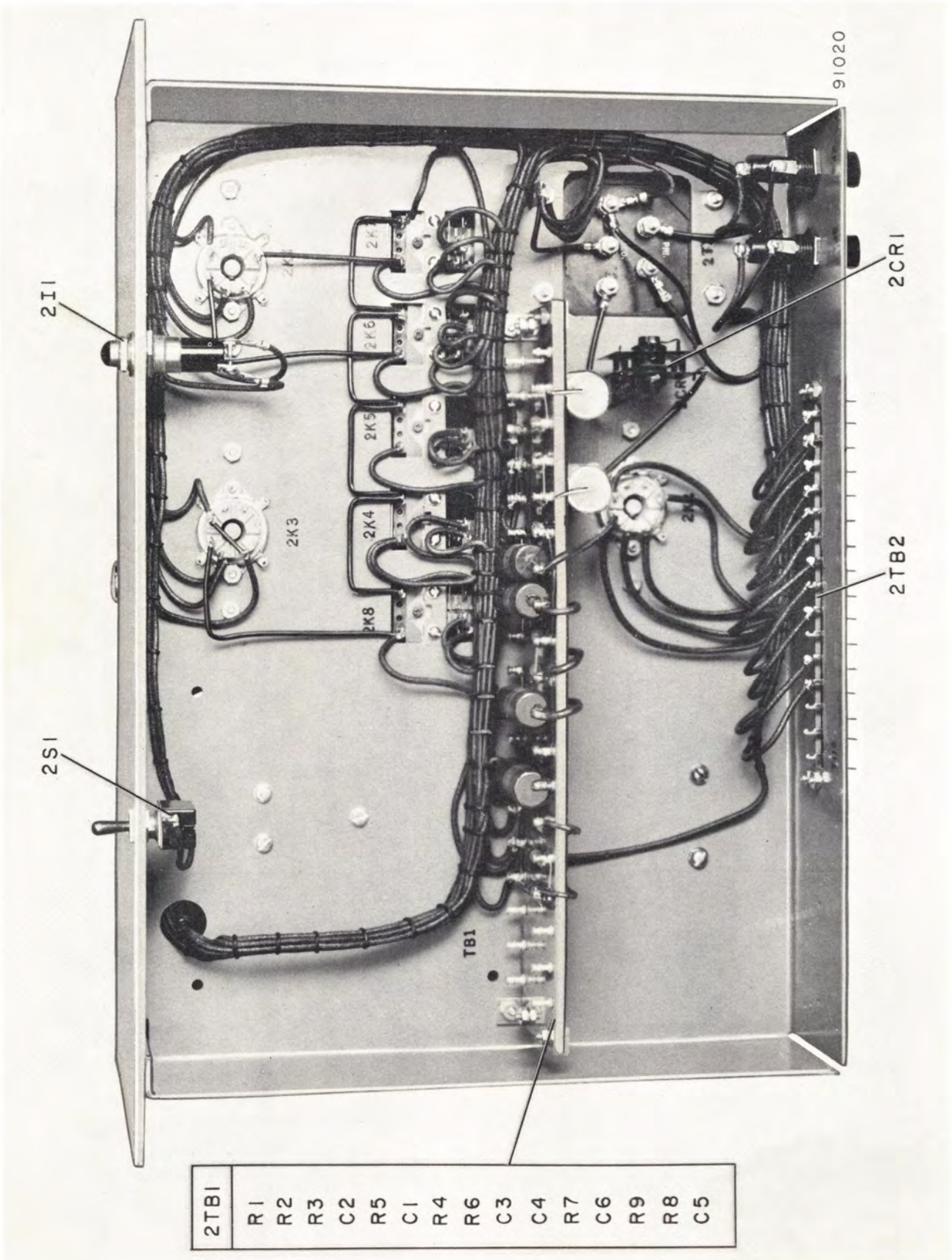


Figure 21 - Bottom View, BTR-11A Transmitter Control Unit

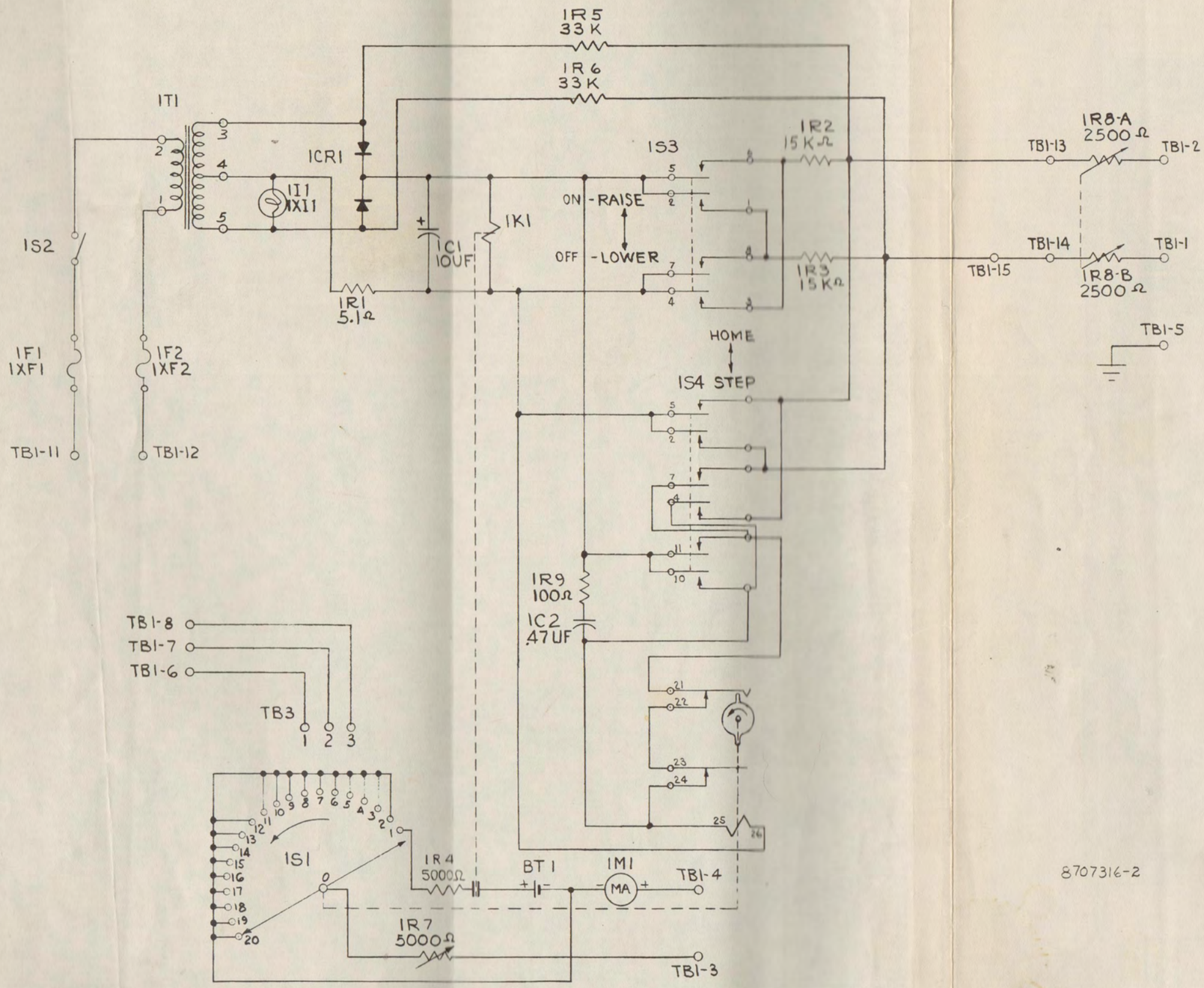


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Figure 22 - Schematic Diagram, BTR-20A Studio Control Unit

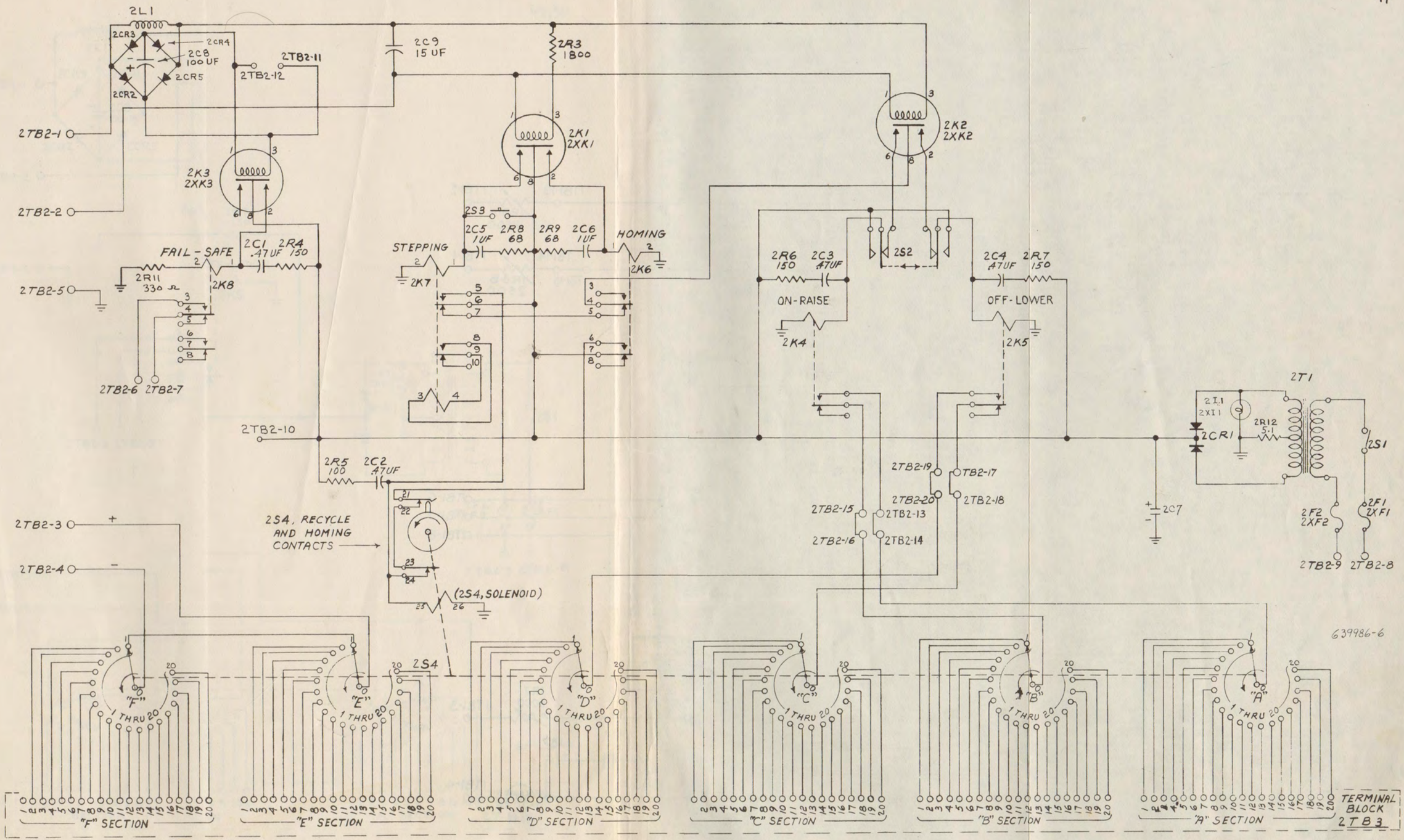


Figure 23 - Schematic Diagram, BTR-20A Transmitter Control Unit

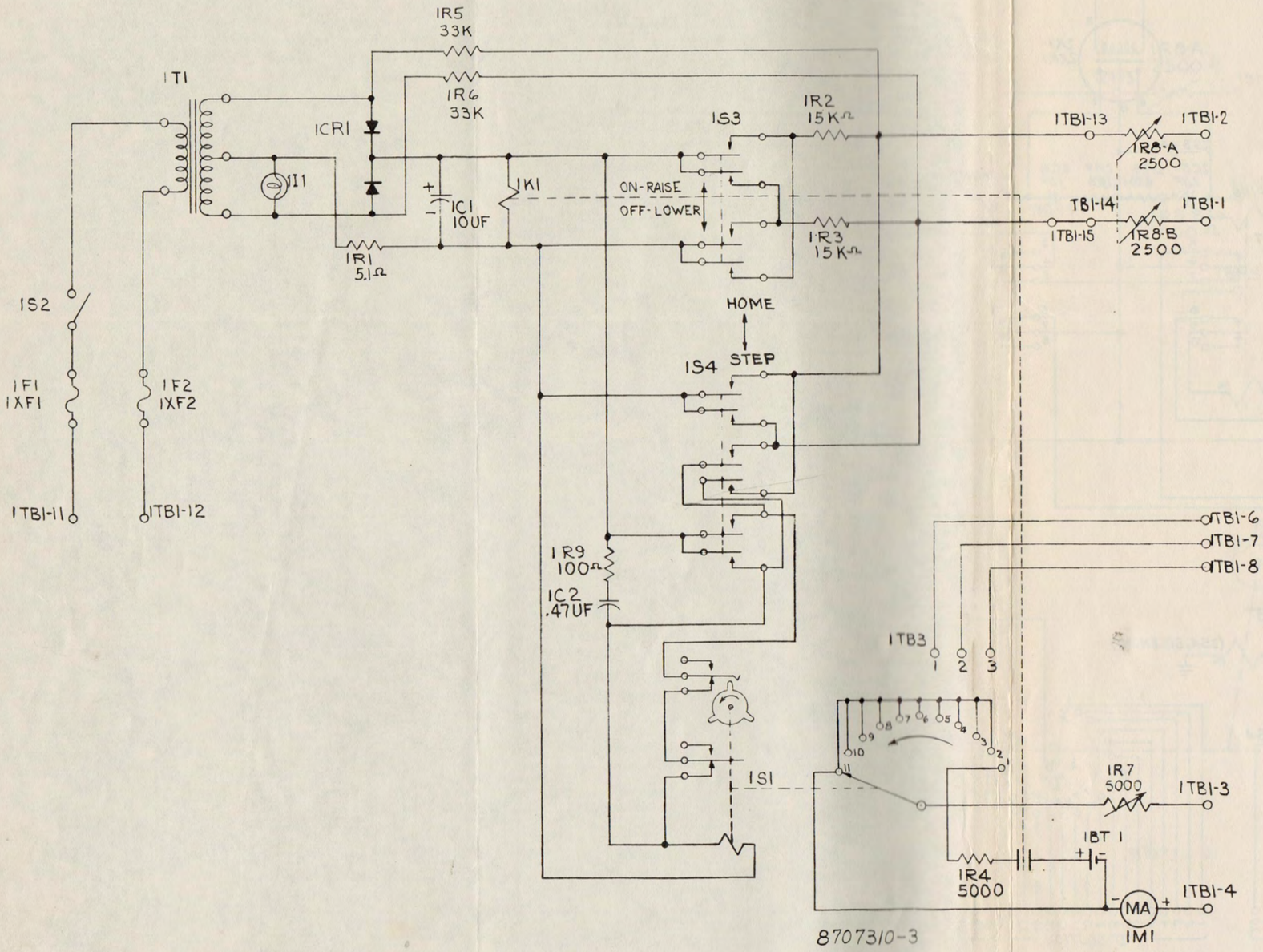


Figure 24 - Schematic Diagram, BTR-11A Studio Control Unit

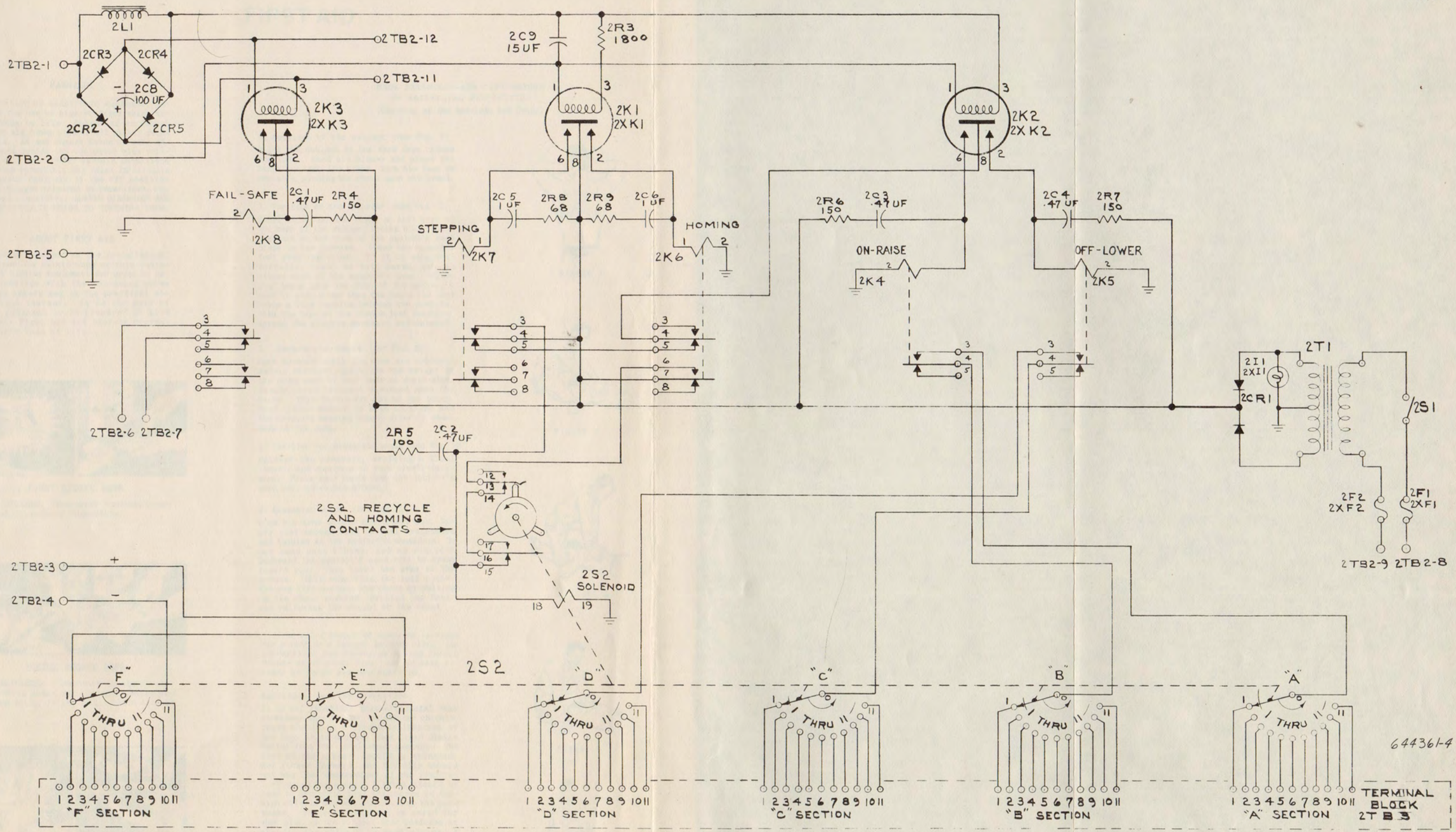


Figure 25 - Schematic Diagram, BTR-IIA Transmitter Control Unit

FIRST AID

WARNING!

Operation of electronic equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside the equipment with voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors, etc. To avoid casualties, ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

ABOUT FIRST AID

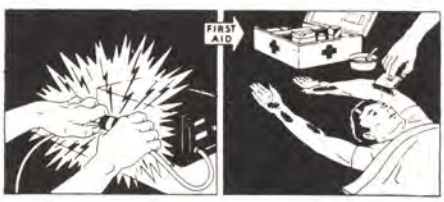
Personnel engaged in the installation, operation and maintenance of this equipment or similar equipment are urged to become familiar with the following rules both in theory and in the practical application thereof. It is the duty of every radioman to be prepared to give adequate First Aid and thereby prevent avoidable loss of life.

FIRST DEGREE BURN

SKIN REDDENED. Temporary treatment—Apply baking soda or Unguentine.

SECOND DEGREE BURN

SKIN BLISTERED. Temporary treatment—Apply baking soda, wet compress, white petroleum jelly, foille jelly, olive oil, or tea.



THIRD DEGREE BURN

FLESH CHARRED. Temporary treatment—Apply baking soda, wet compress, white petroleum jelly, or foille spray. Treat for severe shock.

BACK PRESSURE—ARM LIFT METHOD OF ARTIFICIAL RESPIRATION

(Courtesy of the American Red Cross)

1. Position of the subject (See Fig. 1)

Place the subject in the face down, prone position. Bend his elbows and place the hands one upon the other. Turn his face to one side, placing the cheek upon his hands.

FIGURE 1

2. Position of the operator (See Fig. 2)

Kneel on either the right or left knee at the head of the subject facing him. Place the knee at the side of the subject's head close to the forearm. Place the opposite foot near the elbow. If it is more comfortable, kneel on both knees, one on either side of the subject's head. Place your hands upon the flat of the subject's back in such a way that the heels lie just below a line running between the armpits. With the tips of the thumbs just touching, spread the fingers downward and outward.

FIGURE 2

3. Compression phase (See Fig. 3)

Rock forward until the arms are approximately vertical and allow the weight of the upper part of your body to exert slow, steady, even pressure downward upon the hands. This forces air out of the lungs. Your elbows should be kept straight and the pressure exerted almost directly downward on the back.

4. Position for expansion phase (See Fig. 4)

Release the pressure, avoiding a final thrust, and commence to rock slowly backward. Place your hands upon the subject's arms just above his elbows.

FIGURE 3

5. Expansion phase (See Fig. 5)

Draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the subject's shoulders. Do not bend your elbows, and as you rock backward the subject's arms will be drawn toward you. Then lower the arms to the ground. This completes the full cycle. The arm lift expands the chest by pulling on the chest muscles, arching the back, and relieving the weight on the chest.

THE CYCLE SHOULD BE REPEATED 12 TIMES PER MINUTE AT A STEADY, UNIFORM RATE. THE COMPRESSION AND EXPANSION PHASES SHOULD OCCUPY ABOUT EQUAL TIME; THE RELEASE PERIODS BEING OF MINIMUM DURATION.

FIGURE 4

Additional related directions:

It is all important that artificial respiration, when needed, be started quickly. There should be a slight inclination of the body in such a way that fluid drains better from the respiratory passage. The head of the subject should be extended, not flexed forward, and the chin should not sag lest obstruction of the respiratory passages occur. A check should be made to ascertain that the tongue or foreign objects are not obstructing the passages. These aspects can be cared for when placing the subject into position or shortly thereafter, between cycles. A smooth rhythm in performing artificial respiration is desirable, but split-second timing is not essential. Shock should receive adequate attention, and the subject should remain recumbent after resuscitation until seen by a physician or until recovery seems assured.

FIGURE 5

RADIO CORPORATION OF AMERICA

INDUSTRIAL ELECTRONIC PRODUCTS, CAMDEN, N. J.