ALLEN B. DUMONT LABS., INC.

MODELS 180,181,182,183
Circuit Data,Controls
Trouble Chart

GENERAL FEATURES

These receivers are classed as "Electrostatic and Direct Vision." Electrostatic indicates that the entire deflection system is electrostatic and since the picture is viewed direct, without the use of a mirror, lens or other device, it is referred to as Direct Vision. The latter ensures clarity, brilliance and the widest angle of vision. Steady, clear cut, black and white pictures that are large enough for all the family to enjoy at one time are secured by the use of a fourteen inch cathode-ray tube which furnishes a picture eight by ten inches. A separate high fidelity section brings superb reproduction of the sound channel which is associated with the picture. A single control tunes both the sight and the sound channels so the receiver is no more difficult to operate than an ordinary broadcast receiver. To the above features add its compact size, minimum number of controls and simple straight forward layout and you will have an idea of the first commercial television receiver which we believe you will find easy to install and service in spite of the apparent complexity of the subject Television.

CIRCUIT ARRANGEMENT

A simple straight line layout is used in these receivers that should prove extremely helpful to the serviceman. Viewed from the front the video receiver is on the left side of the chassis and the sound receiver is on the right. Fig. No. 1 shows the front controls and the sound receiver while Fig. No. 2 shows the rear adjustments and the video receiver. The top portion of the chassis contains both sweep circuits along with the modulating circuits of the cathode-ray tube. To prevent confusion each side is considered separately, half appearing in Fig. No. 1 and the remainder in Fig. No. 2. The seven auxiliary controls shown in Fig. No. 2 are provided for the use of the installer and serviceman. These controls are necessary to make the final alignment of picture size and positioning when the receiver is installed under the operating conditions imposed by the earth's magnetic field and the power supply line voltages. Once properly set these controls do not need adjustment and since they were not provided for the owner's use we suggest that the dealer or serviceman seal the back of the cabinet as it is not possible to tamper with the controls when the back is in place. The use of the parts and tubes shown in Fig. No. 1 and Fig. No. 2 can be checked by comparing the "V" numbers, etc., with the schematic drawings

Operating Controls of the Receiver (Front)

First, become familiar with the controls on the front of the receiver. Since the receiver has been tested before shipment, probably only a few minor adjustments will be necessary. Therefore before touching the adjustments in the rear attempt to operate the set according to the instruction sheet supplied the purchaser and make only the adjustments required. These instructions are repeated here to cover the possible loss of this sheet. Figure No. 1 shows the front of the receiver with the controls numbered and the use and the purpose of these controls is as follows.

1. Marked CONTRAST, ON and OFF

This is a power switch for starting and stopping a set. It also is the volume control of the picture signal. It should be adjusted in conjunction with the intensity control (No. 4) to produce a picture of pleasing contrast to the user. If the location is such that the signal received is very small, it may be necessary to use the full gain of this control, while in a good location it may have to be retarded considerably. If the picture is not satisfactory the rear controls must be adjusted as covered in a following section.

2. Marked SELECTOR

This control is a four position switch provided for covering four television channels.

3. Marked TUNING

Only one control is necessary to properly tune both the sight and sound channels. Simply adjust this control until the best reception of the sound is secured and at this point the picture signal will be correctly tuned.

4. Marked INTENSITY

The intensity or brightness of the picture is controlled by this knob. It should be adjusted in conjunction with Control No. 1 to get the best picture. Note: It is a good plan to retard (turn to the left) this control when starting the set. If about 15 seconds is allowed to elapse before advancing this control it will prevent a small bright spot from appearing on the screen which might eventually darken the screen.

5. Marked FOCUS

This control is used to sharpen the individual lines of the pattern and once set seldom requires further adjustment.

6. Marked VOLUME

This volume control adjusts the audio volume and has no effect whatever upon the picture.

Rear Controls of the Receiver

As previously stated, the adjustment of these controls is necessary for the final alignment of picture size and positioning, as the earth's magnetic field and power supply line voltages vary with locations. The location of these controls is shown in Figure No. 2 and their use will be covered in numerical order. Proceed as follows: remove the wood screws holding in the back of the cabinet and pull out the back. The safety switch will open, turning the set off and since it is necessary to have the set in operation while making these adjustments the switch can be made temporarily inoperative. (A large battery clip is convenient for this purpose.) Do not reach into the set with the voltages on. (See Cautions and Warning.) There is one adjustment that cannot be made by these controls, that of rotating the Cathode-ray tube to cause the picture to properly line up with the viewing opening. To remedy this, turn the set off, remove the elastic band that grips the rear support and rotate the tube by hand in the correct direction.

The function of the seven rear controls are as follows:

1. Vertical Frequency Control

This controls the frequency of the vertical sweep. If the picture is not steady and slips past at intervals, vertically, this control should be adjusted until a steady picture is secured.

2. Vertical Size Control

If the picture is too narrow and out of proportion vertically this control will remedy the trouble.

3. Vertical Positioning Control

As its name indicates, this control will move the pattern vertically, allowing the picture to be placed directly in the center of the opening.

4. Astigmatic Positioning Control

This is adjusted in conjunction with Control No. 5 to give the best possible focus on the corners of the picture.

5. Horizontal Positioning Control

This control positions the picture horizontally.

6. Horizontal Size Control

The width of the picture is adjusted by this control.

7. Horizontal Frequency Control

If no picture can be secured but modulation (dark and light spaces) can be seen on the screen, the setting of the horizontal frequency control is probably incorrect. Adjust this control until the picture forms.

With the adjustment of these controls the installation should be satisfactory. However, if the signal is weak or if ghosts or noise is present, return to the dipole antenna and make changes as previously suggested until the best position for it is secured.

LOCATION OF TROUBLE

FAULT	POSSIBLE CAUSES
No picture.	1. Power supply trouble in any or all three sources. 2. Too much bias on modulator electrode. 3. Defective cathode-ray tube.
No scanning.	1. Trouble in 1500 volt power source. 2. Poor connections to deflection plates. 3. Defective scanning circuits. 4. Defective cathode-ray tube.
No modulation.	1. Defective or shorted antenna. 2. Defect in video receiver. 3. Too much bias on modulator electrode. 4. Defective cathode-ray tube.
Poor focus.	1. Improper voltages supplied cathode-ray tube. (check entire divider circuit) 2. Defective video receiver. 3. Poor adjustments. 4. Defective cathode-ray tube.
Uneven brilliance.	1. Hum from power source. 2. Defective scanning circuits. 3. Scanning picked up by modulator circuits. 4. Screen burnt or discolored.
Distorted picture.	1. Poor synchronizing (circuit or adjustment). 2. Overloading (contrast control advanced too far) 3. Defective video receiver. 4. A.C. hum. 5. External interference.
Unsteady picture or flickers.	1. Poor synchronizing action. 2. Leakage. 3. Varying voltages to cathode-ray tube or receiver. 4. Unsteady receiver. 5. Antenna loose or shorting.
Double image.	1. Scanning circuits incorrectly adjusted. 2. Ghost images due to reflection of signals.
Cathode-ray tube controls effect the picture and scanning.	1. Cathode-ray tube defective, probably leaking and going soft.
Superimposed pattern on the picture.	1. Oscillation probably in the receiver.
Streaks across picture.	1. Usually local interference such as ignition or diathermy.

MODELS 180,181,182,183
Chassis Views

ALLEN B. DUMONT LABS., INC.

CONTROLS

Operating Controls 6
Adjustment Controls 7

Types 181, 182, 183
These receivers have the same operating controls as the type 180 and therefore will not be covered separately.

MECHANICAL SPECIFICATIONS

Cabinet Dimensions
Height ..... 24 inches
Width ..... 15¾ inches
Depth ..... 25 inches

Chassis Dimensions
Height ..... 20¾ inches
Width ..... 13¼ inches
Depth ..... 24¼ inches

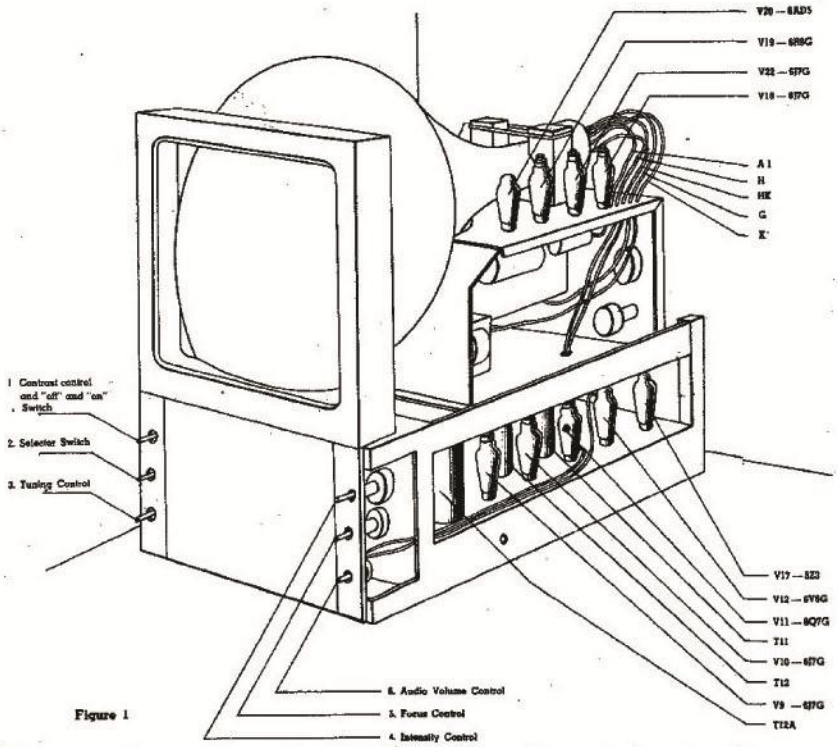


Figure 1

TUBE COMPLEMENT

Type	Purpose
1853	R.F. Amplifier
6J5M	R.F. Oscillator
1852	First Detector
1853	1st Video I.F. Amplifier
1852	2nd Video I.F. Amplifier
6H6M	Video 2nd Detector
1851	1st Video Amplifier
6V6G	Video Power Amplifier
6J7G	1st Sound I.F. Amplifier
6J7G	2nd Sound I.F. Amplifier
6Q7G	Sound 2nd Detector and Amplifier
6V6G	Sound Power Amplifier
6J7G	Horizontal Synch Separator
6AD5G	Horizontal Sweep Oscillator
6R6G	Horizontal Sweep Amplifier
6J7G	Vertical Synch Separator
6AD5G	Vertical Sweep Oscillator
6R6G	Vertical Sweep Amplifier
2Y2	4100 Volt Rectifier
5X3	1600 Volt Rectifier
5Z3	350 Volt Rectifier
114-9-T	Cathode-ray Tube (14")

Frequency Ranges — Four Television Channels provided, present alignment as follows:

STEP	STATION	SIDE BAND	AUDIO CARRIER	VIDEO CARRIER
A	NBC	Single	49.75	45.25
B	CBS	Single	55.75	51.25
C	.....	.....	.....	.....
D	NBC	Double	49.75	46.5

Power Ratings

Power supply 110 to 120 volts, 50 to 60 cycles, 250 watts.
Audio output, maximum 4.25 watts.

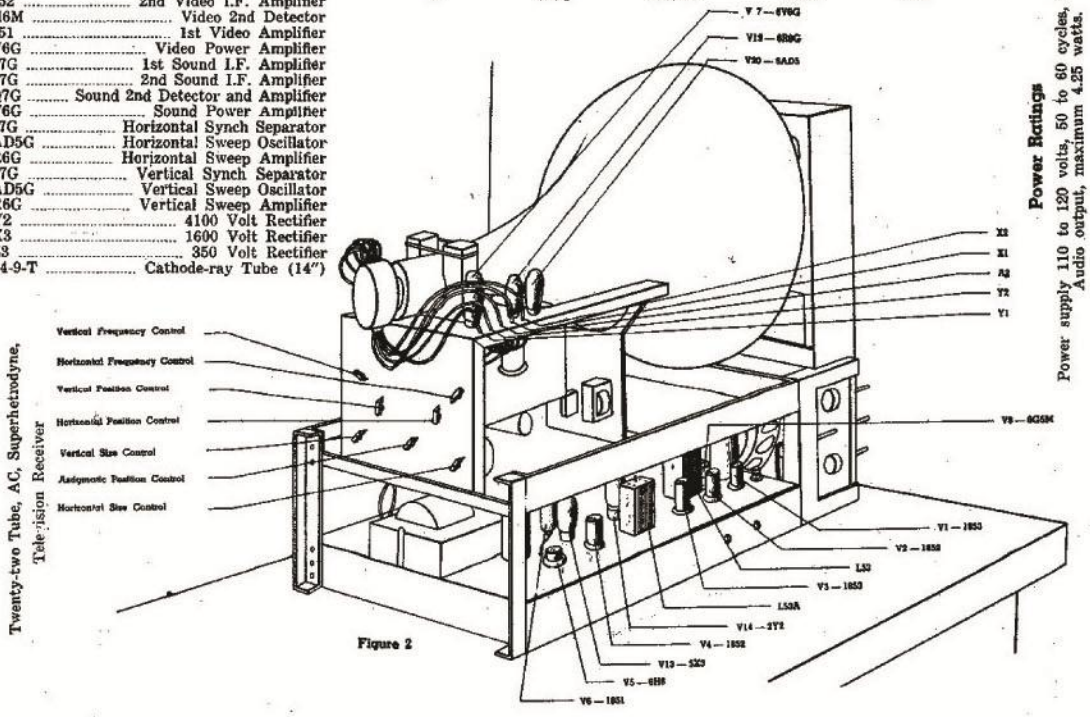
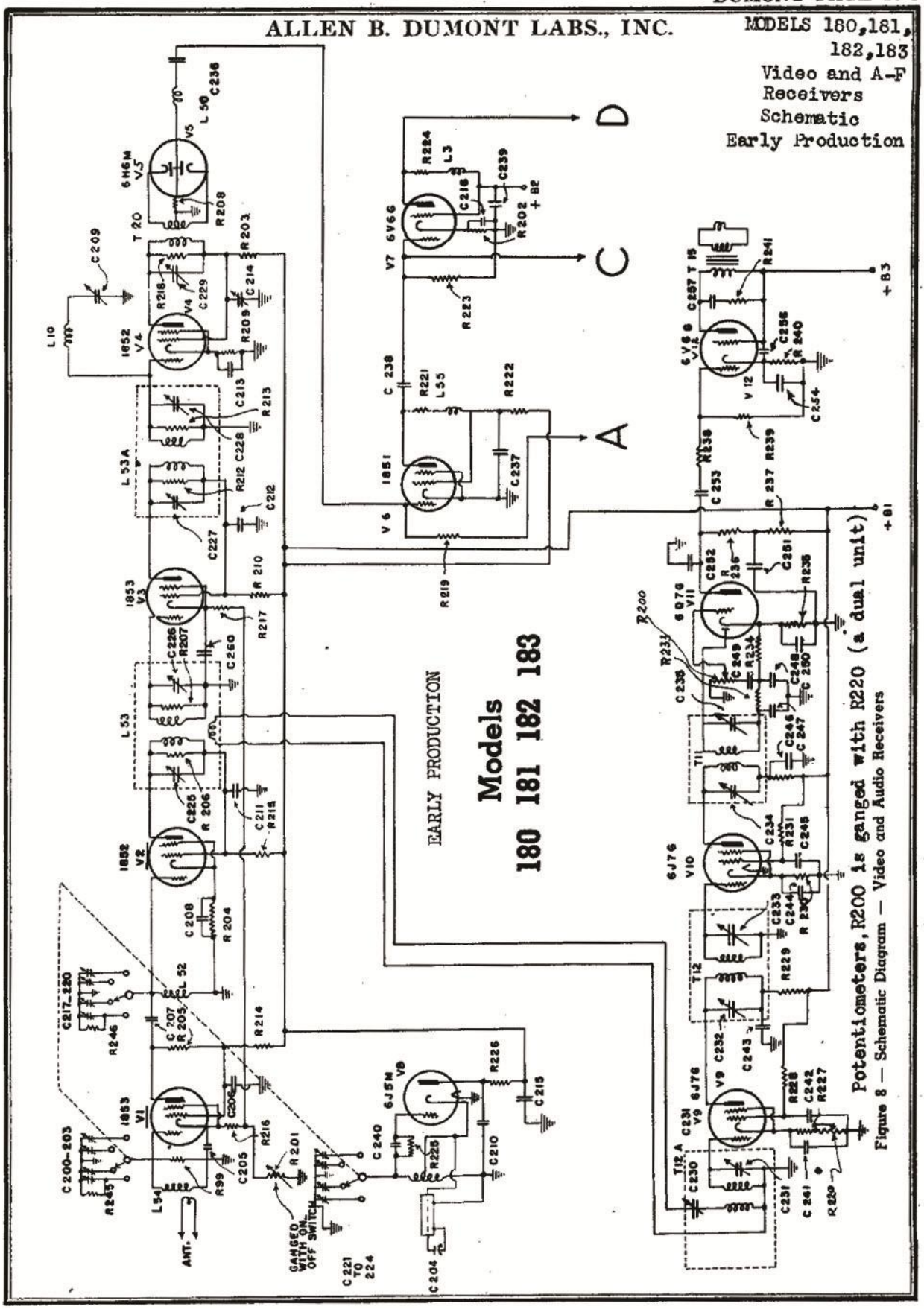


Figure 2

ALLEN B. DUMONT LABS., INC.

MODELS 180,181, 182,183
Video and A-F Receivers
Schematic
Early Production



Potentiometers, R200 is ganged with R220 (a dual unit)

Figure 8 — Schematic Diagram — Video and Audio Receivers

MODELS 180,181,182,183
Separator and Sweep
Voltage Divider
Schematics,Notes

ALLEN B. DUMONT LABS., INC.

Early Production

EARLY PRODUCTION **Models 180 181 182 183**

It is better to shut the set completely off between adjustments than to suffer a painful or even a dangerous burn. The set is equipped with a safety switch which automatically opens upon the removal of the back of the cabinet. This protects the operator from dangerous high voltages which would otherwise be exposed.

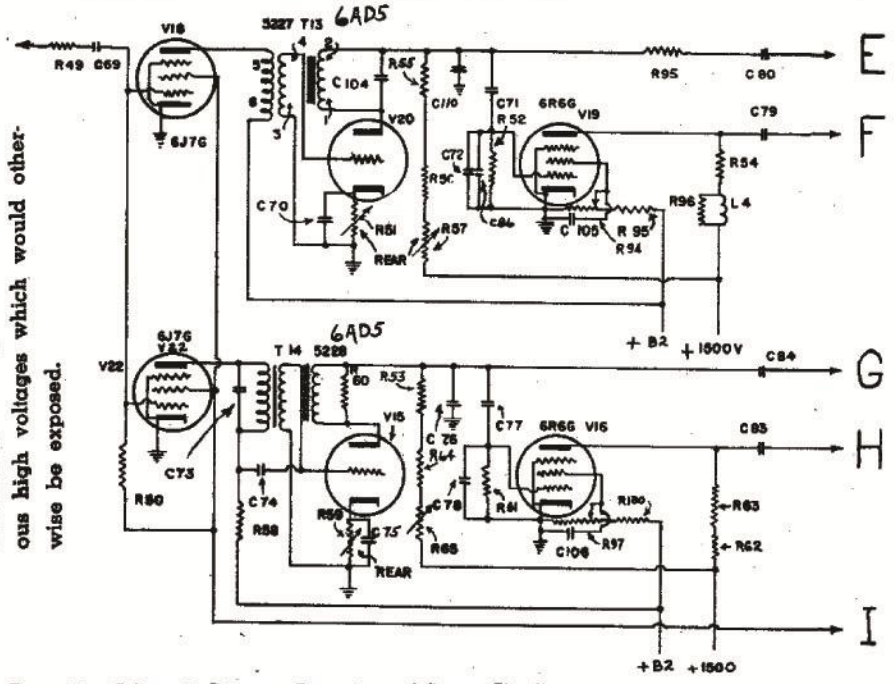


Figure 5 — Schematic Diagram, Separator and Sweep Circuits

The high voltages that are necessary in this type of equipment are very dangerous and should not be approached in a careless manner.

The serviceman that is engaged in installing or servicing television receivers is urged to take all precautions and run no unnecessary risks.

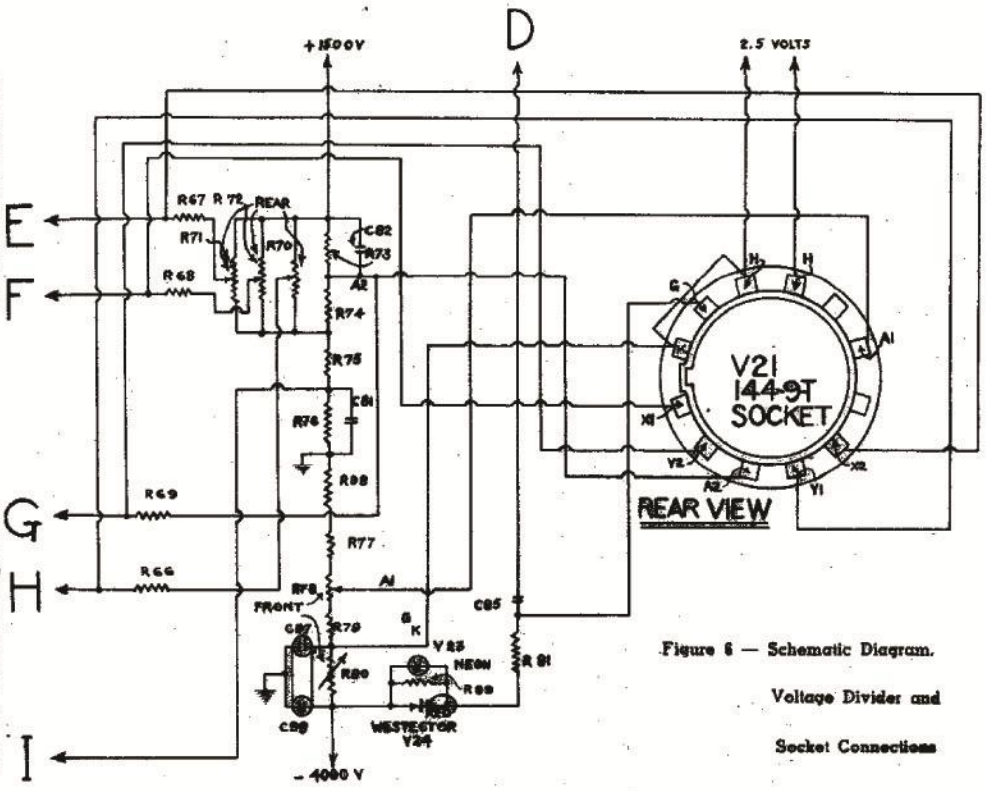


Figure 6 — Schematic Diagram, Voltage Divider and Socket Connections

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CAUTION AND WARNING

Large cathode-ray tubes operate at high voltages and hence are evacuated to a very high degree of vacuum. Therefore the atmospheric pressure on the glass can run into tons depending on the size of the tube. A collapse therefore is as bad as an explosion and all cathode-ray tubes should be handled with care. The Du Mont Laboratories have gone to great expense to provide a cathode-ray tube that is safe for the home and the structural design results in its ability to stand tests nearly twice as severe as usually employed. The serviceman, however, should observe the following rules as he will probably be the only one to handle the average tube.

1. Be careful in handling the tube.
2. Watch the use of tools near the tube.
3. Don't scratch the surface of the glass.
4. Don't stand the tube on a metal surface or in any other way cause certain parts to be quickly heated or cooled.

TERMINAL VOLTAGES

Using Weston Model 772 20,000 Ohms per Voltmeter
(with Televerter)

Tube	Plate	Screen	Grid (Control)	Notes
V9	240	150	— 4.3	
V10	240	155	— 4.3	
V11	190	.....	— 2.2	
V12	275	290	—11.5	Cathode to ground.
V8	115	.....	.....	
V1	140	190	— 2.	Contrast on full.
V2	190	190	— 3.5	
V3	180	180	— 2.25	
V4	178	170	— 2.25	
V6	170	185	— 2.0 Cannot be measured at the grid of V6. Should read —4 volts at center tap of 5Z3 high voltage winding to ground.	
V7	140	225	— 7.5	

V17 5Z3 filament to ground = 310 volts
V13 5X3 filament to ground = 1000 volts
(output after L7 = 1500)
V14 2Y2 output = 3500 to 4200 (ground is positive)
(output after R85 = 2500 to 4100 volts)
The above measurements were taken with respect to ground, the following are point to point.
V21 From cathode to grid —60 to —160
From cathode to first anode +200 to +1600
From cathode to second anode +5000

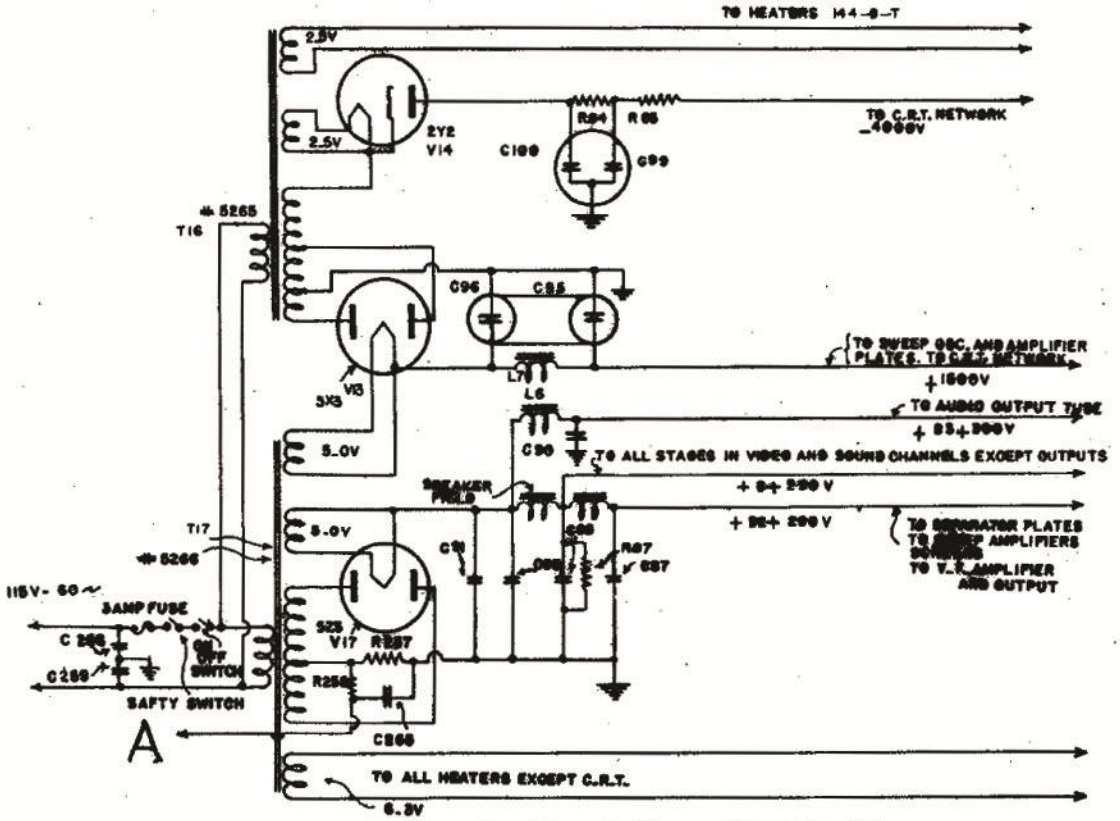

Figure 7 — Schematic Diagram, Power Supplies

MODELS 180,181,182,183
Service Data, Parts ALLEN B. DUMONT LABS., INC.

RESISTOR VALUES

EARLY PRODUCTION

R — Regular
S — Special
W — Wire

R	Ohms	Watt	Class	R	Ohms	Watt	Class
49	10,000	½	R	200	500,000	pot	S
50	10 meg	½	R	201	2,000	pot	R
51	6,000	pot	W	202	150	½	R
52	1 meg	½	R	203	5,000	1	R
53	200,000	2	S	204	400	½	R
54	80,000	20	W	205	3,000	½	R
55	100,000	2	S	206	3,000	½	R
56	100,000	2	S	207	3,000	½	R
57	500,000	pot	S	208	3,000	½	R
58	15,000	½	R	209	150	½	R
59	6,000	pot	W	210	5,000	1	R
60	50,000	½	R	212	3,000	½	R
61	25 meg	1	R	213	3,000	½	R
62	1.5 meg	1	R	214	5,000	1	R
63	1.5 meg	1	R	215	5,000	1	R
64	200,000	2	S	216	150	½	R
65	1 meg	pot	S	217	150	½	R
66	5 meg	½	R	218	5,000	½	R
67	5 meg	½	R	219	1 meg	½	R
68	5 meg	½	R	220	100,000	pot	S
69	5 meg	½	R	221	1,500	1	R
70	2 meg	pot	R	222	5,000	1	R
71	2 meg	pot	R	223	1 meg	½	R
72	2 meg	pot	R	224	1,000	2	R
73	300,000	½	R	225	25,000	½	R
74	300,000	½	R	226	25,000	½	R
75	750,000	2	R	227	400	½	R
76	15,000	½	R	228	100,000	½	R
77	1 meg	2	S	229	4,000	½	R
78	1 meg	pot	S	230	1,000	½	R
79	750,000	2	R	231	100,000	½	R
80	100,000	pot	R	232	4,000	½	R
81	10,000	½	R	233	50,000	½	R
82	35,000	10	W	234	1.5 meg	½	R
83	100,000	1	R	235	2,000	½	R
84	100,000	1	R	236	50,000	½	R
87	100,000	2	R	237	10,000	½	R
88	1 meg	2	S	238	50,000	½	R
89	1 meg	½	R	239	250,000	½	R
90	50,000	½	R	240	160	1	R
94	250,000	pot	S	241	10,000	1	R
95	40,000	½	R	245	10,000	½	R
96	50,000	½	R	246	10,000	½	R
97	50,000	pot	R	257	20	1	R
99	3,000	½	R	258	500,000	½	R
100	200,000	½	R				

CONDENSER VALUES

C.	Mfd.	Volts	C.	Mfd.	Volts
69	.1	400	214	.01	400
70	.05	400	215	.01	400
71	.000075	1500	216	.001	400
72	.0025	400	217	3-30	trimmer
73	.0025	400	218	3-30	trimmer
74	.005	500	219	3-30	trimmer
75	25.	50	220	3-30	trimmer
76	.04	1600	221	3-30	trimmer
77	.0005	1500	222	3-30	trimmer
78	.25	400	223	3-30	trimmer
79	.01	1200	224	3-30	trimmer
80	.04	1600	225	L53	
81	.1	400	226	L53	
82	.25	600	227	L53A	
83	.1	1000	228	L53A	
84	.1	1000	229	T-20	
85	.05	4500	230	T12A	
86	.0005	400	231	T12A	
87	16.	450	232	T12	
88	8.	450	233	T12	
90	8.	450	234	T11	
91	16.	450	235	T11	
93	16.	450	236	.04	400
95	4.	1500	237	8.	450
96	4.	1500	238	.94	400
97	.2	4000	239	.01	400
98	.2	4000	240	.000050	400
99	.2	4000	241	.02	400
100	.2	4000	242	.10	400
104	.0003	400	243	.25	400
105	.02	400	244	.02	400
106	25.	50	245	.10	400
110	.0002	1500	246	.25	400
200	3-30 mmf.	trimmer	247	.0002	400
201	3-30 mmf.	trimmer	248	.000050	400
202	3-30 mmf.	trimmer	249	.01	400
203	3-30 mmf.	trimmer	250	25.	25
204	3-5	variable	251	4.	450
205	.0006	400	252	.0006	400
206	.0006	400	253	.1	400
207	.0006	400	254	50.	25
208	.01	400	256	.0005	400
209	3-30 mmf.	trimmer	257	.01	400
210	.0006	400	258	.0006	400
211	.01	400	259	.0006	400
212	.01	400	260	.01	400
213	.01	400	265	25.	25

SERVICE

While the technique employed in servicing television receivers is similar to ordinary radio practice, there is a greater need for basic knowledge and the time will be well spent that is used to study the fundamental principles of television before attempting actual service work. For obvious reasons it will be impossible to include fundamental theory in this manual, however, since very little data concerning the form of sweeps used in these receivers is available, the following description may be helpful.

Fig. 5 is a schematic diagram showing synchronizing signal separation and sweep circuits used in this receiver. The two 6J7G tubes (V18 & V22) function as the synchronizing signal separators. The outputs of the two plates are fed their respective synchronizing windings of the horizontal and vertical oscillation transformers. Linear sawtooth deflection is effected using a 6AD5G triode as an oscillator and a 6R6G pentode as an amplifier. Oscillations are generated as follows:

Let us consider first the low frequency vertical circuit. Condenser C76 is charged from the power supply through the resistor consisting of R64 80Ω and R65 1Ω functions mainly as an amplitude or size control, although it has some effect upon the frequency of operation. Condenser C76 charges to practically full power supply potential. As a result of previous oscillations, a charge on condenser C75 is held on the cathode, which gradually decreases to zero through R59 as C76 is charging. This charge on C75 is high enough to hold the tube at cutoff. The grid of the tube is at D.C. ground potential. As the cathode approaches ground potential due to the discharge of C75 the 6AD5G triode becomes conducting. As plate current flows C76 is discharged, producing the return trace of the sawtooth. The surge of plate current through the winding of the oscillation transformer induces a voltage in the grid winding of proper polarity to drive the grid more positive, thereby reducing the plate circuit impedance and therefore the return trace time. At the same time that C76 is discharging, C75 is charging to its initial value to cut off the flow of plate current. As this action takes place, the plate current surge decreases, thereby applying less positive voltage to the grid and increasing the rate of action. Ultimately, the tube is completely cut off, and the cathode is at its full positive potential, and the charging cycle again begins. Resistor R59 functions as both an amplitude and a frequency control since it determines the breakdown potential and the frequency of recurrence of the oscillations in the plate circuit of the triode. Synchronizing pulses are injected into the grid of the oscillator tube through the winding of the oscillation transformer. These synchronizing pulses are polarized so that they drive the grid in a positive direction with respect to the cathode and therefore hasten the "breaking down" of the oscillator tube and effect synchronization. Since condenser C76 is charged to nearly full power supply voltage, the signal which is taken from the plate circuit of the triode is extremely non-linear. It is applied, however, to one plate of the deflecting pair in the cathode-ray tube. At the same time it is divided by a capacity-resistance network and is applied to the grid of the 6R6G pentode. This triode section is so operated that its output is distorted in a manner opposite to that distortion introduced by the non-linear operation of the oscillator triode. The output of the 6R6G is applied to the other deflection plate of the pair and the deflection from this signal is such that the resultant deflection is linear.

Since the high frequency or horizontal sweep operates in the same manner it will be unnecessary to repeat the above description. The horizontal circuit is, however, a little more critical than the vertical and it is absolutely essential to keep the stray circuit capacities of the horizontal oscillator and amplifier at a minimum in order to keep the return trace time at a minimum. Therefore, if repairs are ever necessary on this circuit care must be taken not to increase the capacity of the circuit.

In Fig. 6 the use of a copper oxide rectifier and neon lamp can be explained as follows. The D.C. component necessary for background level, is introduced by the action of the copper oxide (Westector) V24. The neon lamp V23 is provided to protect the rectifier from high voltage surges when the equipment is first turned on.

Assuming that the controls are properly set and handled, the first step will be to determine the location of the trouble and isolate the defective portion. In this you will be aided by the design of the receiver, for, as previously pointed out, the various sections are separately located.

The following brief outline, while by no means complete, will serve to point out possible causes and location.

While no fast rule can be laid down, once the section failing has been decided on it will generally be found that a systematic check correctly interpreted will locate the fault. A voltage check of the suspected circuit along with the checking of the tubes employed will probably be the next step. Then, if the voltages are correct and a cathode-ray oscillograph is available it can be used to trace the source of the trouble.

It is quite probable that the majority of service problems will fall within this range in spite of this limitation, as the correct adjustment of the regular control knobs along with the replacement of tubes and parts will provide the answer to nearly all troubles.

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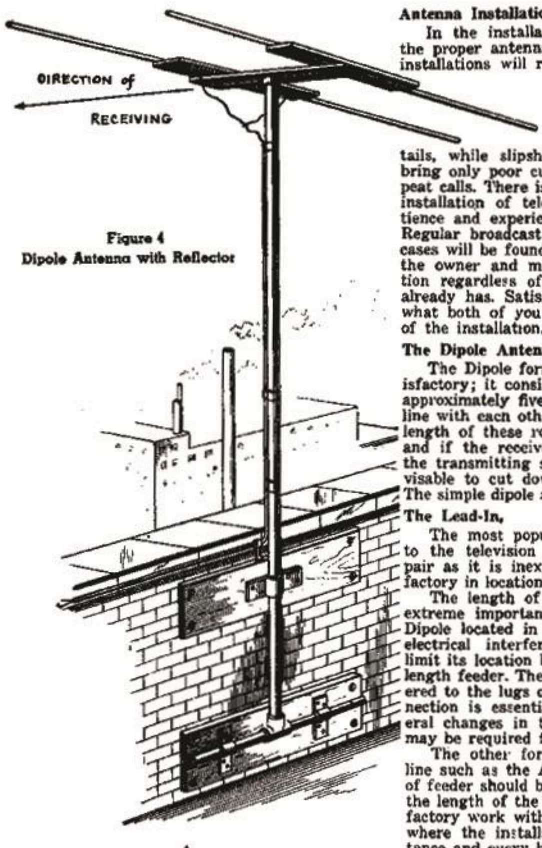
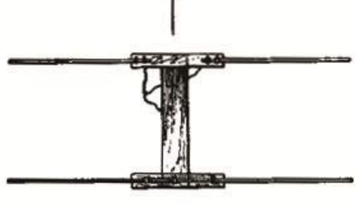


Figure 4
Dipole Antenna with Reflector



Antenna Installation

In the installation of television receivers the proper antenna is a necessity. Successful installations will result from attention to details, while slipshod and careless work will bring only poor customer satisfaction and repeat calls. There is nothing difficult about the installation of television aerials, a little patience and experience is all that is required. Regular broadcast aerials in the majority of cases will be found useless. Impress this upon the owner and make a satisfactory installation regardless of what other equipment he already has. Satisfactory picture reception is what both of you require for the completion of the installation.

The Dipole Antenna

The Dipole form of aerial is generally satisfactory; it consists of two metal rods, each approximately five feet long and placed on a line with each other. Extreme accuracy in the length of these rods is usually not necessary and if the receiver is located very close to the transmitting station it may be found advisable to cut down the length of each rod. The simple dipole aerial is shown in Fig. No. 3.

The Lead-In,

The most popular lead-in from the dipole to the television receiver will be a twisted pair as it is inexpensive and generally satisfactory in locations where the signal is strong.

The length of this lead is usually not of extreme importance. It is better to get the Dipole located in the clear and as far from electrical interference as possible than to limit its location by using a theoretical, exact length feeder. The twisted pair should be soldered to the lugs on the Dipole as a good connection is essential and necessary since several changes in the position of the antenna may be required for best results.

The other form of lead-in is the coaxial line such as the Amphenol No. 72. This form of feeder should be used in installations where the length of the lead-in is too long for satisfactory work with the twisted pair and again where the installation is at an extreme distance and every bit of energy picked up must be delivered to the receiver.

Polarization

If the dipole is mounted horizontally it is said to be horizontally polarized, and if vertical it is vertically polarized. Since the physical location materially affects the aerial no specific form can be advised and we can merely suggest that you start by using horizontal polarization and change if necessary to produce the best results.

Location of the Antenna

Whenever possible the Dipole should be erected so that it is in line of sight with the transmitter. This does not mean that no signals can be secured where a direct view of the transmitter cannot be obtained. Surprising results are often secured on these high frequencies and no concise rules can be assigned to this work. If the location is on a street having heavy traffic there may be considerable noise level due to automobile ignition systems. In this case, locate the Dipole to the rear of the building and away from the source of the noise as far as possible. In the case of electrical machinery over which you have no control, the same method can be employed along with the utilization of the directional effects of the aerial which will be covered later.

Room Illumination

Wherever possible the receiver should be so placed in the home that a direct glare from either natural or artificial light does not fall upon the face of the cathode-ray tube. The received pictures may be viewed under a variety of conditions where it is not always convenient to darken the room completely. Adjustments made to meet these conditions will not cause damage to the receiver. Viewing the pictures in as dark a room as possible is always at an advantage as it permits the setting of the Intensity and Contrast controls in a manner that will give picture tone values more correctly relating to those actually used in the studio from which the picture is transmitted.

Installation Process

It is a good plan to proceed as follows with the installation.

1. Erect the Dipole antenna in the clear. Start by using horizontal polarization (mount the rods horizontally) and turn them until their plane is at right angles with the location of the transmitter.
2. Adjust the receiver to produce a picture.
3. Return to the antenna and make final adjustments for best signal strength and removal of ghosts, etc.

Ghost Effects

Where the picture appears to be duplicated and slightly displaced, the additional picture is referred to as a ghost. This effect is usually due to the reflection of the signals and can be cured by the slanting or rotating of the Dipole or the use of a reflector or reflectors. If, after all possible positions have been tried, the ghost still exists it will be necessary to change the location of the antenna and try again.

Directional Effects

In the simple Dipole, directional effects are not very pronounced, but it does have a rather sharp no-signal radius and it is possible in some instances to materially reduce interference by placing the offending source in this area. If the installation of the receiver is being made at quite a distance from the transmitter or if the signal level is very low due to local conditions, it is well to consider the use of a reflector. This is done by placing a rod, about ten feet long, parallel with the Dipole and about five feet in back of it. The directional effect of the Dipole remains the same, namely at right angles to the plane. Signals coming from the front will be greatly increased. In using reflectors it is well to bear in mind, however, that any signal approaching from the rear (where the reflector is located) will be greatly attenuated. Fig. No. 4 shows the reflector added to the simple Dipole.

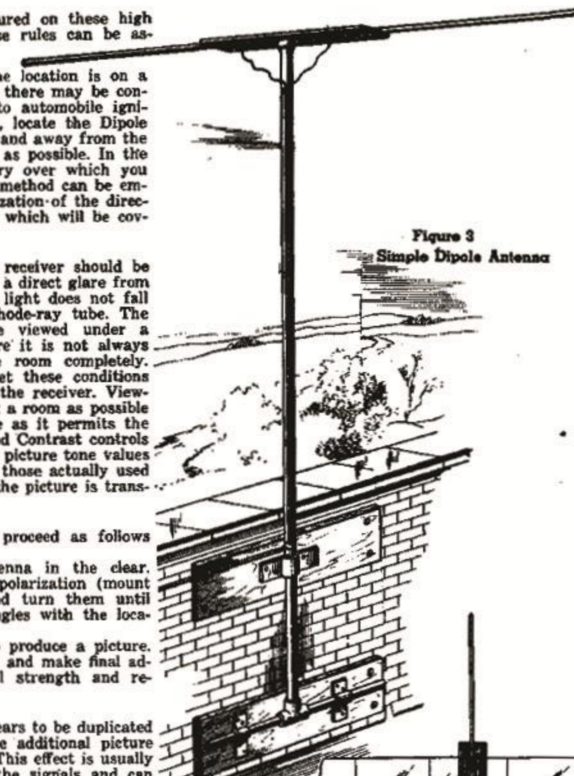


Figure 3
Simple Dipole Antenna