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T.O. 12R1-2ARA19-11
(formerly T.O. 16-30ARA19-11)

HANDBOOK
OPERATING INSTRUCTIONS

REMOTE TUNING GROUP

CONTROL PANEL C-423A/A

CONTROL PANEL C-423B/A

CONTROL PANEL C-1513/A

AMPLIFIER ASSEMBLY AM-203/ARA-19

TUNING DRIVE ASSEMBLY PD-5A/ARA-19

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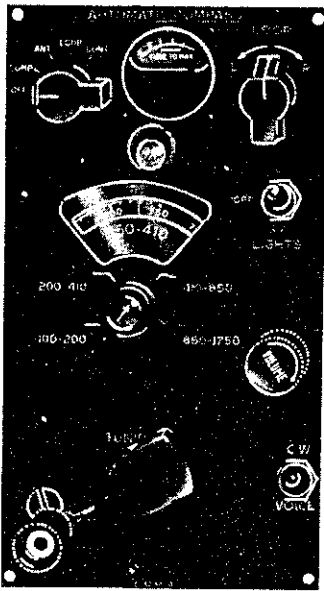
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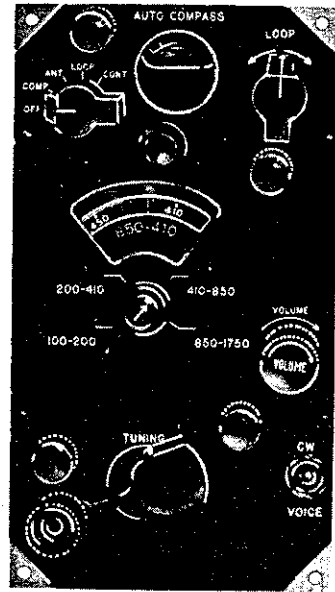
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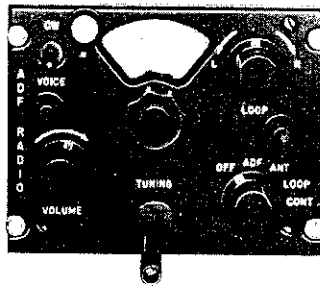
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CONTROL
PANEL
C-423A/A

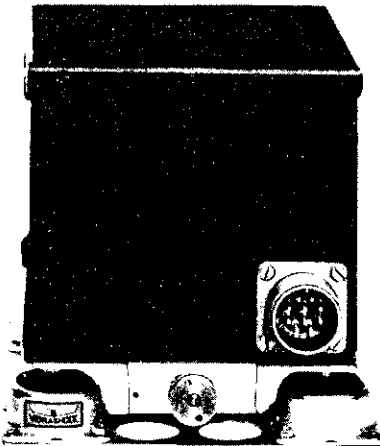


CONTROL
PANEL
C-423B/A



CONTROL PANEL
C-1513/A

AMPLIFIER
ASSEMBLY
AM-203/ARA-19



TUNING
DRIVE
ASSEMBLY
PD-5A/ARA-19



Figure 1-1. Remote Control Tuning Group

SECTION I

GENERAL DESCRIPTION

1-1. GENERAL.

1-2. This handbook is issued as one of four basic handbooks covering the Remote Control Tuning Group. The other three handbooks are: Handbook of Service Instructions (T. O. 12R1-2ARA19-12); Handbook of Overhaul Instructions (T. O. 12R1-2ARA19-13); and Illustrated Parts Breakdown (T. O. 12R1-2ARA19-14).

1-2A. Additional instructions for Control Panel C-1513/A are contained in T. O.'s 12R1-2ARA19-22, 12R1-2ARA19-23, and 12R1-2ARA19-24.

1-3. This handbook describes the function of the Remote Control Tuning Group, briefly explains the theory of operation, and includes all pertinent information and instructions to enable operating personnel to operate the equipment accurately and efficiently.

1-4. EQUIPMENT SUPPLIED.

Table I
Equipment Supplied

Quantity Per Installation		Name of Unit	Army/Navy Type Designation
Single	Dual		
1	2	Control Panel Amplifier Mounting Assy. Tuning Drive	C-423A/A, C-423B/A, or C-1513/A AM-203/ARA-19 MT-569/ARA-19 PD-5A/ARA-19
1	1		
1	1		
1	1		

1-5. Equipment furnished to Operating Activities will depend on the type of installation. The Remote Tuning Group may be installed with a single Control Panel or may be installed as a dual installation, where use by both the pilot and navigator is required. Either of three types of control panels, Government type designation C-423A/A, C-423B/A, or C-1513/A, may be used and are covered in this publication. Serial numbers of the control panels are as follows:

Control Panel Assembly C-423A/A
Serial Nos. 1 to 641.

Control Panel Assembly C-423B/A
Serial Nos. 641 and up.

Control Panel Assembly C-1513/A
Serial Nos. not used.

1-6. EQUIPMENT SUPPLIED IS LISTED IN TABLE I.

1-7. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-8. Table II lists the equipment required but not supplied for an installation.

1-9. PURPOSE OF EQUIPMENT.

1-10. This Remote Tuning Group has been designed for use with airborne Radio Compass AN/ARN-6. These units provide an accurate means of electrically repositioning the Radio Compass tuning mechanism without the use of mechanical linkage. All operating controls necessary for performing any system function are located on either type C-423A/A, C-423B/A, or C-1513/A Control Panels.

1-11. The Remote Tuning Group, Figure 1-1, is housed in three units: Control Panel(s) C-423A/A, C-423B/A, or C-1513/A; Amplifier AM-203/ARA-19 (with Mounting Assembly MT-569/ARA-19); and Tuning Drive PD-5A/ARA-19. These units are electrically interconnected by cables through a junction box and the Tuning Drive output is geared to the Radio Compass Unit.

1-12. DETAILED DESCRIPTION.

1-13. CONTROL PANEL C-423A/A. (See figure 1-2.)

1-14. The Control Panel is a rectangular shaped unit, designed for flush mounting in a channel, box or well depending upon the type of mounting provided on the

Table II
Equipment Required But Not Supplied

Quantity Per Installation		Name of Unit	Army/Navy Type Designation
Single	Dual		
1	1	Radio Compass (Includes Junction Box & Mount) Headphone Set	AN/ARN-6
1	2		



Figure 1-2. Control Panel C-423A/A

craft. The panel contains all operating controls and circuit elements to provide complete remote control of the Radio Compass and system functions. The controls provide a means of selecting operating frequency, voice or cw reception. The controls also provide a means of selecting mode of operation (compass, antenna, or loop), and of controlling audio gain, and lighting. A meter is also provided for visual tuning indication. Electrical connections to the junction box are made through a harness assembly.

1-17. CONTROL PANEL C-1513/A. (See figure 1-4.)

1-18. Control Panel C-1513/A is smaller and more compact than Control Panel C-423A/A or C-423B/A. However it performs the same operations as the other two Control Panels with the following exceptions. Control Panel C-1513/A has no tuning meter and no means of controlling light intensity on the frequency dials. All other controls perform the same function as described in paragraph 1-14.



Figure 1-3. Control Panel C-423B/A

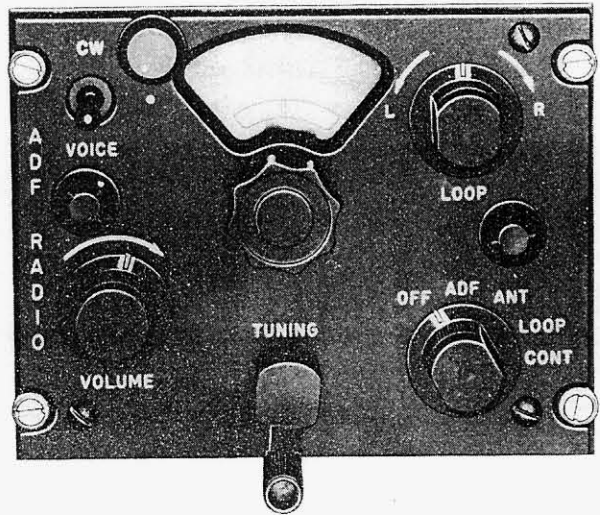


Figure 1-4. Control Panel C-1513/A

1-17. CONTROL PANEL C-1513/A. (See figure 1-4.)

1-18. Control Panel C-1513/A is smaller and more compact than Control Panel C-423A/A or C-423B/A. However it performs the same operations as the other two Control Panels with the following exceptions. Control Panel C-1513/A has no tuning meter and no means of controlling light intensity on the frequency dials. All other controls perform the same function as described in paragraph 1-14.

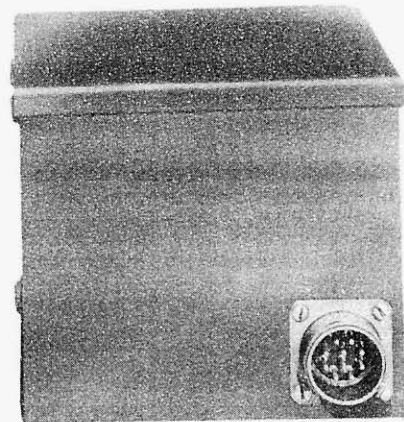


Figure 1-5. Amplifier Assembly

1-19. AMPLIFIER ASSEMBLY AM-203/ARA-19. (See figure 1-5.)

1-20. The Amplifier Assembly contains an oscillator, voltage amplifier and relays. The circuitry and components are all contained within the amplifier cabinet. The top cover and bottom panel of the cabinet are secured by binding head screws and are easily removed for servicing. This unit is mounted on a shock absorbing type base. All connections are made through a multiple type pin connector.

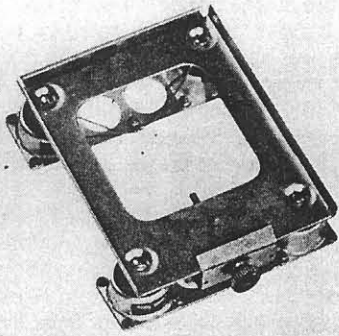


Figure 1-6. Mounting Assembly

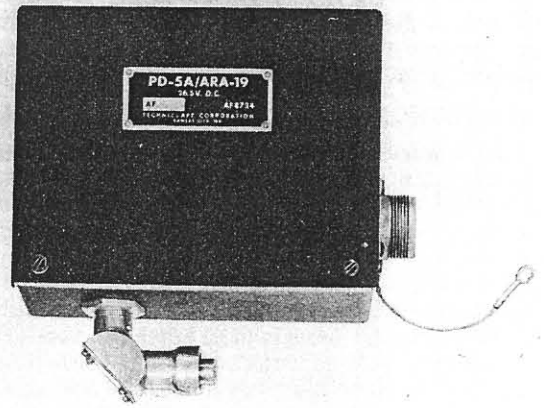


Figure 1-7. Tuning Drive Assembly

1-21. MOUNTING ASSEMBLY KIT-569/ARA-19.
(See figure 1-6.)

1-22. The mounting assembly provides a shock proof mount for the Amplifier. Shock mounting is provided by four vibration mounts riveted on two aluminum strips. An adjustable clamp holds the Amplifier Assembly securely to the mount.

1-23. TUNING DRIVE ASSEMBLY PD-5/ARA-19

1-24. This unit is designed to mount on the front of the AN/ARN-6 Radio Compass Receiver Unit. It contains the tuning motor and gear coupling assembly, a potentiometer, and motor input filter components. The gear train is coupled to the Receiver tuning shaft by a spline coupler. The front panel is removable for servicing the mechanism and electrical components.

1-25. THEORY OF OPERATION.

1-26. Basically, the Remote Tuning Group performs two functions; selects the type of system operation, and automatically positions the tuning shaft of the Radio Compass Receiver Unit to the selected frequency. The use of the operating controls are discussed in the Operating Section. For detailed theory of the control circuits and functioning of AN/ARN-6 Radio Compass, refer to Handbook of Maintenance Instructions Radio Compass AN/ARN-6, publication No. T. O. 12R5-2ARN6-2 formerly AN16-30ARN6-3.

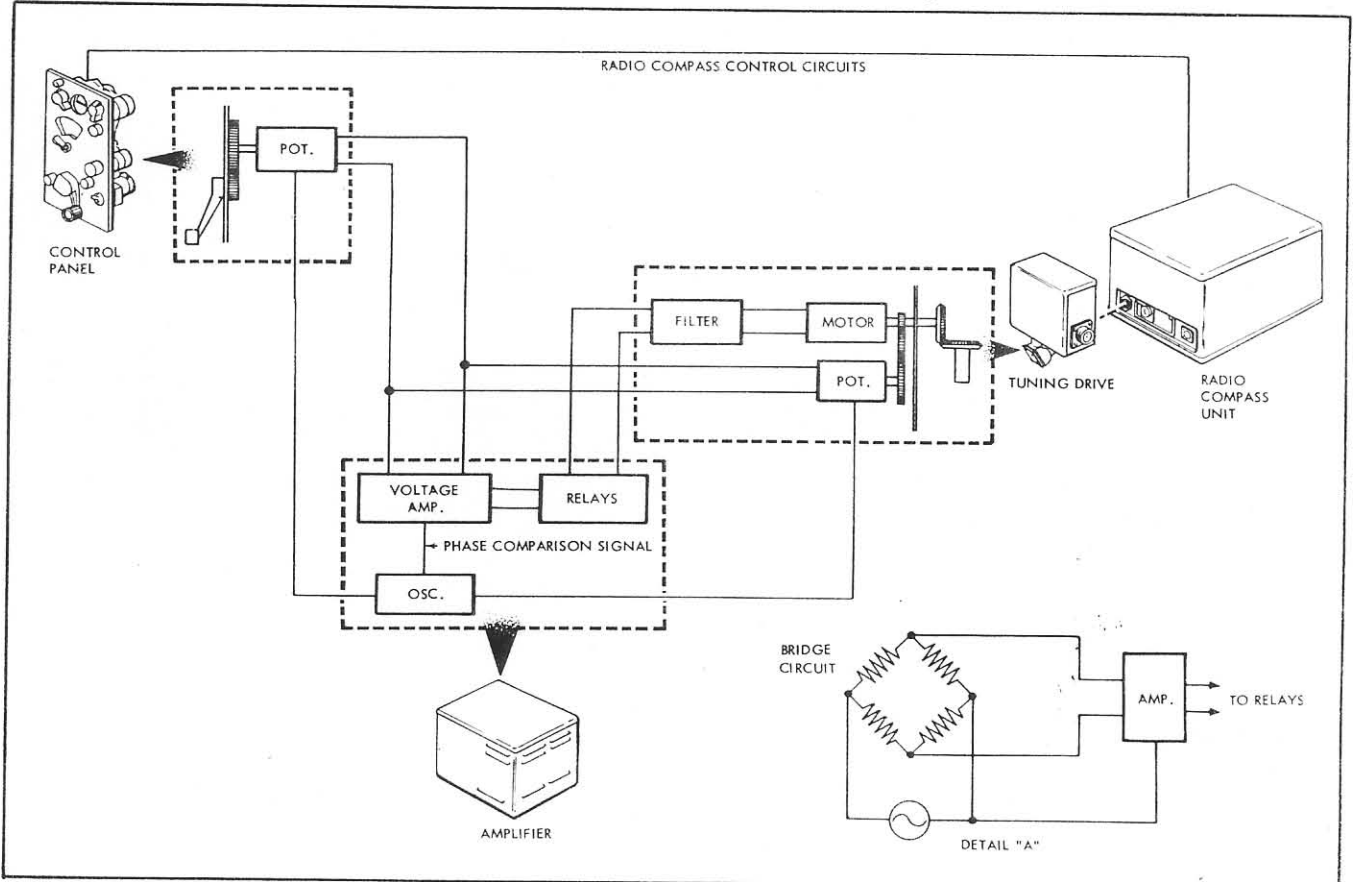


Figure 1-8. Simplified Remote Tuning Functional Diagram

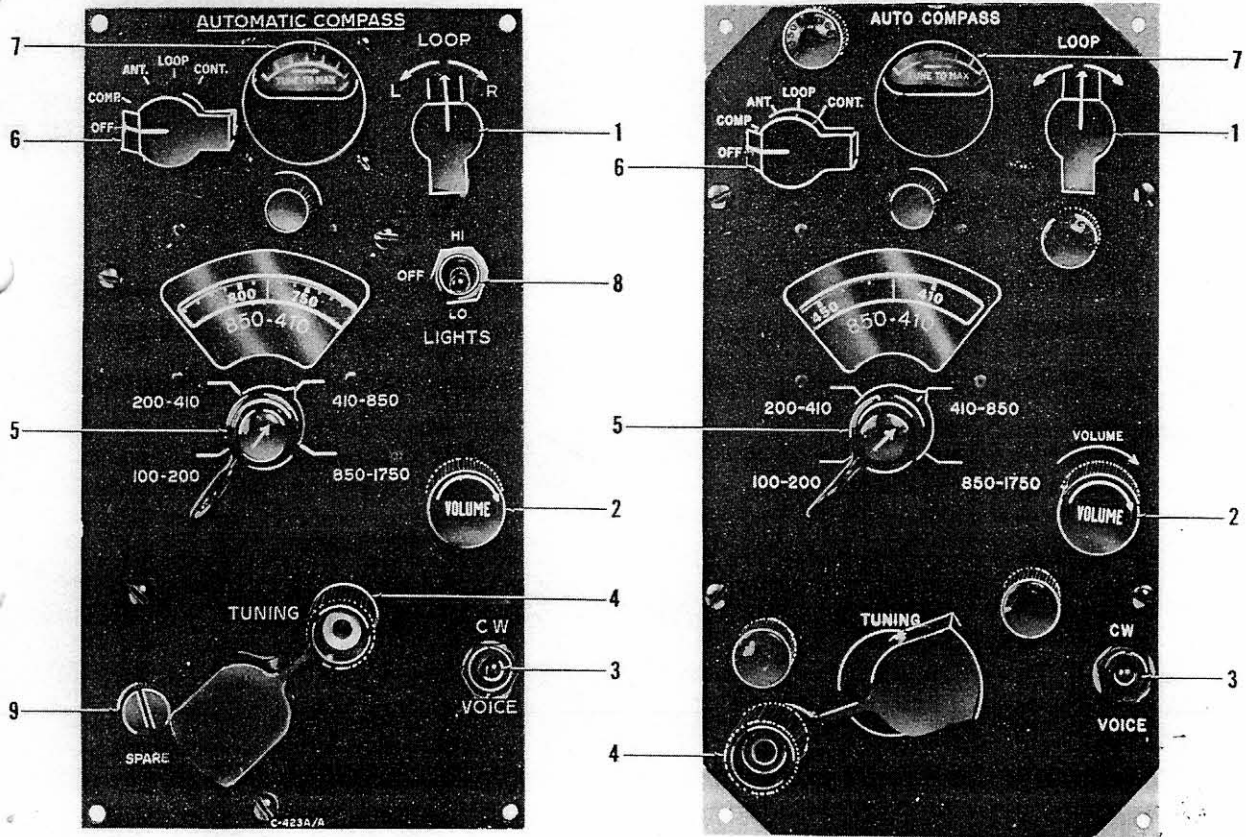
1-27. The theory in this handbook is limited to a simplified discussion of the remote tuning function of the Remote Tuning Group in order to familiarize the operator with its operation.

1. REMOTE CONTROL TUNING FUNCTION.

1-29. Figure 1-8 shows a simplified gearing and wiring schematic of the Remote Tuning Group for purposes of explaining its operation. The two potentiometers are electrically connected so as to form a bridge circuit (see detail A). The oscillator circuit supplies an output voltage of approximately 11 volts at 300 cycles. The output voltage of the oscillator is connected across two corners of the bridge. The other two corners of the bridge are connected to the input of the voltage amplifier. When the shafts of the potentiometers are electrically aligned (bridge circuit electrically balanced), no output voltage is impressed across the amplifier input.

1-30. When the selection of a certain frequency is desired, the bandswitch is rotated to the frequency band in which operation is desired. The TUNING control is then turned to the desired station frequency. Turning the TUNING crank rotates the shaft of the control potentiometer geared to the TUNING crank. This causes the bridge circuit to become unbalanced and a portion of the oscillator voltage reaches the input of the amplifier. The input voltage is amplified sufficiently to operate the relays and energizes the tuning motor. Through gearing, the motor causes the tuning drive potentiometer shaft to turn in such a direction as to balance the bridge. As soon as the bridge is balanced at the new position, the relays are de-energized and the motor stops. Direction of rotation of the motor is determined by phase relationship between the amplifier voltage and the phase comparison signal supplied by the oscillator.

SECTION II
OPERATING PROCEDURES



CONTROL PANEL C-423A/A

CONTROL PANEL C-423B/A

Figure 2-1. Operating Controls

2-1. OPERATING CONTROLS.

2-2. All operating controls are located on the Control Panels. Each type of Control Panel is illustrated in Fig-

ure 2-1 and 2-2. Each control used on the panels is indexed and listed. Corresponding controls on all panels are identified by corresponding reference numbers. Table III lists each control and describes its function.

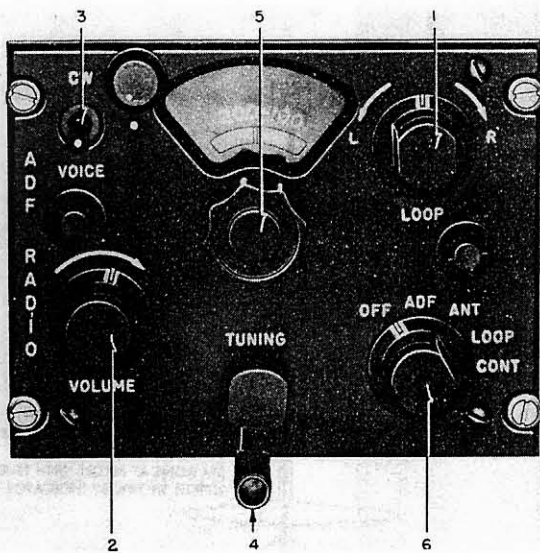


Figure 2-2. Operating Controls,
Control Panel C-1513/A

2-3. STARTING AND STOPPING THE EQUIPMENT.

- a. To start the equipment, turn the function switch to the COMP. or ADF, ANT., or LOOP position.
- b. In dual installations, turn the function switch to the CONT. position and hold momentarily to obtain control. Repeat step a. above to start equipment.
- c. To stop equipment, turn the function switch back to OFF.

2-4. OPERATION.

2-5. The equipment will perform the following three major functions.

- a. Homing compass operation.
- b. Position finding using automatic and aural-null methods.
- c. Receiver operation using ANT. or LOOP.

2-6. HOMING COMPASS OPERATION. To use as a homing compass, perform the following procedural steps:

- a. Turn function switch to COMP. or ADF.
- b. Rotate bandswitch to the frequency band in which operation is desired.
- c. Turn the TUNING crank to the desired station frequency and tune for maximum swing of the tuning meter. Control Panel C-1513/A has no tuning meter. Greater accuracy in tuning may be obtained by placing the CW-VOICE switch in CW position. A 900-cycle tone will be heard along with the station modulation. This will aid in accurate tuning. After tuning, return the CW-VOICE switch to voice to eliminate the 900-cycle tone.
- d. Adjust VOLUME control for desired headset level.
- e. Listen for station identification to be sure that the correct station is being received.
- f. Turn the VAR knob on the Radio Compass Indicator until the azimuth zero is at the index.

g. The indicator pointer will now show the bearing of the station relative to aircraft heading. For example, if the pointer is to the left of zero, the station is on your left. Turn your aircraft to the left until the pointer is at zero. If the aircraft heading is held at zero degrees on the Radio Compass Indicator, you will ultimately fly over the radio station antenna. Cross winds, however, will cause the flight path to be a curved line. Direction of wind drift may be determined by noting any change in magnetic bearing while homing with the radio compass. An increasing magnetic bearing indicates a wind from the right while a decreasing magnetic bearing indicates a wind from the left. Compensate for wind drift, by offsetting the aircraft heading until there is a minimum rate of change of the magnet compass reading. The Radio Compass Indicator now shows directly in degrees the relative aircraft-to-station-heading necessary to correct for wind drift.

Table III
Operating Controls

Index No.	Control Name	Control Function
1.	LOOP left-right switch	Controls direction and speed of loop rotation by direction and amount of LOOP left-right switch rotation respectively.
2.	VOLUME control	Variable control for increasing or decreasing the audio gain.
3.	CW-VOICE Switch	Selector switch for cw or voice operation.
4.	TUNING control	Manual crank for tuning desired station frequency within the frequency band.
5.	Bandswitch	Four position selector switch for obtaining the correct frequency band in which the station is operating.
6.	Function switch	Selector switch for obtaining desired type system operation.
	OFF	De-energizes the equipment.
	COMP. or ADF	Position for homing compass operation and automatic position finding.
	ANT.	Used for normal receiver operation. (Antenna reception)
	LOOP	Used for aural-null position finding and receiver reception. (Loop reception)
	CONT.	Used in dual installations. Turn to CONT. and hold momentarily to gain control.
	Tuning meter	Used as a visual tuning indicator.
*8.	LIGHTS switch	Three position toggle switch for panel light control.
	OFF	De-energizes panel light circuit.
	HI	Provides maximum light intensity.
	LO	Provides minimum light intensity.
*9.	SPARE	Spare lamp for panel light replacement.

* Indicates Control Panel C-423A/A only.

2-7. **POSITION FINDING.** There are two methods of position finding, automatic and aural-null. Prior to the use of either method, the following steps should be taken in order to shorten the time required for a complete set of readings.

a. Select three stations whose geographical locations are spaced at approximately equal intervals about the aircraft.

b. Tune in the stations, identify them and log their dial readings.

2-8 **AUTOMATIC METHOD.** For operation as an automatic indicating position finder, perform the following operations.

a. Adjust VAR knob on the Radio Compass Indicator until its bearing scale at the index is the same as the true magnetic heading of the aircraft.

b. Set the function switch to COMP. or ADF.

c. Tune in one of the selected stations, and record the bearing as indicated by the tail of the indicator pointer.

d. Repeat (c.) for the other stations, in rapid succession, while flying with a steady level heading.

NOTE

Because of the aircraft's motion, the less time taken for observations, the greater the accuracy of the fix.

e. The recorded bearings will be the station to aircraft bearings from north. Project lines from the stations at the recorded bearings. The aircraft position will be within the vicinity of the small triangle formed by the intersection of the projected lines.

2-9. **AURAL-NULL METHOD.** For operation as an aural-null position finder, use the following procedure.

a. Adjust the VAR knob on the Radio Compass Indicator until its bearing scale at the index is the same as the true magnetic heading of the aircraft.

b. Set the function switch to LOOP position.

c. Tune in the desired station. To obtain good signal strength for station identification it may be necessary to rotate the loop by means of the LOOP left-right switch for maximum signal.

d. Rotate loop for minimum headset volume. Record the bearing shown by the Radio Compass Indicator pointer. Better definition of the null may be obtained by turning the VOLUME control fully clockwise and locating the null by either listening for minimum audio signal or noting a counterclockwise dip of the tuning meter pointer. Use of CW operation also improves the definition of the null. To obtain CW operation throw the CW-VOICE switch to CW position.

e. Position finding in LOOP operation is subject to a 180-degree error since there are two null points in a 360-degree rotation of the loop. This ambiguity is overcome by keeping aware of your general geographical location and selecting stations located well to the right and left of your course. Figure 2-3 demonstrates a flight on a north course with station A supposedly ahead. If the indicator shows a bearing of 180

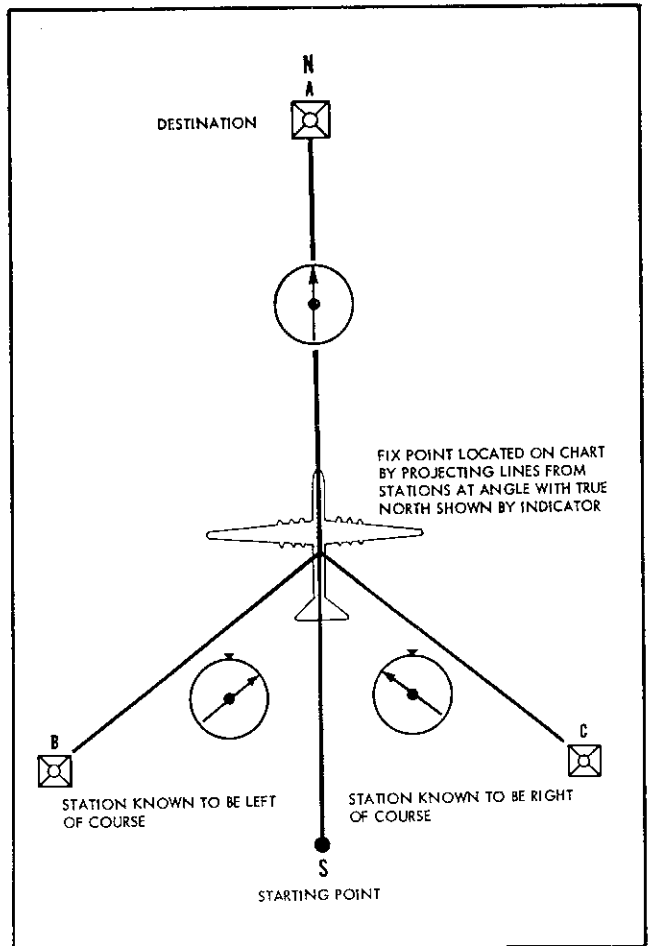


Figure 2-3. Position Fix

degrees when station A is used, you apparently have passed station A and are flying away from it. This indication also could be the result of using the wrong null. However, you know station B is to your left and station C is to your right, so by taking null point bearings on stations B and C and projecting lines through the stations at angles indicated by their bearings relative to north until they cross, you determine your approximate position. You then know if you really have passed station A or if you used the wrong null.

2-10. **RECEIVER OPERATION.**

2-11. **ANTENNA RECEPTION.**

a. Turn function switch to ANT.

b. Turn band switch to desired frequency band.

c. Throw CW-VOICE switch to CW for aural reception of unmodulated signals.

d. Use the TUNING crank and tune in the desired station.

e. Adjust volume control for optimum headset volume.

NOTE

For best definition of radio range stations, adjust the VOLUME control for the lowest usable headset volume and continue to reduce volume as the A-N signals increase in strength.

2-12. LOOP RECEPTION. If reception on ANT. is noisy due to precipitation static, commonly known as rain or snow static, better results may be obtained by operating in LOOP position as follows:

- a. Turn function switch to LOOP.
- b. Turn band switch to desired frequency band.
- c. If station is unmodulated, place CW-VOICE switch in CW position.
- d. Tune in desired station.
- e. Rotate loop with LOOP left-right switch until maximum signal is obtained. If flight course is not straight, readjustments may be necessary.
- f. Adjust VOLUME control for desired headset volume.
- g. For best definition of radio range A-N signals on LOOP, it is necessary to maintain the loop near the 90 or 270-degree position and adjust the VOLUME control for lowest usable headset volume.

Note

Cone of silence indications are not always reliable while receiving on LOOP. In some cases, an increase instead of a decrease in signal may be noted. This is the result of certain types of radio range transmitting antennas and the loop location on the aircraft.

2-13. SUMMARY OF PRECAUTIONS DURING OPERATION.

a. Select radio stations that provide stable bearings. Do not use a station for bearing unless it can be identified by headset signal on COMP. or ADF operation. High-powered clear channel stations should be used when possible. Any interference from other stations will cause an error in bearing. Tune equipment accurately. Station identification must be checked, especially stations broadcasting network programs. Avoid taking bearings on synchronized stations except when close to desired station. If station stops transmitting or fades, bearings may change to other stations of the same frequency thus causing errors. This is especially true of code stations operating in a network.

b. Night effect or reflection of radio waves from the sky may be recognized by fluctuations in bearings.

Night effect is worse at sunrise and sunset. The higher the frequency of operation the greater the night effect. It may be present at distances over 20 miles when receiving 850 to 1750-kilocycle stations, however with 100 to 450-kilocycle stations reliable bearings above 200 miles can be taken even when night effect is present. The remedies for night effect are:

1. Increase altitude, thereby increasing signal strength of direct waves.
2. Use stations operating on lower frequency.
3. Take an average of the fluctuations.

c. Mountain effect is considered to be the reflection of radio waves from mountain surfaces. It is known to exist around Salt Lake City and Pittsburgh. Do not rely fully on bearings taken in such areas.

d. For aural reception of A-N signals, operate equipment on ANT. or LOOP instead of COMP. or ADF since the action of AVC (automatic volume control) in COMP. or ADF position will cause broad course indications. Always operate the equipment with VOLUME control set at lowest usable headset volume and reduce it as the A-N signal strength increases. Cone of silence indications are not always reliable when operating the equipment on LOOP. Use equipment on ANT. for cone of silence indication.

e. This equipment should provide compass bearings during conditions of moderate precipitation static which interrupt normal reception. When static becomes too severe it will be necessary to operate on LOOP position. In this position, satisfactory aural reception and aural-null direction finding will be possible most of the time.

f. Do not depend on two stations for a fix of location; use at least three stations with bearings spaced at approximately equal intervals throughout 360 degrees for greatest accuracy.

g. While taking bearings, always keep aircraft on a steady level heading.

h. When homing or direction finding on LOOP operation, there is a 180-degree ambiguity and station bearing may be 180 degrees from the null obtained. Use stations with good signal strength for sharply defined nulls. Width of null may be controlled by position of VOLUME control. The tuning meter may be used as a visual-null indicator.

SECTION III

OPERATING CHECKS AND ADJUSTMENTS

3-1. PRE-FLIGHT CHECKS.

Pre-flight checks should be made prior to take-off to insure that the equipment is operating satisfactorily for dependable inflight operation.

3-3. VISUAL CHECK.

- a. Check to see that all equipment is mounted securely in place.
- b. Check all cable connections for tightness.
- c. Check the nuts that secure the coupling between the Tuning Drive Unit (PD-5A/ARA-19) and Radio Compass Unit.

3-4. OPERATIONAL CHECK

- a. Turn the function switch to COMP. or ADF.
- b. Using the bandswitch and the TUNING control, select a frequency on which a station is known to be transmitting. (Choose a station within receiver range.)
- c. Observe the indicator meter while using the TUNING control to tune in the signal. Control Panel C-1513/A has no tuning meter. If the meter peaks (indicator moves toward max) on the signal the tuning mechanism is working properly.

d. Check VOLUME control by varying the setting of the control while listening to the receiver output.

e. Turn Function switch to LOOP. Operate LOOP left-right switch and observe action of Radio Compass Indicator pointer. Speed and direction should be in accordance with direction and amount of LOOP left-right rotation.

f. Check CW and voice operation by listening to a signal and operating the CW-VOICE from one position to the other. Normal operation will be indicated by a beat note when the switch is in CW position.

g. On Control Panel C-423A/A check operation of light circuit by flicking LIGHTS switch to LO and HI position. Light should go on and increase in intensity in HI position.

h. Check Control Panel C-423A/A SPARE lamp by removing spare lamp cover with screwdriver and inserting bulb in light receptacle and flicking LIGHTS switch to HI or LO position.

i. On Control Panels C-423B/A and C-1513/A, visually check to see that lights function properly when the function switch is thrown to the COMP. or ADF, ANT., or LOOP position.

j. Repeat steps a. through i. using other control panel if a dual installation is being used.

SECTION IV

EMERGENCY OPERATION

4-1. There are no provisions for emergency operation due to equipment failure.

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(USAF) T.O. 12R1-2ARA19-22
(NAVY) NAVWEPS 16-30ARA19-22

TECHNICAL MANUAL

SERVICE

REMOTE TUNING GROUP

AN/ARA-19

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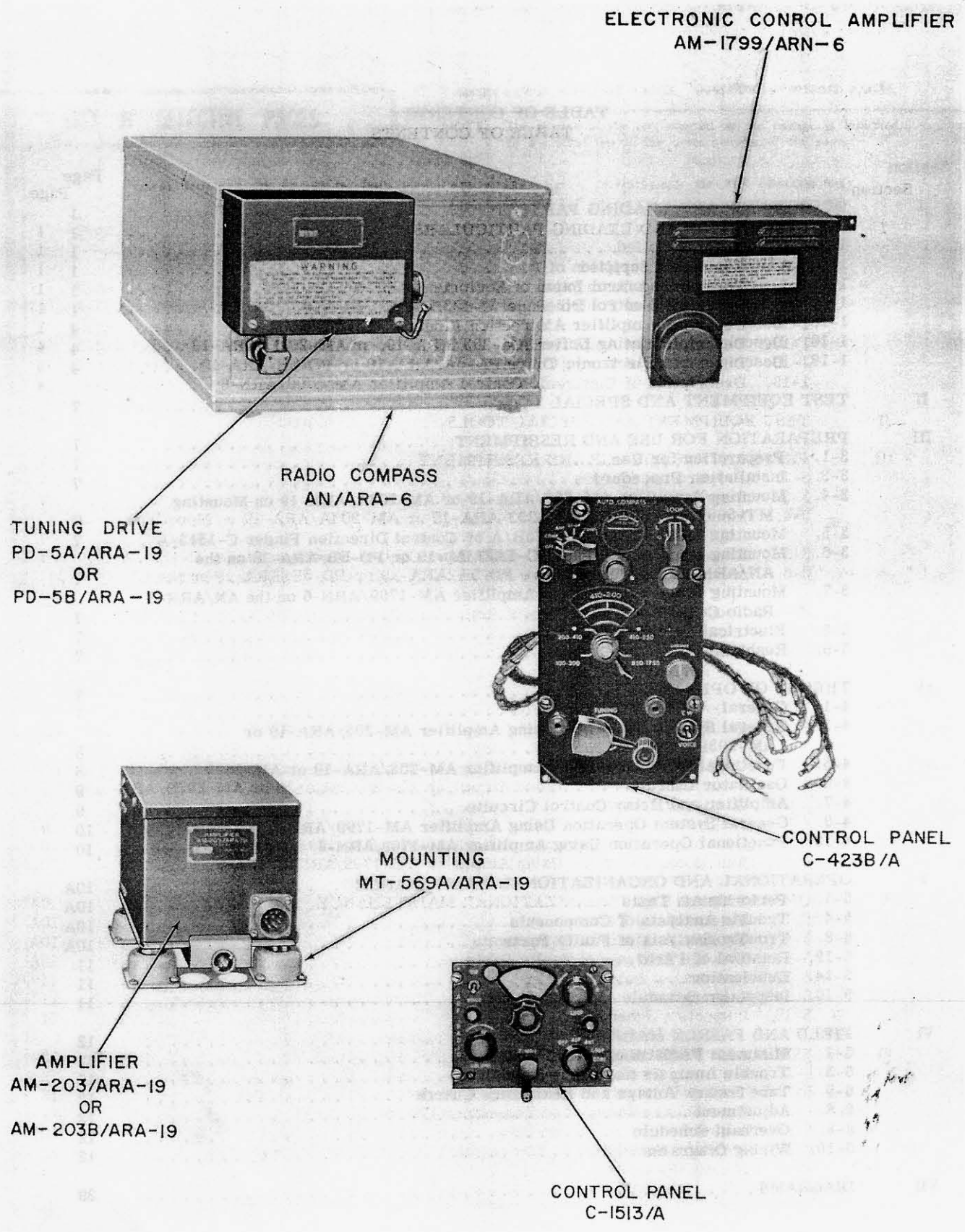


Figure 1-1. Remote Tuning Group AN/ARA-19

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. The purpose of this manual is to provide service instructions for the Remote Tuning Group AN/ARA-19 electronic equipment (figure 1-1) manufactured by North American Philips Co., Inc., Mount Vernon, New York; Central Commercial Industries, Inc., Lowrey Organ Division, Chicago, Illinois; the Magnavox Co., Fort Wayne, Indiana; Howel-Ronset Instrument Co., Inc., Tuckahoe, New York, and Cosmos Industries, Inc., Long Island City, New York. The equipment as manufactured by Central Commercial Industries was produced under three separate contracts. Under contract AF33(600)-27279 the nomenclature for Tuning Drive PD-5A/ARA-19 was changed to PD-5B/ARA-19 and Amplifier AM-203/ARA-19 was changed to AM-203B/ARA-19. Instructions are contained herein for Control Direction Finder C-1513/A prime contracted by the Magnavox Company, Fort Wayne, Indiana. Control Direction Finder C-1513/A may be used in place of Control Panel C-423B/A in Remote Tuning Group AN/ARA-19. Electronic Control Amplifier AM-1799/ARN-6 is used in place of both Tuning Drive PD-5A/ARA-19 or PD-5B/ARA-19 and Amplifier AM-203/ARA-19 or AM-203B/ARA-19. Detail part variations are listed in T.O. 12R1-2ARA19-24/NAVWEPS 16-30ARA19-24.

1-3. EQUIPMENT SUPPLIED.

1-4. Table I lists the equipment supplied by the contractors.

1-5. PURPOSE AND DESCRIPTION OF EQUIPMENT.

1-6. PURPOSE OF EQUIPMENT. Remote Tuning Group AN/ARA-19 has been designed for use with Radio Compass AN/ARN-6. An accurate means of elec-

trically repositioning the AN/ARN-6 Radio Compass tuning mechanism without the use of mechanical linkages is provided by the AN/ARA-19 equipment.

1-7. DESCRIPTION OF CONTROL PANEL C-423B/A.

1-8. The controls on this panel (figure 1-2) provide for remote control of Radio Compass AN/ARN-6. These controls provide a means for orienting the loop antenna (S103) for selecting frequency (S101) and tuning (R101), for selecting voice or CW reception (S104), for controlling audio gain (R103) and for controlling the function of the system. A meter which is used for visual tuning purposes is provided on the front panel. The tuning range is divided into four bands, ranging from 100 kc to 1750 kc.

1-9. The front panel is provided with lamps (I102, I103, I104, I105) enclosed in red filters so that all panel markings are shown red. A separate single lamp (I101) is provided for illumination of the band selector switch and meter dials. The unit is furnished without a cabinet.

1-10. DESCRIPTION OF CONTROL DIRECTION FINDER C-1513/A.

1-11. The controls on this panel (figure 1-3) provide for remote control of Radio Compass AN/ARN-6. These controls provide a means for orienting the loop antenna (S3), selecting frequency (S1), tuning (R6), selecting voice or CW reception (S4), controlling audio gain (R3), and controlling the function of the system. The tuning range is divided into four bands, ranging from 100 kc to 1750 kc.

TABLE I. EQUIPMENT SUPPLIED

Qty per Equip.	Name of Unit	Government Designation	Approximate Overall Dimensions	Weight
1	Control Panel Direction Finder Amplifier and Tuning Drive	C-423B/A or C-1513/A	5" x 9" x 4-7/8" 5-3/4" x 4-1/2" x 5-1/10"	3-1/2 lb 2-7/16 lb
1	Electronic Control Amplifier	AM-1799/ARN-6	6-3/4" x 10" x 4-3/4"	
1	or Amplifier	AM-203/ARA19 or AM-203B/ARA-19	5-1/4" x 4-5/8" x 7-3/8"	5-1/2 lb
1	Mounting	MT-569A/ARA-19	6" x 2" x 8-1/4"	1 lb
1	Tuning Drive	PD-5A/ARA-19 or PD-5B/ARA-19	6" x 5-7/8" x 2-1/4"	2-1/8 lb

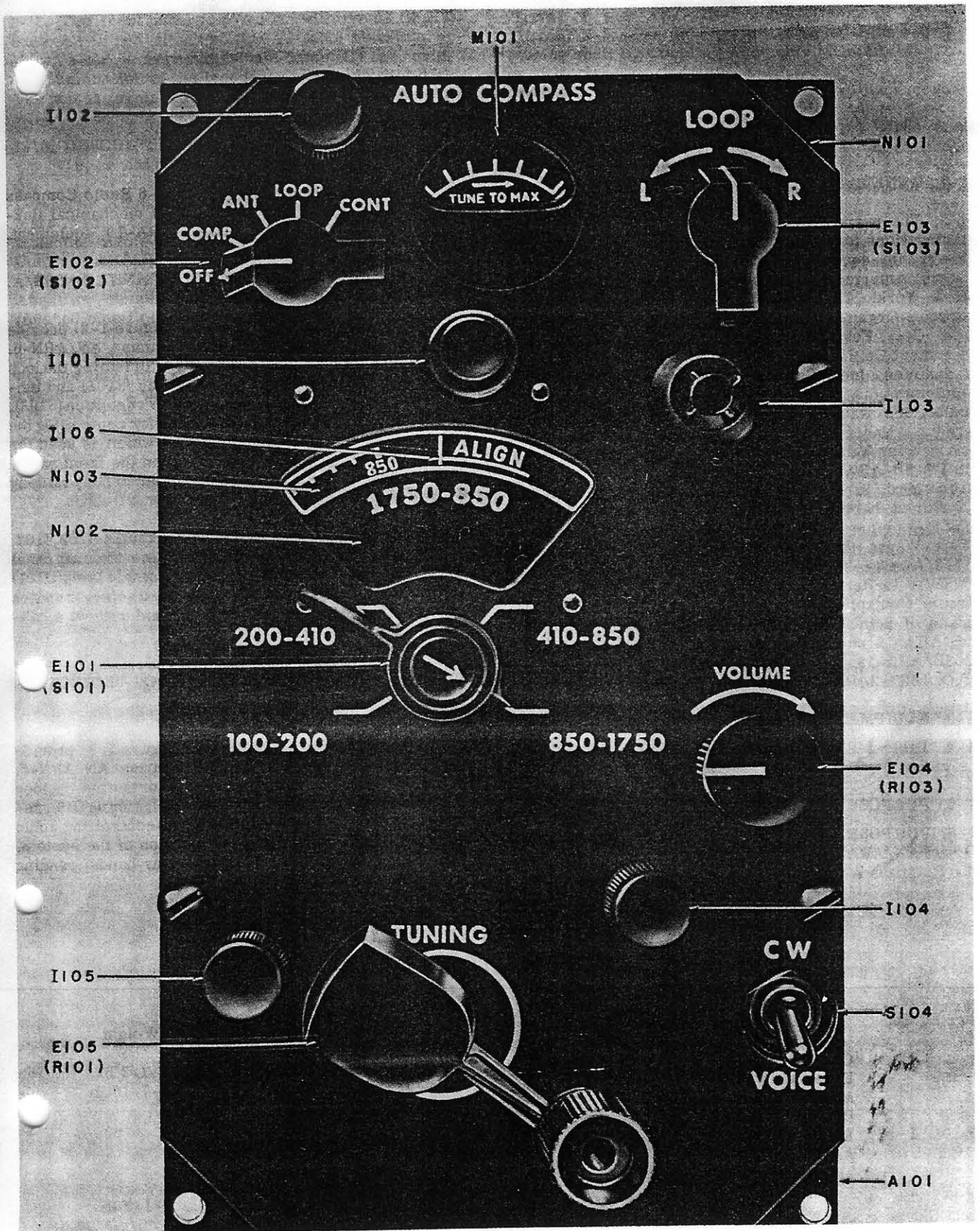


Figure 1-2. Control Panel C-423B/A

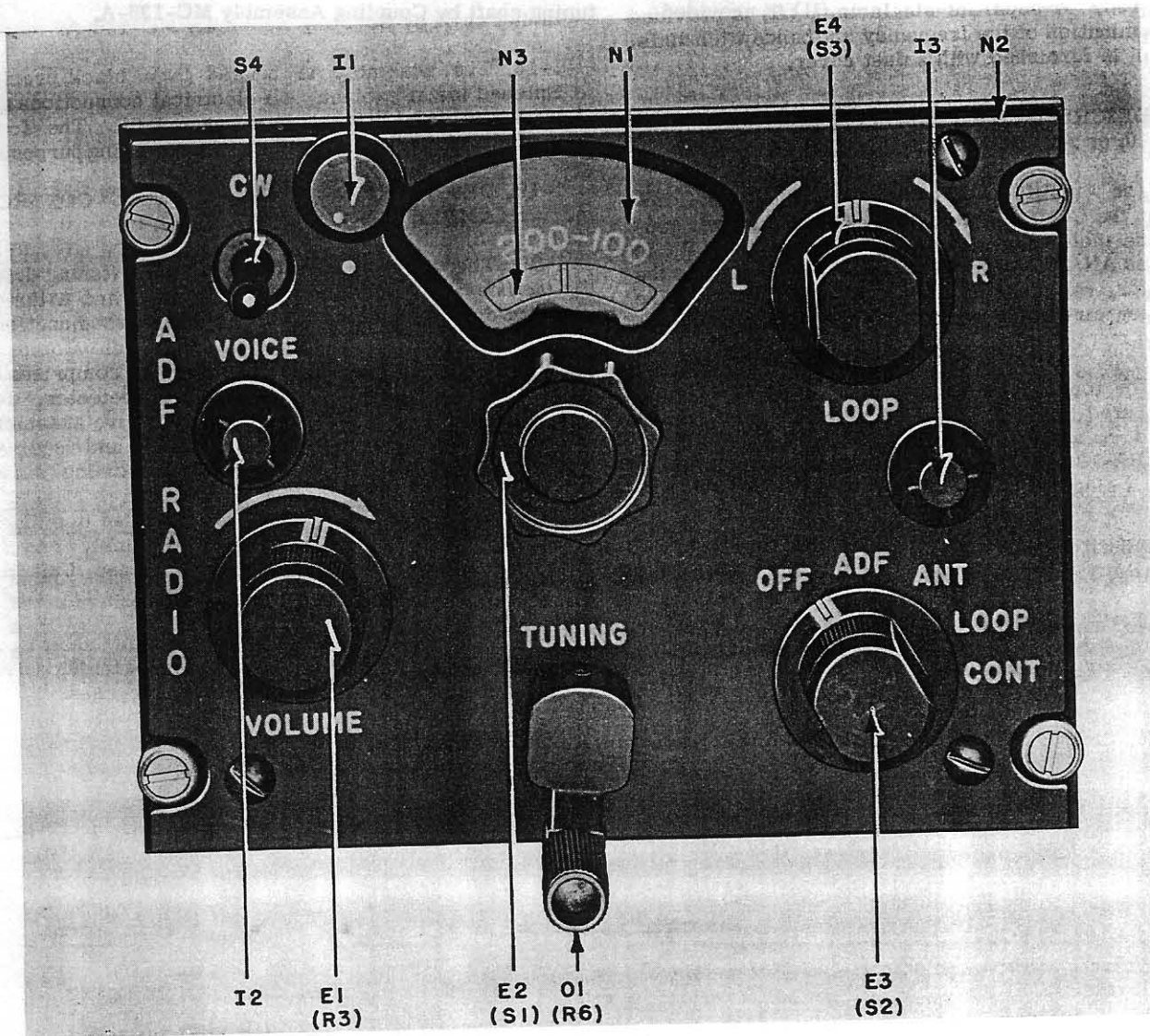


Figure 1-3. Control Direction Finder C-1513/A

1-12. The front panel is provided with lamps (I2, I3), enclosed in red filters so that all panel markings are shown red. A separate single lamp (I1) is provided for illumination of the frequency and bandswitch dials. The unit is furnished with a dust cover.

1-13. DESCRIPTION OF AMPLIFIER AM-203/ARA-19, or AM-203B/ARA-19.

1-14. The Amplifier, in conjunction with potentiometers in the Control Panel and the Tuning Drive, controls the motor in the Tuning Drive that tunes Radio Compass AN/ARN-6. The Amplifier unit contains the oscillator, voltage amplifier and relay circuits. The Amplifier circuits are contained in a black crackle finished metal chassis assembly.

1-15. The top cover and bottom plate of the chassis are secured in position with screws. The unit is mounted on a shock absorbing base, Mounting MT-569A/ARA-19. All electrical connections are made through a single connector (J101).

1-16. DESCRIPTION OF TUNING DRIVE PD-5A/ARA-19 or PD-5B/ARA-19.

1-17. The Tuning Drive Unit contains a tuning motor and gear assembly, a potentiometer, and a motor input filter. The assembly is designed to mount on the

front of the AN/ARN-6 Radio Compass Unit R-101/ARN-6. The gear train is coupled to the receiver tuning shaft by Coupling Assembly MC-136-A.

1-18. The assembly is housed in a black crackle finished metal cabinet. All electrical connections are made through a single connector J101. The front panel of the unit is removable for servicing purposes.

1-19. DESCRIPTION OF ELECTRONIC CONTROL AMPLIFIER AM-1799/ARN-6.

1-20. The electronic control amplifier (tuning drive amplifier) contains both an amplifier and a tuning motor drive assembly. This component in conjunction with Control Panel C-1513/A tunes Radio Compass AN/ARA-6. The amplifier assembly comprises a two-stage amplifier, phase-sensitive detector, d-c amplifier, and rectifier. The motor drive assembly consists of a d-c motor, potentiometer, and required gearing to drive the radio compass tuning shaft.

1-21. The tuning drive amplifier is housed in a black crackle finished metal chassis assembly and is mounted on the front of Radio Compass Unit R-101/ARN-6. All electrical connections are made through a single connector (J101). The motor drive assembly is coupled to the receiver tuning shaft by a flexible shaft assembly. The cover of the tuning drive amplifier is removable for servicing purposes.

SECTION II

TEST EQUIPMENT AND SPECIAL TOOLS

2-1. No special test equipment or tools are required.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. PREPARATION FOR USE.

3-2. UNPACKING. The AN/ARA-19 Remote Tuning Group is shipped in four separate cartons, one for each of the units. Remove all packing material and lift the units out carefully, inspecting each unit for loose screws, nuts, or bolts. Before attempting to install the equipment, check all controls such as switches, dials, etc. to see that they are working properly.

3-3. INSTALLATION PROCEDURE.

3-4. MOUNTING AMPLIFIER AM-203/ARA-19 or AM-203B/ARA-19 ON MOUNTING MT-569A/ARA-19.

- a. Mounting MT-569A/ARA-19 should be mounted horizontal and upright, whenever possible.
- b. Fasten the mounting permanently in position.
- c. Place Amplifier AM-203/ARA-19 or AM-203B/ARA-19 unit on the mounting and secure by tightening the knurled knob.

3-5. MOUNTING CONTROL PANEL C-423B/A or CONTROL DIRECTION FINDER C-1513/A. The control panel should be mounted in the desired control position, secured by appropriate means, and the necessary electrical connections made. No mechanical linkage between units of the system is involved.

3-6. MOUNTING THE TUNING DRIVE PD-5A/ARA-19 or PD-5B/ARA-19 ON THE AN/ARN-6 RADIO COMPASS. To avoid damaging the equipment do not attempt to mount this Tuning Drive on Receiver before doing the following:

- a. Set splined tuning shaft (R101) on front of radio compass ARN-6 to maximum counterclockwise rotation.
- b. Set dial on Control Panel C-423B/A or Control Direction Finder C-1513/A to ALIGN.
- c. Turn on the entire equipment.
- d. While still energized, mount the Tuning Drive on the Receiver unit.

3-7. MOUNTING ELECTRONIC CONTROL AMPLIFIER AM-1799/ARN-6 ON THE AN/ARN-6 RADIO COMPASS. Observe the same precautions and procedures outlined in paragraph 3-6 when mounting the tuning drive amplifier. The cover of the tuning drive amplifier must be removed in order to secure the component to the radio compass unit.

3-8. ELECTRICAL CONNECTIONS. Figure 3-1 illustrates the wiring diagram for a dual installation of the AN/ARA-19 Remote Tuning Group and the AN/ARN-6 Radio Compass, and figure 3-2 illustrates a single installation. The wiring for installation of the remote tuning group, using Electronic Control Amplifier AM-1799/ARN-6, is illustrated in figure 7-10. Interconnecting cables should comprise wire size AWG No. 20 (minimum).

3-9. RESHIPMENT.

3-10. Components should be packaged in accordance with Specification JAN-P-658(3). Pack with sufficient filler material to ensure that the component remains rigid during shipment. For overseas shipment or storage, include a desiccant material to absorb moisture.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. The operation of the remote tuning compass system produces an output shaft position that is mechanically coupled to the tuning shaft of the radio compass. A bridge circuit is formed by two micro-potentiometers. One potentiometer is operated by the

tuning control on the control panel while the other potentiometer is geared to the tuning drive motor in the tuning drive assembly or the tuning drive amplifier. The difference in the position of the arms of the potentiometers is detected by the amplifier and an output is developed and applied to the tuning drive motor such that the difference is nulled. This in

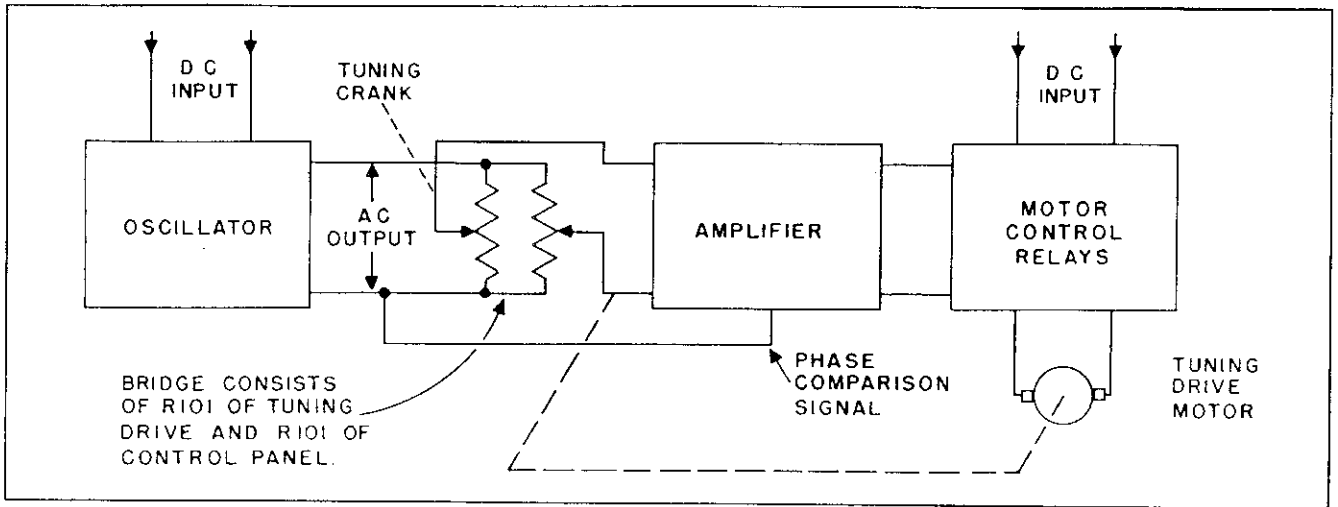


Figure 4-1. Block Diagram of Remote Tuning Group AN/ARA-19

turn will position the tuning shaft of the radio compass to the position of the tuning control on the control panel. The remote tuning drive assembly (motor and potentiometer) which is part of PD-5A/ARA-19 or PD-5B/ARA-19 is used with Amplifier AM-203A/ARA-19 or AM-203B/ARA-19. The operation of each system is described in this section.

4-3. GENERAL SYSTEM OPERATION USING AMPLIFIER AM-203/ARA-19 OR AM-203B/ARA-19. (See figure 4-1.)

4-4. Two micropotentiometers are employed to form a bridge circuit. One potentiometer is operated by the tuning crank on the control panel while the other potentiometer is geared to the tuning drive motor. A self-excited oscillator circuit having an output of approximately 11 volts at 300 cycles is connected

across two corners of the bridge. The wiper arms of the potentiometers are connected to the input of an amplifier. When the bridge is electrically balanced, no voltage is impressed across the input of the amplifier. When the operator turns the tuning control handle, the bridge becomes unbalanced allowing a portion of the oscillator voltage to reach the amplifier input where it is amplified in order to operate the relays. Current of one milliamper is sufficient to operate the relays and energize the tuning motor causing it to turn its potentiometer to such a value as to re-balance the bridge. As soon as the bridge is re-balanced, the relays will be de-energized. (The relays will be released at a current of 0.6 milliamperes.)

4-5. FUNCTIONAL OPERATION USING AMPLIFIER AM-203/ARA-19 OR AM-203B/ARA-19.

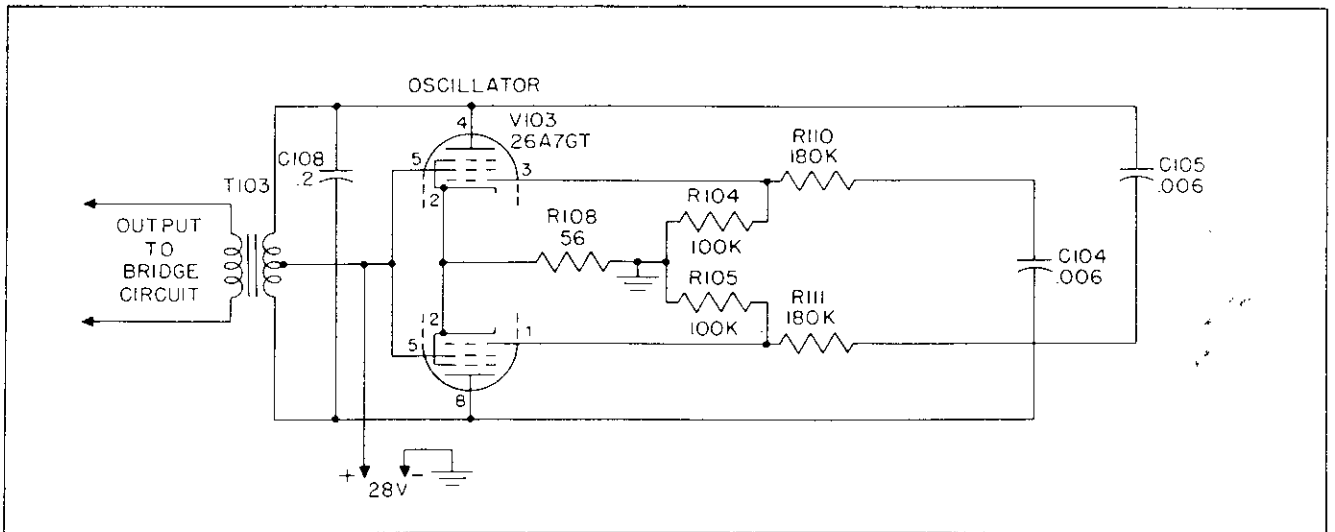


Figure 4-2. Oscillator Circuit

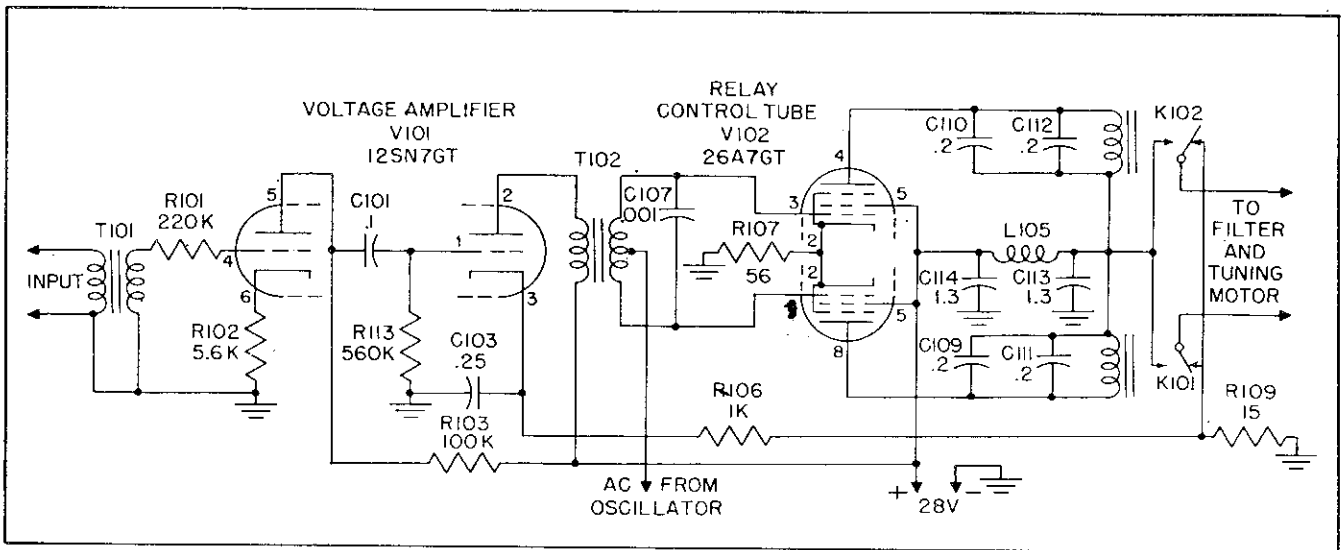


Figure 4-3. Amplifier and Relay Circuits

4-6. OSCILLATOR CIRCUIT. The oscillator circuit (figure 4-2) employs a twin tetrode tube V103, a type 26A7GT, in an audio frequency oscillator circuit. The 26A7GT can be connected directly to the 28 volt d-c power source. The circuit oscillates at a frequency of approximately 300 cycles. The output is inductively coupled to the bridge circuit mentioned in paragraph 4-3 by transformer T103.

4-7. AMPLIFIER AND RELAY CONTROL CIRCUITS. A twin triode tube V101, type 12SN7GT, is employed as a two stage voltage amplifier, each section of the tube operating independently. A twin beam tetrode tube V102, type 26A7GT, is used in a balanced relay control circuit. The bridge circuit is coupled to the voltage amplifier by transformer T101. Bias is supplied by resistors R102, R106 and R109 in the

cathode circuits. The plate circuit of the first voltage amplifier is coupled to the grid circuit of the second stage by capacitor C101. Transformer T102 couples the plate circuit to the relay control tube grid circuit. The plate circuit of V102 is formed by relays K101 and K102. The network consisting of L105, C113 and C114 is used as a noise filter. The voltage drop across R109 is used as bias on the voltage amplifier, so when the motor starts to turn, V101 is biased to cut-off, de-energizing the relays. This action is delayed by R106 and C103 and results in a stepping action which prevents hunting and allows the motor to advance in small increments at a speed determined by the speed of rotation of the tuning crank. When a very strong signal is present, such as would be caused by rapid turning of the tuning crank, the bias on V101 is over-ridden and steady operation of the motor

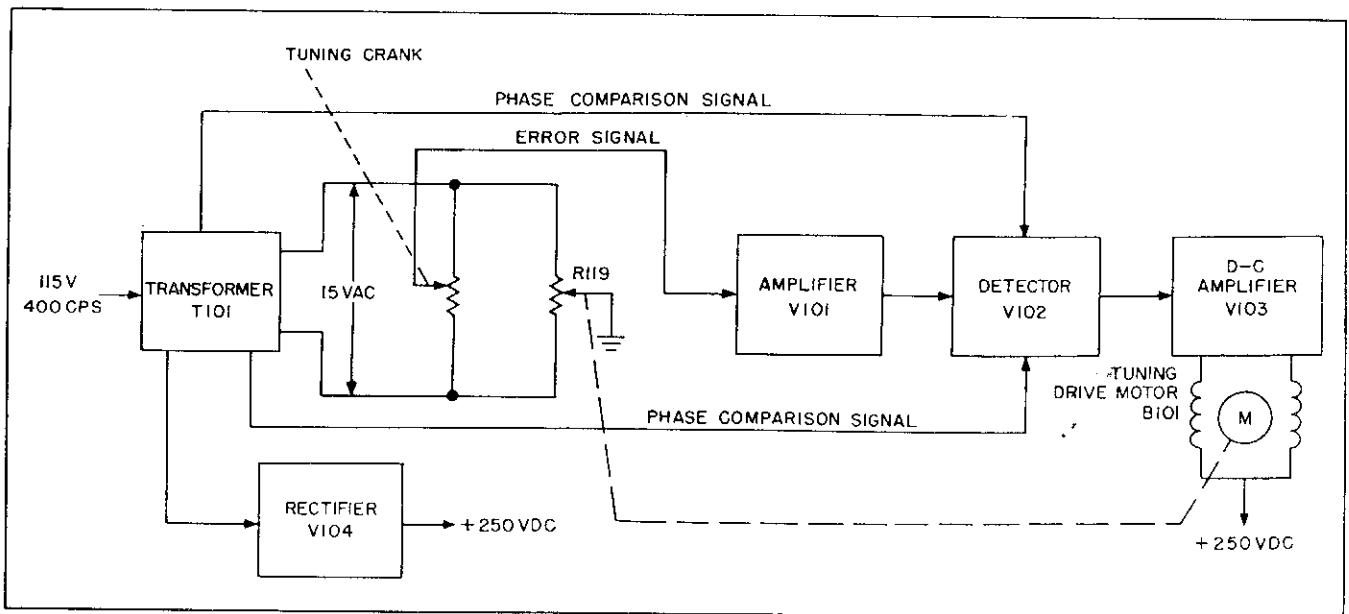


Figure 4-4. Block Diagram of Remote Tuning Group AN/ARA-19, Using Amplifier AM-1799/ARN-6

occurs until the bridge nears balance. The direction of rotation of the motor in the Tuning Drive is dependent on the push-pull amplifier, V102. The polarity shift across T102 (the input to V102) causes one portion of V102 to conduct more heavily than the other portion. If the greater plate current reaches one milliamperere, the relay K101 or K102 in its plate circuit will close causing B101 to turn in the direction as governed by the polarity across T102. A 30-second time delay relay tube K103 in equipments procured under contracts AF33(600)-27279 is connected between R109 and the common connection of K101 and K102 to warm up properly, thereby preventing damage to the micro-potentiometer in the Tuning Drive due to the motor running out of control.

4-8. GENERAL SYSTEM OPERATION USING AMPLIFIER AM-1799/ARN-6. (See figure 4-4.)

4-9. A bridge circuit is formed by two potentiometers, identical to that used with Amplifier AM-203/ARA-19 and AM-203B/ARA-19 (paragraph 4-4). However, the bridge circuit is excited by a 15-volt, 400 cps, signal developed across transformer T101. The arm of the potentiometer geared to the tuning drive motor is grounded. If the arm of the potentiometer on the control panel is repositioned, thereby unbalancing the bridge, an output voltage, the phase and amplitude of which is proportional to the direction and magnitude of the unbalance, is applied to the two stage amplifier circuit of V101. The amplified output, as compared with reference signals by phase-sensitive detector, is applied to d-c amplifier V103. The field windings of the tuning drive motor are in series with the d-c amplifier. The output of the phase-sensitive detector, and hence, the d-c amplifier, will cause the motor to drive its potentiometer to a value that will re-balance the bridge circuit. Rectifier V104 provides a +250-volt plate supply voltage for the operation of the amplifier assembly.

4-10. FUNCTIONAL OPERATION USING AMPLIFIER AM-1799/ARN-6. (See figure 7-10.)

4-11. The 15-volt, 400-cps, output developed across winding 10-11 of transformer T101 is applied across the bridge circuit comprising potentiometer R119, in the tuning drive amplifier, and R101, on the control panel. The arm of potentiometer R119 is grounded.

Any unbalance in the bridge circuit, caused by the repositioning of the TUNING control on the control panel, will result in an output of potentiometer R101 that is proportional to the direction and magnitude of the unbalance. This signal is applied through resistor R101 to the control grid of amplifier V101A. Amplifier V101 provides two stages of amplification with degenerative feedback taken from the plate of the second stage and applied through capacitor C101 and resistor R103 to the cathode of V101A to stabilize the operation of the stage. The amplifier output of V101 is applied through capacitor C104 to both grids of phase-sensitive detector V102. The plate supply voltage for phase-sensitive detector is provided by windings 6-7 and 8-9 of transformer T101. The ground return for the transformer windings is through the grid circuits of d-c amplifier V103. The 400-cps signals appearing at plates 1 and 6 of the detector are 180 degrees out of phase with each other. Each section of the detector functions similar to a half-wave rectifier, conducting only on the positive half cycles of the plate voltage. The error signal applied to the grids is either in or out of phase with the plate signal. Consequently, conduction is heavier when the grid signal is in phase with the plate voltage. When no error signal is applied, conduction on alternate half cycles of each section of the tube is equal and the system is in a balanced condition. The output of the phase-sensitive detector is a pulsating d-c signal that is filtered by the R-C grid networks comprising R109 and C108, and R110 and C107 in the grid circuit of d-c amplifier V103. The d-c voltages are applied across the voltage dividers formed by resistors R112 and R113, and R111 and R114. Capacitors C109 and C110 couple rapid changes in the detector output to the grids of d-c amplifier V103. The plates of the d-c amplifier are returned to the plate supply voltage through the field windings of tuning drive motor B101. An unbalanced input to the amplifier will result in an unbalanced current through the field windings of motor B101, causing the motor to reposition the arm of potentiometer R119 to coincide with potentiometer R101 on the control panel. The armature of the motor is excited by 28-volts dc applied through filter L101. Tube V104 is a full-wave rectifier that supplies the +250-volt plate supply for operation of the amplifiers V101 and V103. The output of the rectifier is filtered by capacitor C106.

SECTION V

OPERATIONAL AND ORGANIZATIONAL MAINTENANCE

5-1. PERFORMANCE TESTS.

5-2. PRELIMINARY INSTRUCTIONS. With equipment installed per paragraph 3-3, proceed as follows:

a. Turn the function switch (S102) of the remote Control Panel C-423B/A to the COMP position. On Control Direction Finder C-1513/A, turn the function switch (S2) to the ADF position.

b. Allow the radio compass at least five minutes to warm up.

c. Turn all external adjustments full counterclockwise.

5-3. TESTS. Check the equipment as outlined in the Performance Check Charts, Table II or III as applicable.

5-4. TROUBLE ANALYSIS OF COMPONENTS.

5-5. GENERAL. Before attempting to remove and repair any defective parts, ascertain which component contains the source of trouble. Keep in mind that the components are dependent upon each other for proper operation, so that the trouble will not always be located in a non-operating component.

5-6. TROUBLE ANALYSIS OF FAULTY COMPONENTS. If the system is not operating satisfactorily,

replace each component with a spare component until the system operates satisfactorily. If, after replacing the Control Panel, Direction Finder, Amplifier and Tuning Drive, the original trouble still exists, the trouble will be in the AN/ARN-6 Radio Compass.

5-7. REPLACEMENT OF COMPONENT PARTS. See paragraphs 3-4, 3-5, and 3-6.

5-8. TROUBLE ANALYSIS OF FAULTY PARTS.

5-9. CONTROL PANEL C-423B/A or CONTROL DIRECTION FINDER C-1513/A. To determine the faulty part in the Control Panel or Direction Finder refer to Section IX of T.O. 12R1-2ARA19-23, Overhaul manual.

5-10. AMPLIFIER AM-203/ARA-19 or AM-203B/-ARA-19 AND TUNING DRIVE PD-5A/ARA-19 or PD-5B/ARA-19. Since the Amplifier and Tuning Drive can only operate as part of a system, troubles within the faulty component, unless visually discernible, can best be determined with the component connected into the system. Follow the data given in Table IV to locate the faulty part. Note that the equipment has been moisture and fungus-proofed. Therefore, it will be necessary to scratch through this insulation in order to obtain voltage or resistance readings. (Refer to the complete schematic diagram, figure 7-4.)

TABLE II. PERFORMANCE CHECK CHART FOR CONTROL PANEL C-423B/A

WHAT TO CHECK	HOW TO CHECK	REMARKS
1. Tuning mechanism.	1. Using the band switch and the tuning control, select a frequency on which it is known a signal is being transmitted. While observing the meter, use the tuning control to tune in the signal. If stations of the proper frequency are available, checks should be made at the high and low end of each frequency band.	1. If the meter peaks on the station signal, it may be assumed that the tuning mechanism is operating properly. If the meter peaks on stations that do not coincide with the frequency settings on the tuning dial, visually check the tuning mechanism for damage, play, or improper fitting. Refer to T.O. 12R1-2ARA19-23 for disassembly instructions for the tuning mechanism if disassembly is necessary.
2. Control Panel controls	2. Operate all controls in accordance with the normal operating procedures for the AN/ARN-6 Radio Compass.	2. If performance is unsatisfactory, refer to paragraph 5-6.
3. Pilot lamps on the Control Panel.	3. If all lights are inoperative, check wiring from +28 v input. If I101 does not light, check wiring to remote position via terminal 462. If I102, I103, I104 or I105 does not light, replace the defective lamp.	3. I102, I103, I104, I105 should light when power is applied to the equipment. Operation of I101 is controlled from another position in the plane through terminal 462.

TABLE III. PERFORMANCE CHECK CHART FOR CONTROL PANEL C-1513/A

WHAT TO CHECK	HOW TO CHECK	REMARKS
1. Tuning mechanism	1. Using the band switch and the tuning control, select a frequency on which it is known a signal is being transmitted. While observing external meter, tune in the signal. If stations of the proper frequency are available, checks should be made at the high and low end of each frequency band.	1. An external tuning meter must be used for the installation check of Control Direction Finder C-1513/A. Use Dejur Amsco Type FA-112 or equivalent having 295 microamp movement from bumper to full scale. Meter must be connected in series with R1. If the meter peaks on the station signal, it may be assumed the tuning mechanism is operating properly. If the meter peaks on stations that do not coincide with the frequency settings on the tuning mechanism, check for damage, play, or improper fitting. Refer to 12R1-2ARA19-23 for disassembly instructions for the tuning mechanism if disassembly is necessary.
2. Direction Finder controls	2. Operate all controls in accordance with the normal operating procedures for the Radio Compass AN/ARN-6.	2. If performance is unsatisfactory refer to paragraph 5-6.
3. Pilot lamps on the Direction Finder	3. If all lights are inoperative check wiring from +28V input. If I1 does not light, check wiring to remote position via terminal CC. If I2 or I3 do not light, replace the defective light.	3. I2 and I3 should light when power is applied to the equipment. Operation of I1 is controlled from another position in the aircraft through terminal CC.

TABLE IV. AMPLIFIER AM-203/ARA-19 or AM-203B/ARA-17 TROUBLE ANALYSIS CHART

Step	Test Points	Normal Indication	Possible Cause of Abnormal Indication
1.	① A and J of J101 of Amplifier	+28 volts dc (Supply voltage to Amplifier)	Shorted C101, C104, C113, or C114.
2.	② B and D of J101 of Amplifier	11 volts at 300 cycles (Output of the oscillator)	V103, T103. Component parts of V103 circuit.
3.	③ D and C of J101 of Tuning Drive	0 to 1000 ohms	R101, B101, Z101, Z102, J101.
4.	Ⓐ F and C of J101	0.003 volts ac (Indication of over-all sensitivity of the Amplifier)	Weak V101 or V102, R101 or J101
5.	Ⓑ G and H of J101	+ 28 volts dc Power input for the motor	J101 of Amplifier Power Source.
6.	Ⓐ Pin 3 of V101	+0.8 volts dc	T102 open. C103, R106 shorted.
7.	Ⓐ② Pin 2 of V102	+1.2 volts dc	R107, V102, open relays.
8.	Ⓐ③ Pin 3 of V102, Ⓐ④ Pin 1 of V102	-18 volts dc	Secondary winding of T102, R107, R112, C107.

TABLE V. AMPLIFIER AM-1799/ARN-6, TROUBLE ANALYSIS CHART

Step	Test Points	Normal Indication	Possible Cause of Abnormal Indication
1.	④ I and E of J101	115 volts, 400 cps (Supply voltage to amplifier)	Amplifier power Source of J101 defective.
2.	⑤ A and J of J101	28 volts dc (Supply voltage to amplifier)	Defective filter L101 or shorted armature of B101.
3.	⑥ B and D of J101	15 volts, 400 cps	Defective transformer T101 or potentiometers R119 (in amplifier) or R101 (in control panel).
4.	③ V101, pin 7 to ground	+390 volts dc	V104 or T101 defective.
5.	④ T101, terminals 6 and 7	190 volts ac	T101 defective
6.	⑤ T101, terminals 8 and 9	190 volts ac	T101 defective.
7.	① V101, pin 1 to ground	+58.5 volts dc	V101A or associated circuit parts defective.
8.	② V101, pin 6 to ground	+72 volts dc	V101B or associated circuit parts defective.
9.	③ V102, pin 1 to ground	-300 volts dc 300 volts ac	V102A or associated circuit parts defective.
10.	④ V102, pin 6 to ground	-280 volts dc 300 volts ac	V102B or associated circuit parts defective.
11.	⑤ V103, pin 1 to ground	+300 volts dc 130 volts ac	V103 or field winding 1-3 of B101 defective. Associated circuit parts of V103A defective.
12.	⑥ V103, pin 6 to ground	+300 volts dc 135 volts ac	V103 or field winding 2-3 of B101 defective. Associated circuit parts of V103B defective.

5-11. AMPLIFIER AM-1799/ARN-6. Procedures for locating defective parts in the remote tuning group, when using Amplifier AM-1799/ARN-6, are given in Table V. The equipment has been moisture and fungus-proofed and it is, therefore, necessary to scratch through this protective coating to obtain accurate voltage and resistance indications. (Refer to the complete schematic diagram, figure 7-10, for additional information.)

5-12. REMOVAL OF PARTS.

5-13. Most of the parts in the AN/ARA-19 Remote Tuning Group are easily accessible. If necessary, refer to T.O. 12R1-2ARA19-23, Overhaul manual, for dismantling and disassembly instructions. When

unsoldering or disconnecting leads, tag the leads to insure proper connections after the faulty part has been replaced. Figures 6-4 through 6-18 show interior views of the equipment. Figures 6-1 to 6-3 are wiring diagrams.

5-14. LUBRICATION.

5-15. Lubrication is not required. The ball bearings in the tuning assembly have been pre-lubricated and are self-sealed.

5-16. INSPECTION SCHEDULE.

5-17. Inspection of the equipment should be carried on for the intervals indicated in Table VI.

TABLE VI. INSPECTION SCHEDULE

Component	Inspection	Time
Control Panel C-423B/A or Control Direction Finder C-1513/A	1. Performance test (as outlined in paragraph 5-3).	25 hrs.
	2. Front panel for dirt and corrosion.	25 hrs.
	3. Junction Box properly laced and secure.	100 hrs.
	4. Check gears in tuning mechanism for signs of wear.	100 hrs.
Amplifier AM-203/ARA-19 or AM-203B/ARA-19	1. Fastening to Mounting MT-569A/ARA-19 secure.	25 hrs.
	2. Connector (J101 contacts secure and not shorted).	100 hrs.
	3. Tubes for proper seating in their sockets.	100 hrs.
	4. Check wiring connections for signs of wear or damage due to vibration.	
Tuning Drive PD-5A/ARA-19 or PD-5B/ARA-19	1. Mounting to AN/ARN-6 Receiver secure.	25 hrs.
	2. Connector (J101) contacts secure and not shorted.	100 hrs.
	3. Check motor (B101) and potentiometer (R101) for signs of overheating.	100 hrs.

SECTION VI

FIELD AND FASRON MAINTENANCE

6-1. MINIMUM PERFORMANCE STANDARDS.

6-2. Follow the instructions given in paragraphs 5-2 and 5-3.

6-3. TROUBLE ANALYSIS AND REMOVAL OF PARTS.

6-4. Follow the instructions given in paragraphs 5-4 and 5-13.

6-5. TUBE SOCKET VOLTAGE AND RESISTANCE CHARTS. If, after following the instructions in paragraphs 5-4 and 5-13, source of the trouble is still not evident, refer to Table VII or VIII for tube socket checks. The voltage measurements are taken under normal operating conditions with a 20,000 ohm/volt voltmeter. Resistances are measured between socket terminals and ground with no power applied.

6-6. ADJUSTMENT.

6-7. When placing the Control Panel or the Direction Finder back into service, follow the instructions in paragraph 3-6 to ensure alignment between the tuning mechanism in the Control Panel on the Direction Finder and the tuning capacitor in the AN/ARN-6 receiver.

6-8. OVERHAUL SCHEDULE.

6-9. As long as the equipment is operating satisfactorily, overhaul is not necessary. The tubes in the Amplifier should be checked every 1000 hours for low emission.

6-10. WIRING DIAGRAMS.

6-11. Wiring diagrams for the Control Panel Direction Finder, Amplifier, and Tuning Drive are shown in figures 6-1 to 6-3.

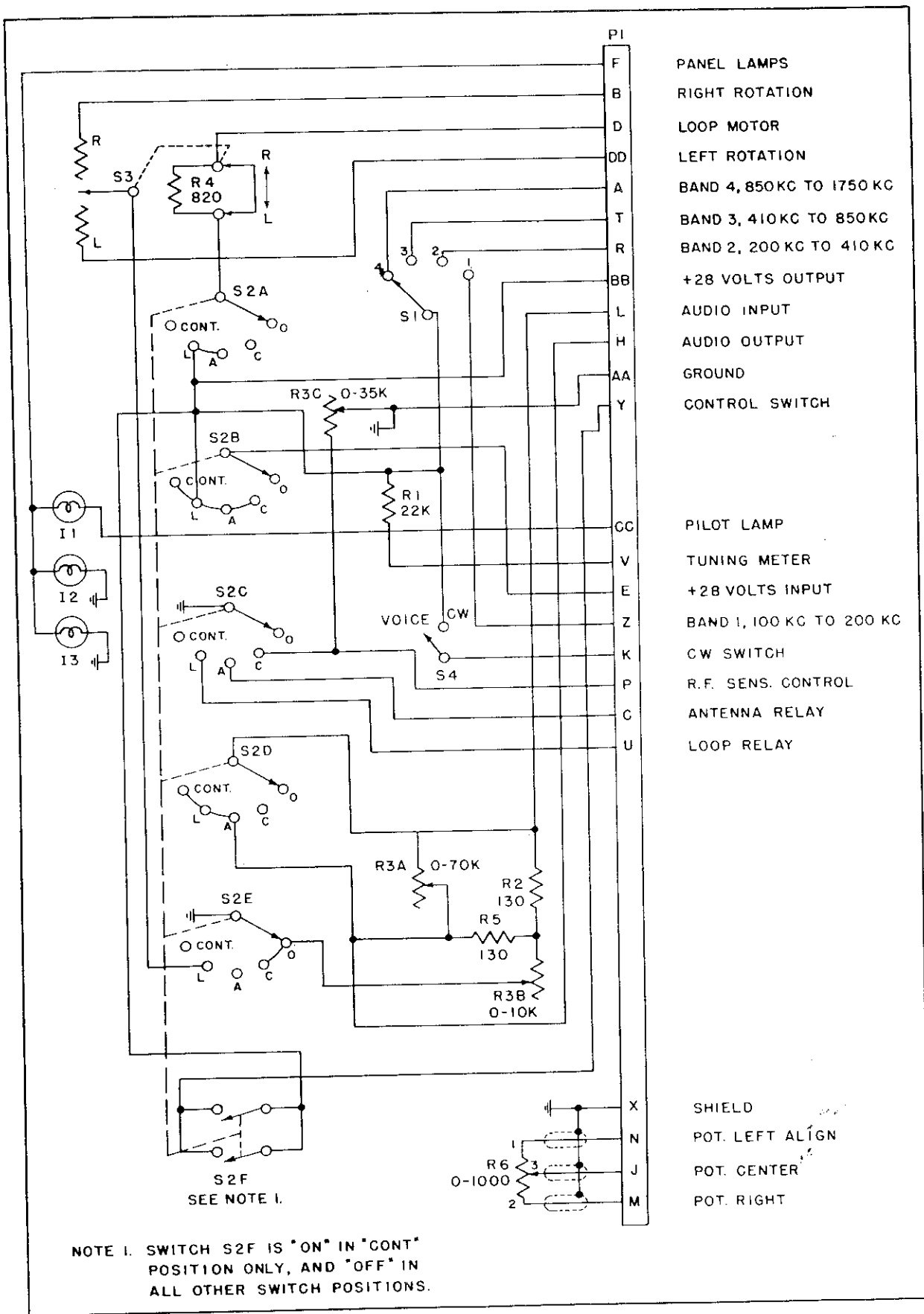


Figure 7-3. Schematic Diagram of Control Director Finder C-1513/A

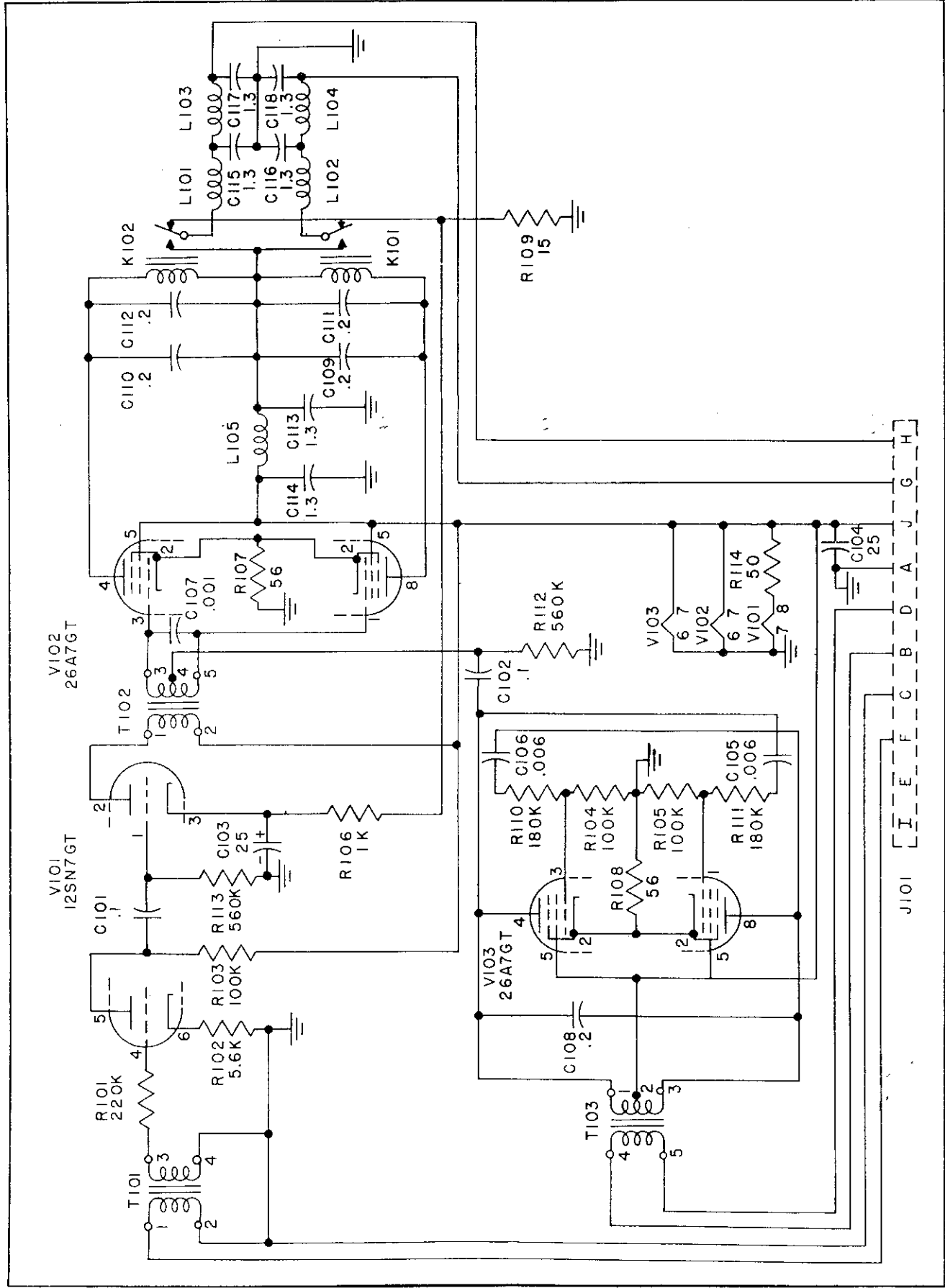
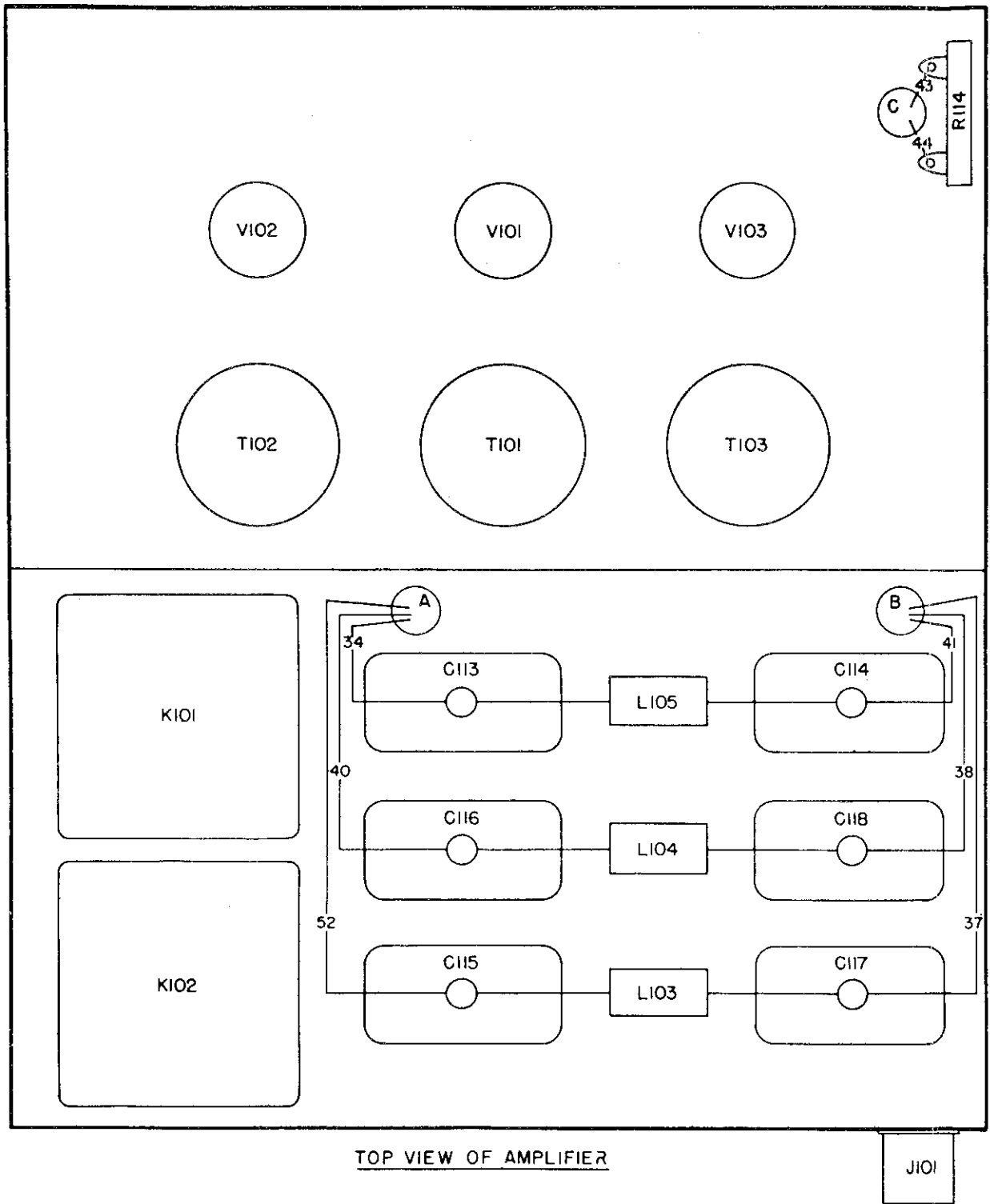
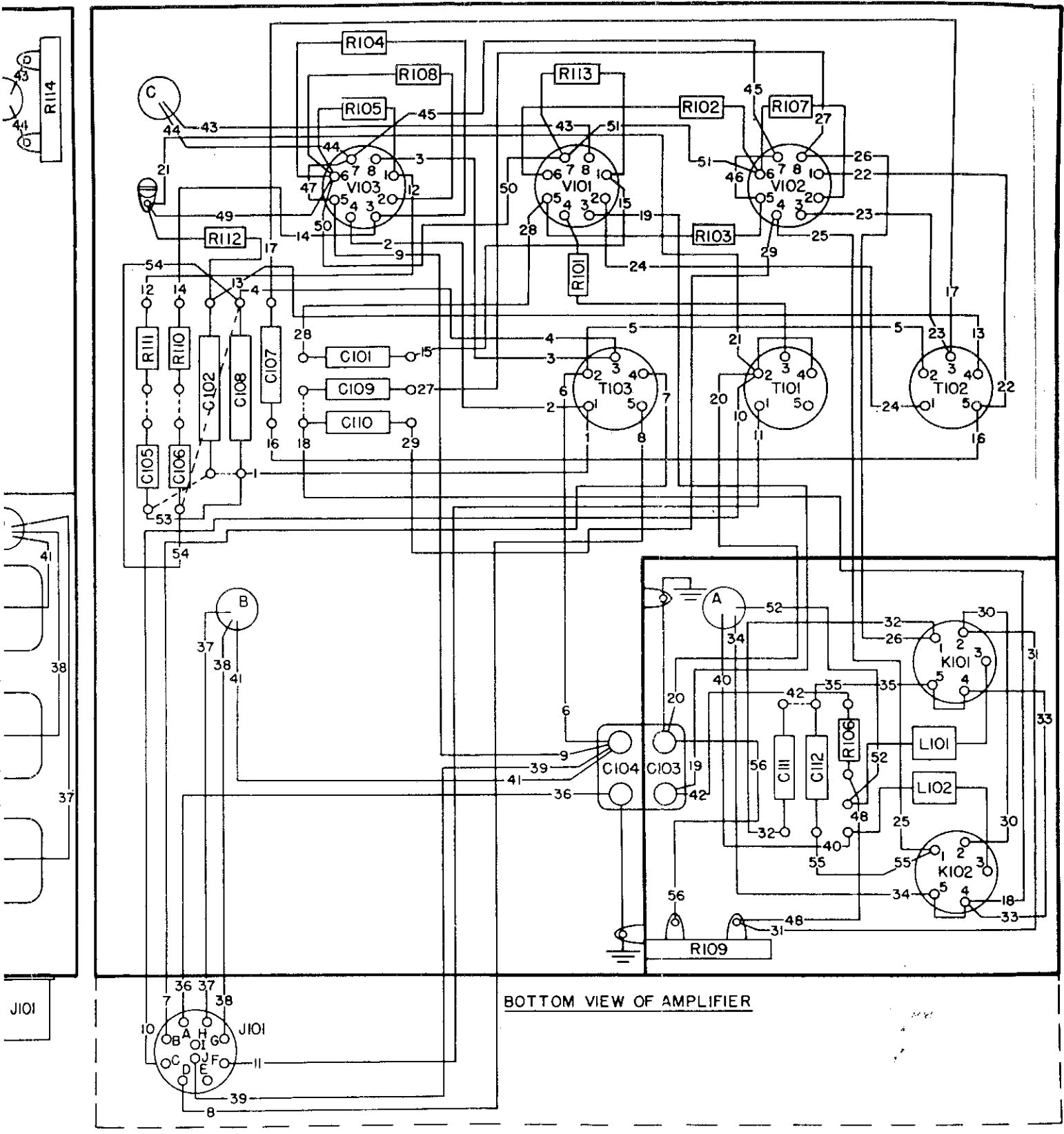


Figure 7-4. Schematic Diagram of Amplifier AM-203/ARA-19

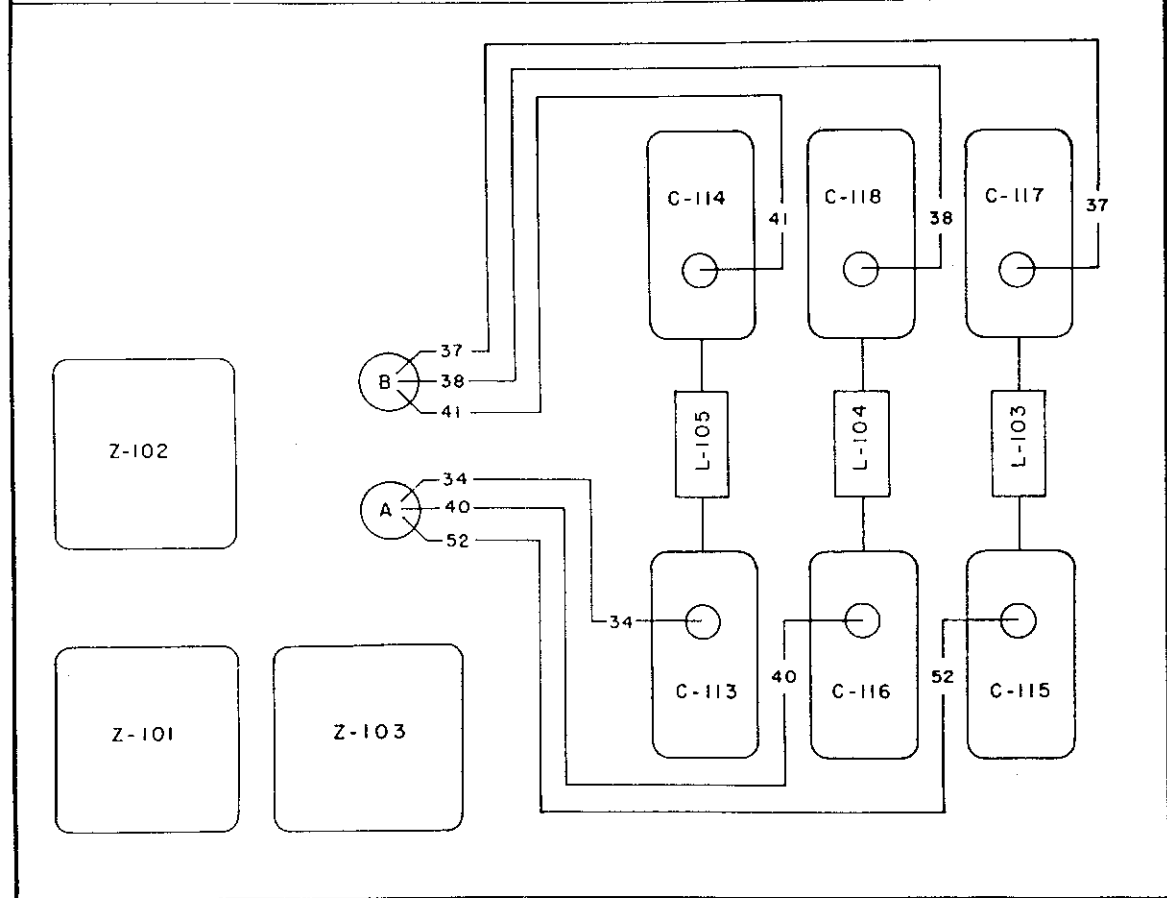
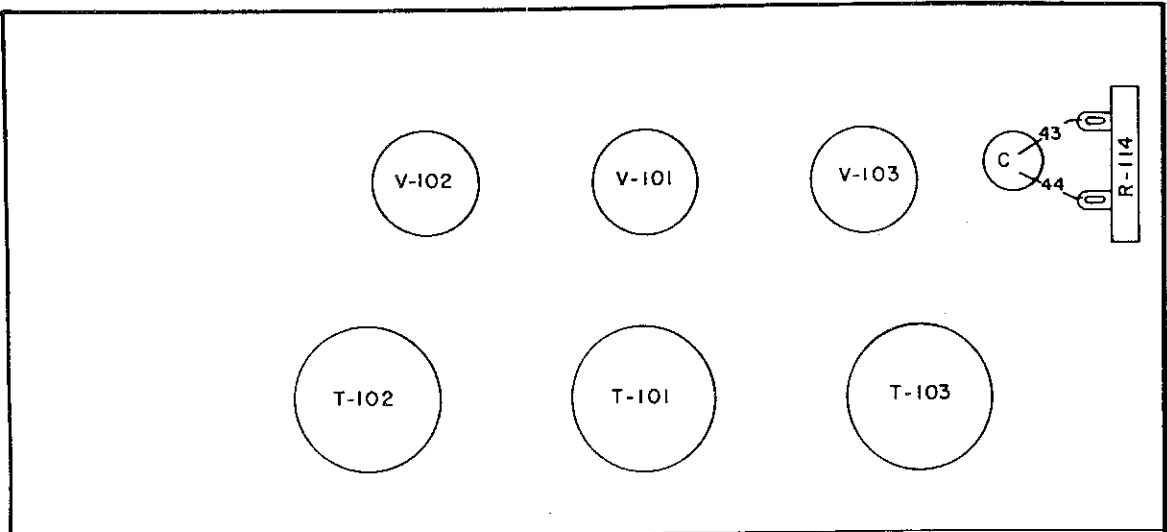


TOP VIEW OF AMPLIFIER

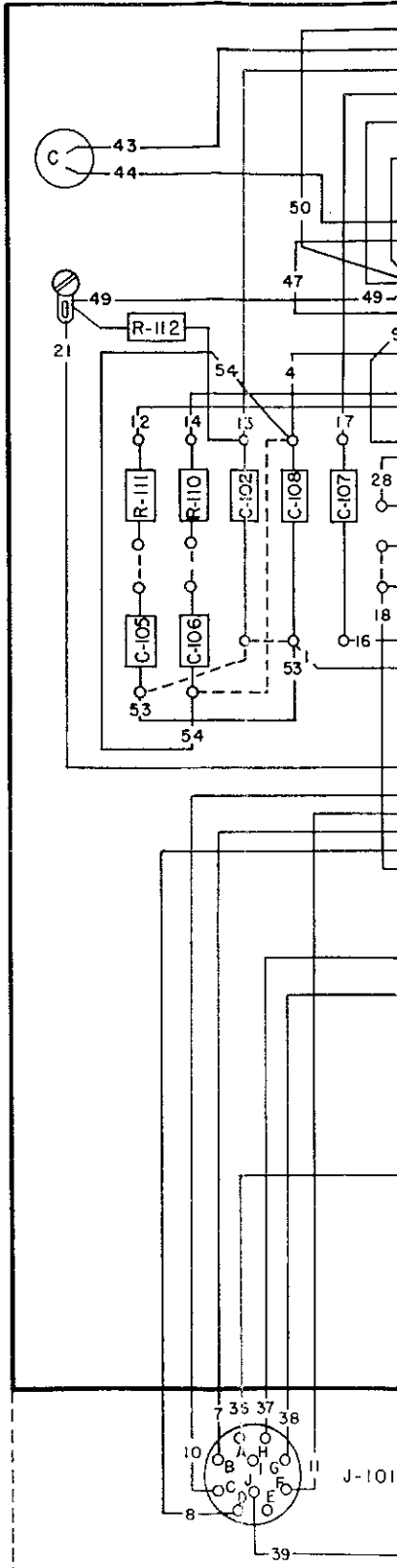
Figure 6-3. Practical Wiring Diagram of Amplifier AM-203/ARA-19



BOTTOM VIEW OF AMPLIFIER



TOP VIEW OF AMPLIFIER



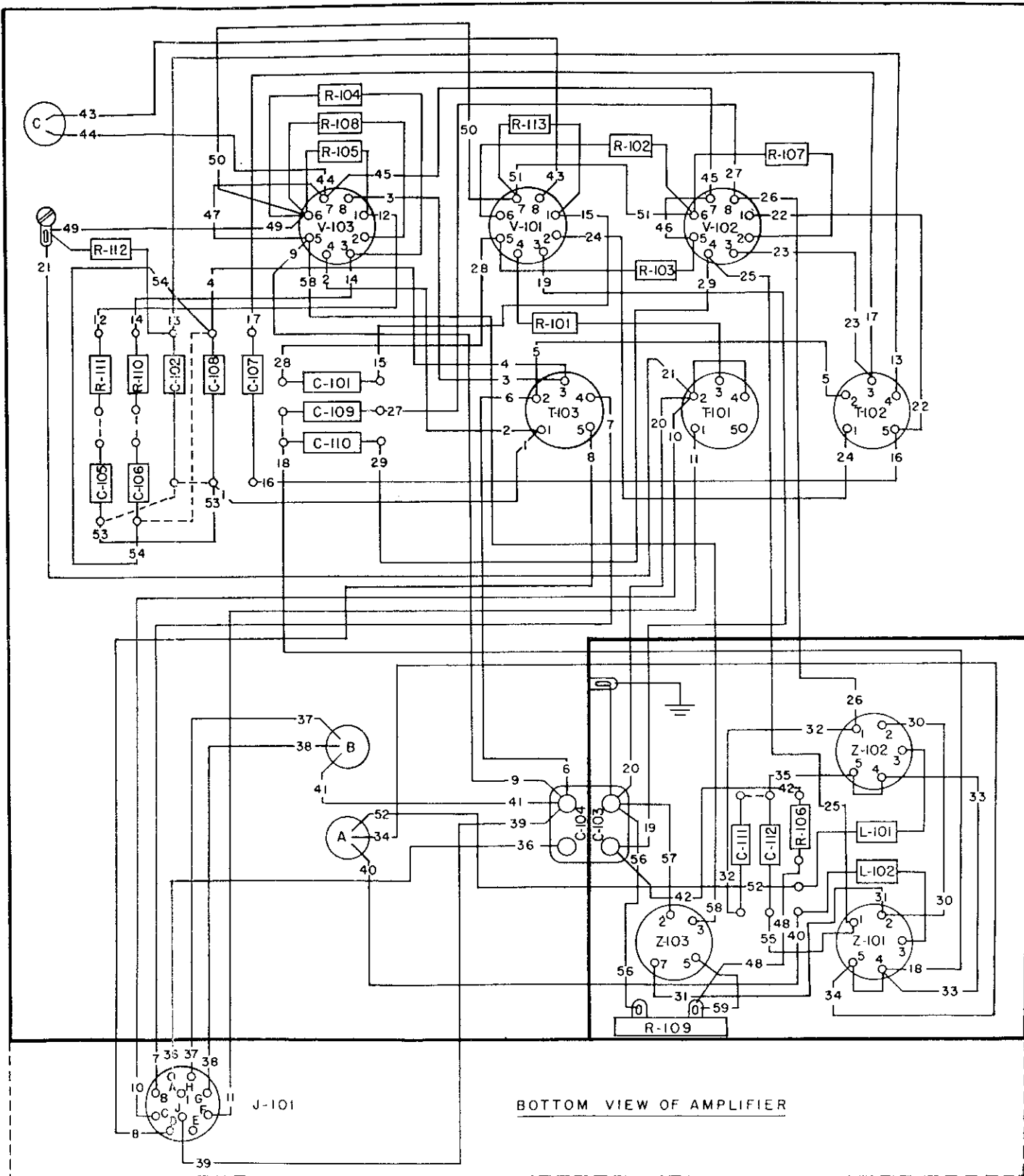


Figure 6-4. Practical Wiring Diagram of Amplifier AM-203B/ARA-19.

TABLE VII. AMPLIFIER AM-203/ARA19 OR AM-203B/ARA-19 VOLTAGE AND RESISTANCE CHART

Tube	Socket Terminal	Resistance Measurements (Ohms)	Voltage * Measurements (Volts)
V101 (12SN7GT) Voltage Amplifier	1	560 K	-0.5
	2	700	27
	3	1000	0.5
	4	220 K	0
	5	100 K	12
	6	5600	0.8
	7	GND	0
	8	7.5	12.3
V102 (26A7GT) Relay Control	1	560 K	-30
	2	56	0.7
	3	560 K	-30
	4	7000	12.5
	5	4	27
	6	GND	0
	7	4	27
	8	7000	12.5
V103 (26A7GT) Oscillator	1	100 K	-1.7
	2	56	3
	3	100 K	-1.5
	4	40	26.5
	5	4	27
	6	GND	0
	7	4	27
	8	40	26.5

* Voltage measurement made with equipment in quiescent state.

TABLE VIII. ELECTRONIC CONTROL AMPLIFIER AM-1799/ARN-6, VOLTAGE AND RESISTANCE CHART

Tube	Socket Terminal	Resistance Measurements (Ohms)	Voltage * Measurements (Volts)
V101 (6681) Amplifier	1	100 MEG	58.5
	2	INF	0
	3	3.4 K	0.76
	4	7	15
	5	0	0
	6	100 MEG	72
	7	1 MEG	-0.08
	8	3.5 K	0.7
	9	6	6.6
V102 (6680) Detector	1	150 K	-300
	2	1 MEG	-2.35
	3	0	0
	4	8	27
	5	8	13.5
	6	150 K	-280
	7	1 MEG	-2.35
	8	0	0
	9	8.5	20

* Voltage measurement made with equipment in quiescent state.

TABLE VIII. ELECTRONIC CONTROL AMPLIFIER AM-1799/ARN-6,
VOLTAGE AND RESISTANCE CHART (Cont.)

Tube	Socket Terminal	Resistance Measurements (Ohms)	Voltage * Measurements (Volts)
V103 (6680) D-C Amplifier	1	100 MEG	300
	2	470 K	-15
	3	0	0
	4	8	14
	5	0	0
	6	100 MEG	300
	7	460 K	-13
	8	0	0
	9	6	7
V104 (12X4) Rectifier	1	200	-0.9
	2	100 MEG	175
	3	8	27.5
	4	7.5	13.
	5	INF	0
	6	180	-3.3
	7	100 MEG	390

*Voltage measurement made with equipment in quiescent state.

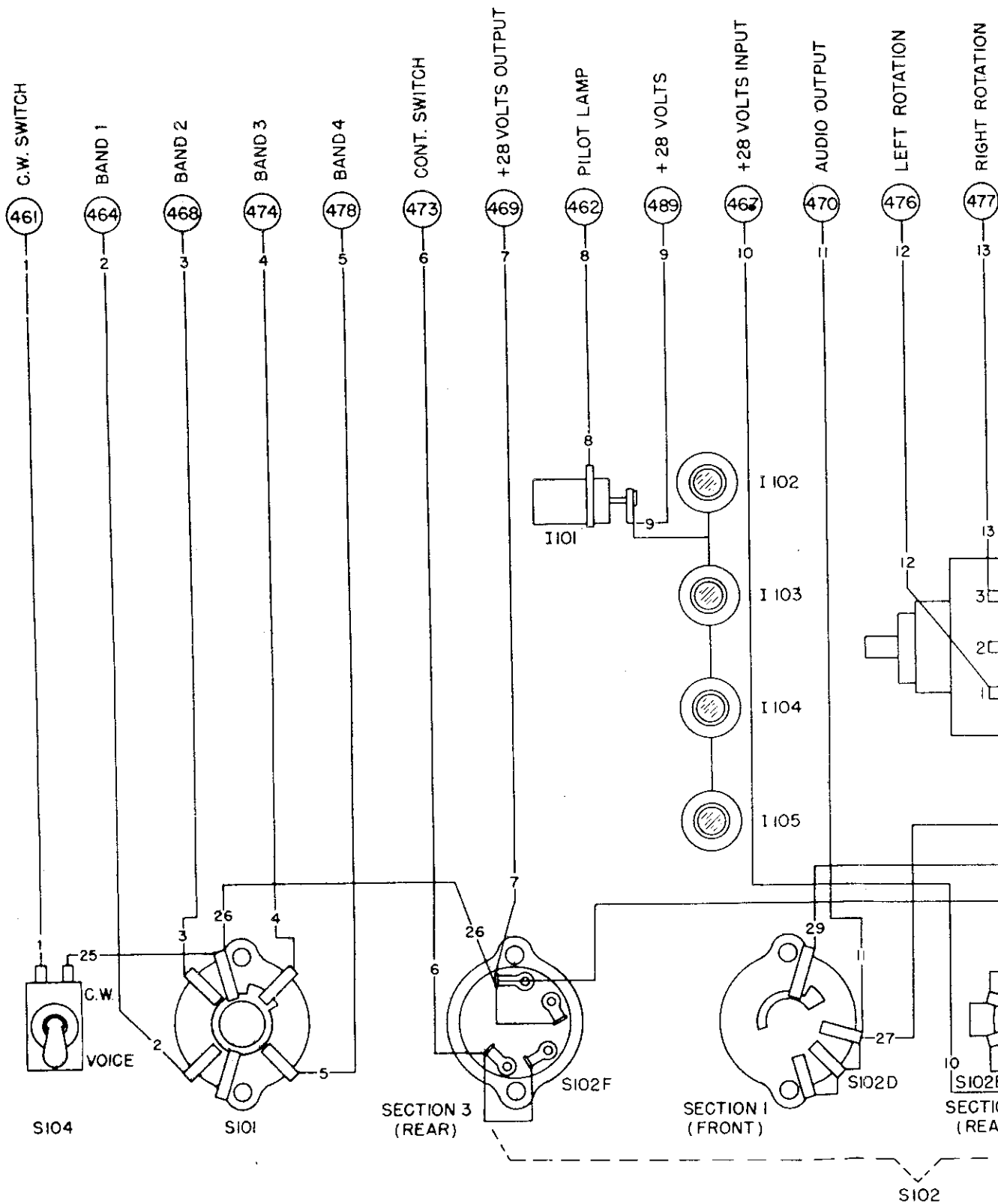
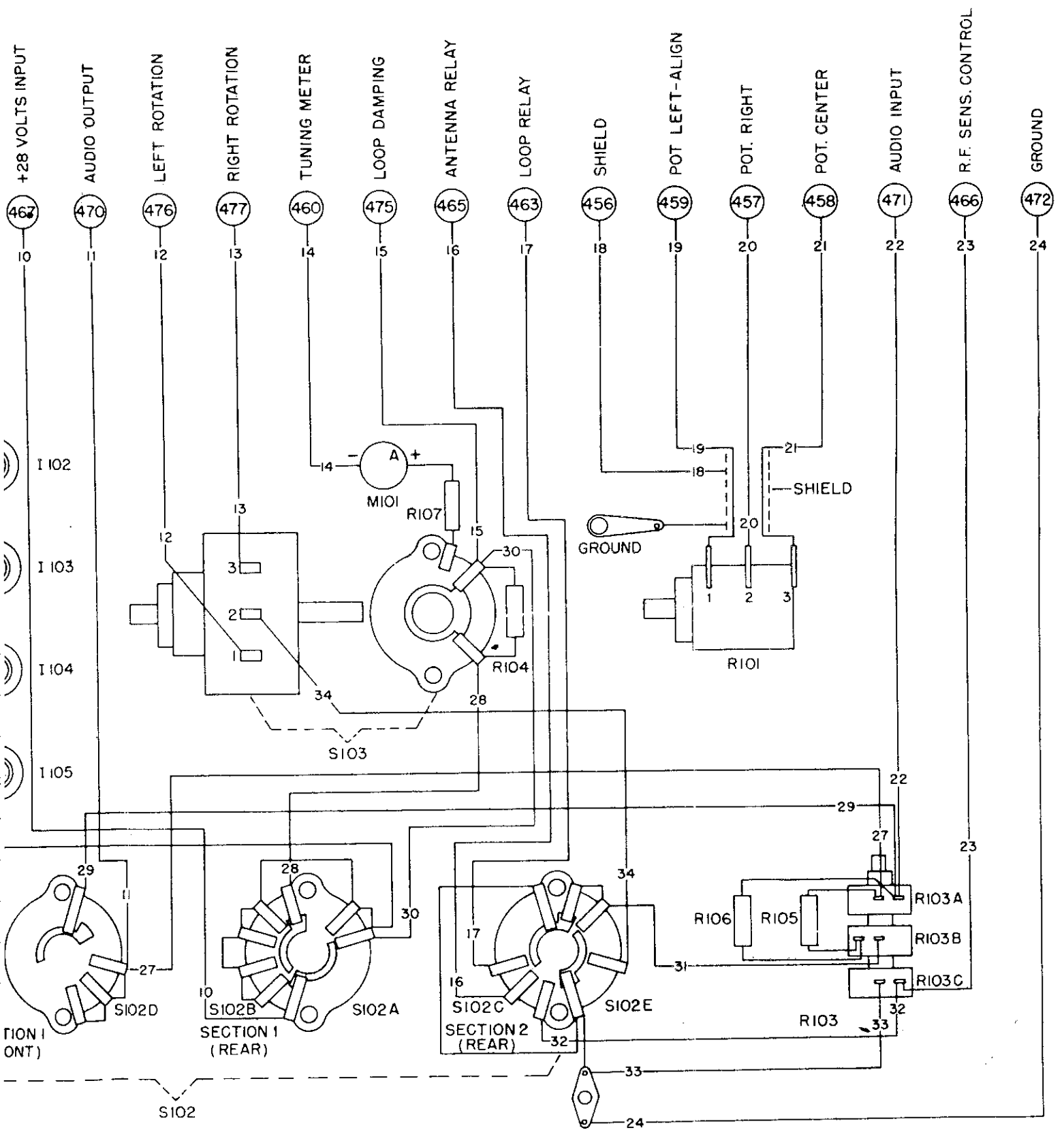
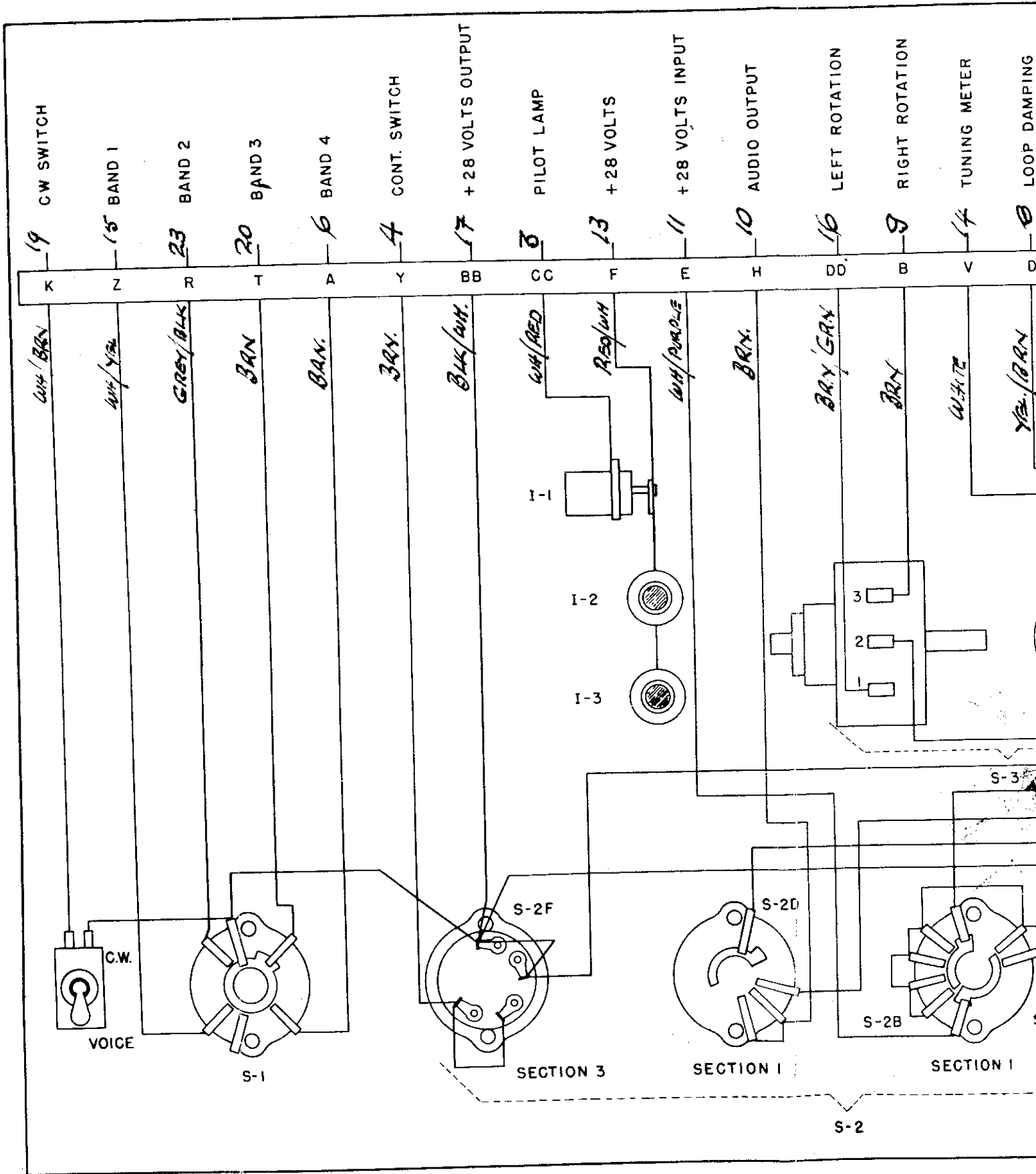


Figure 6-1. Practical Wiring Diagram of Control Panel C-423B/A.





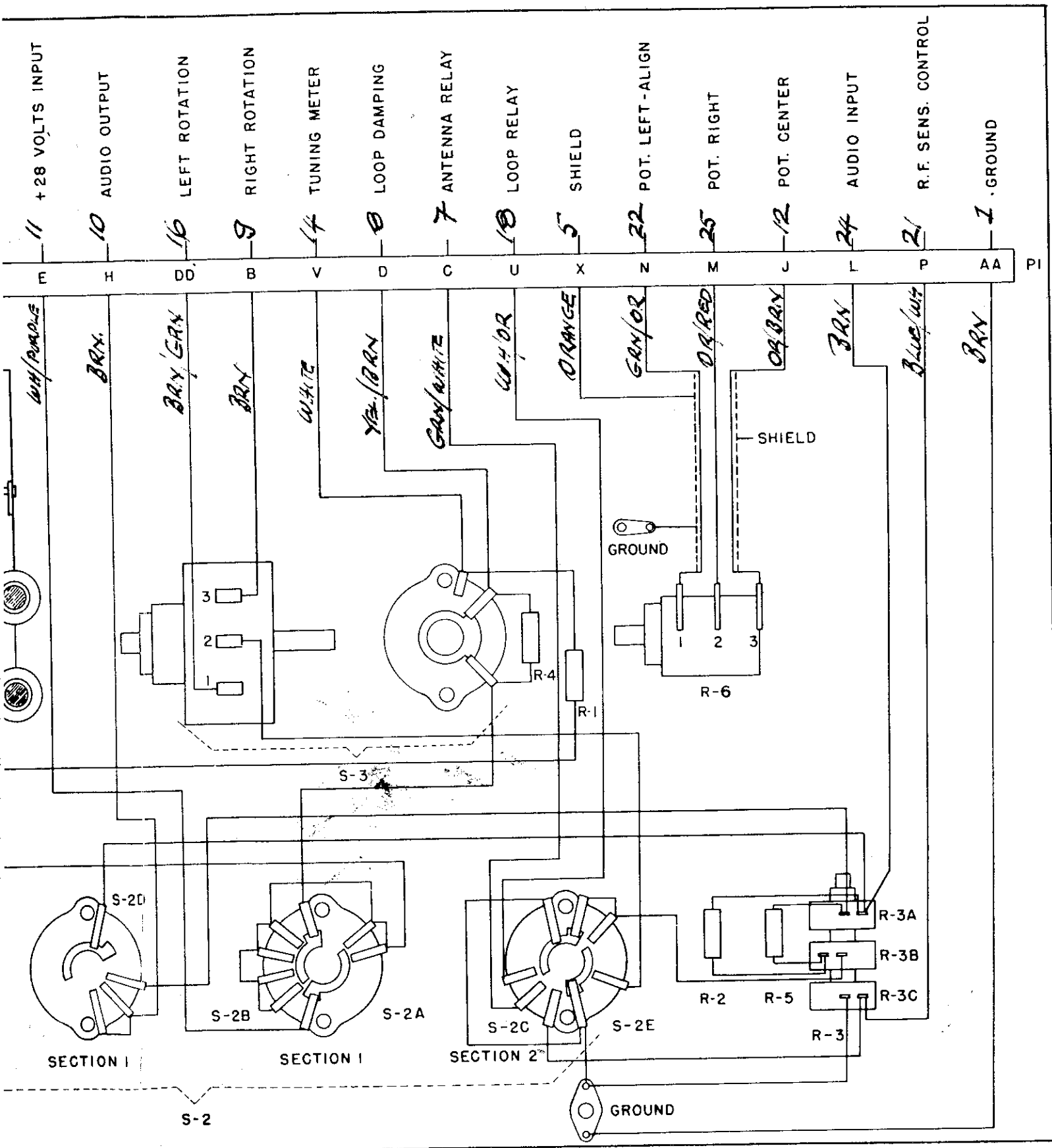


Figure 6-2. Practical Wiring Diagram of Control Direction Finder C-1513/A

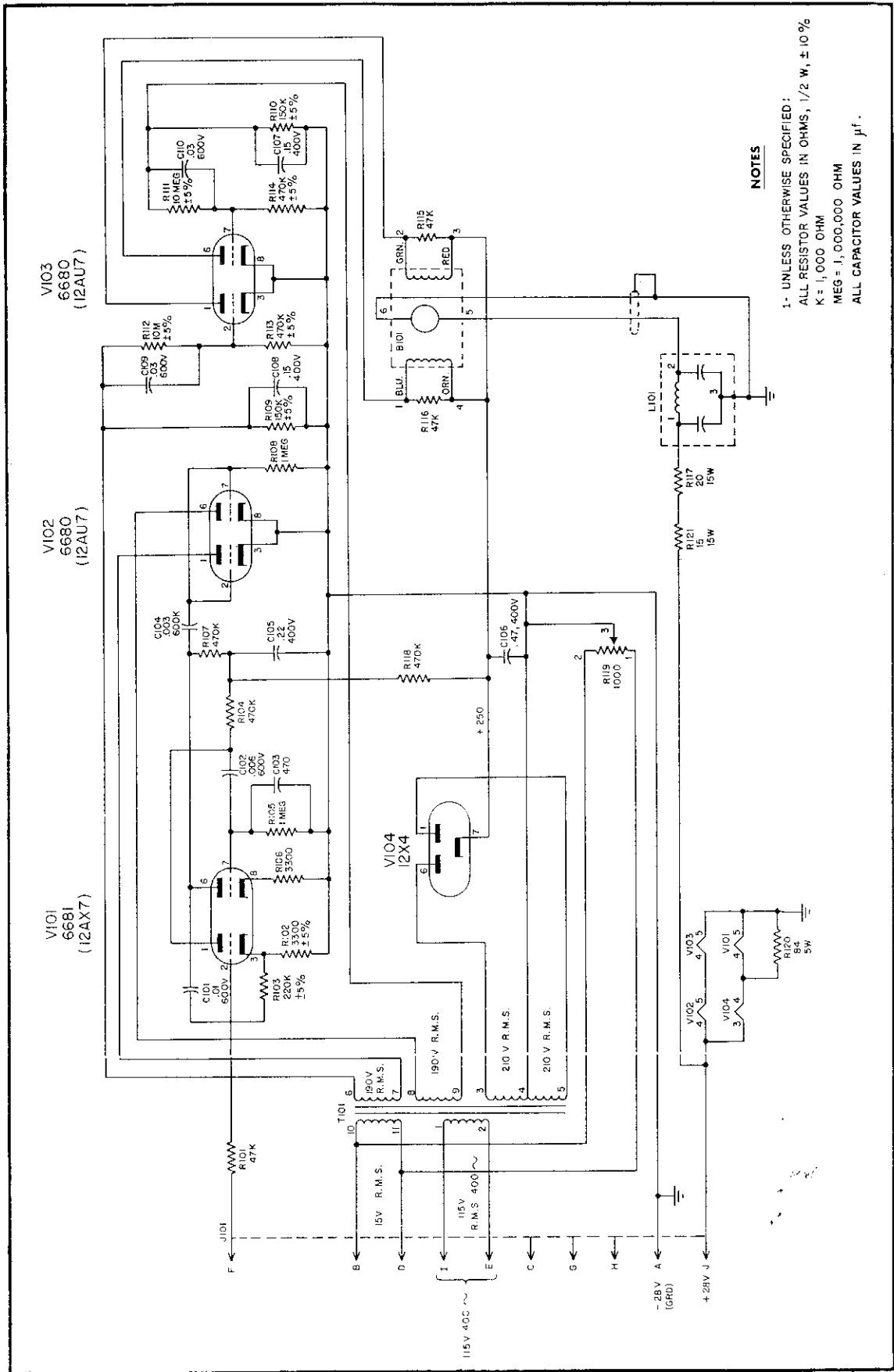
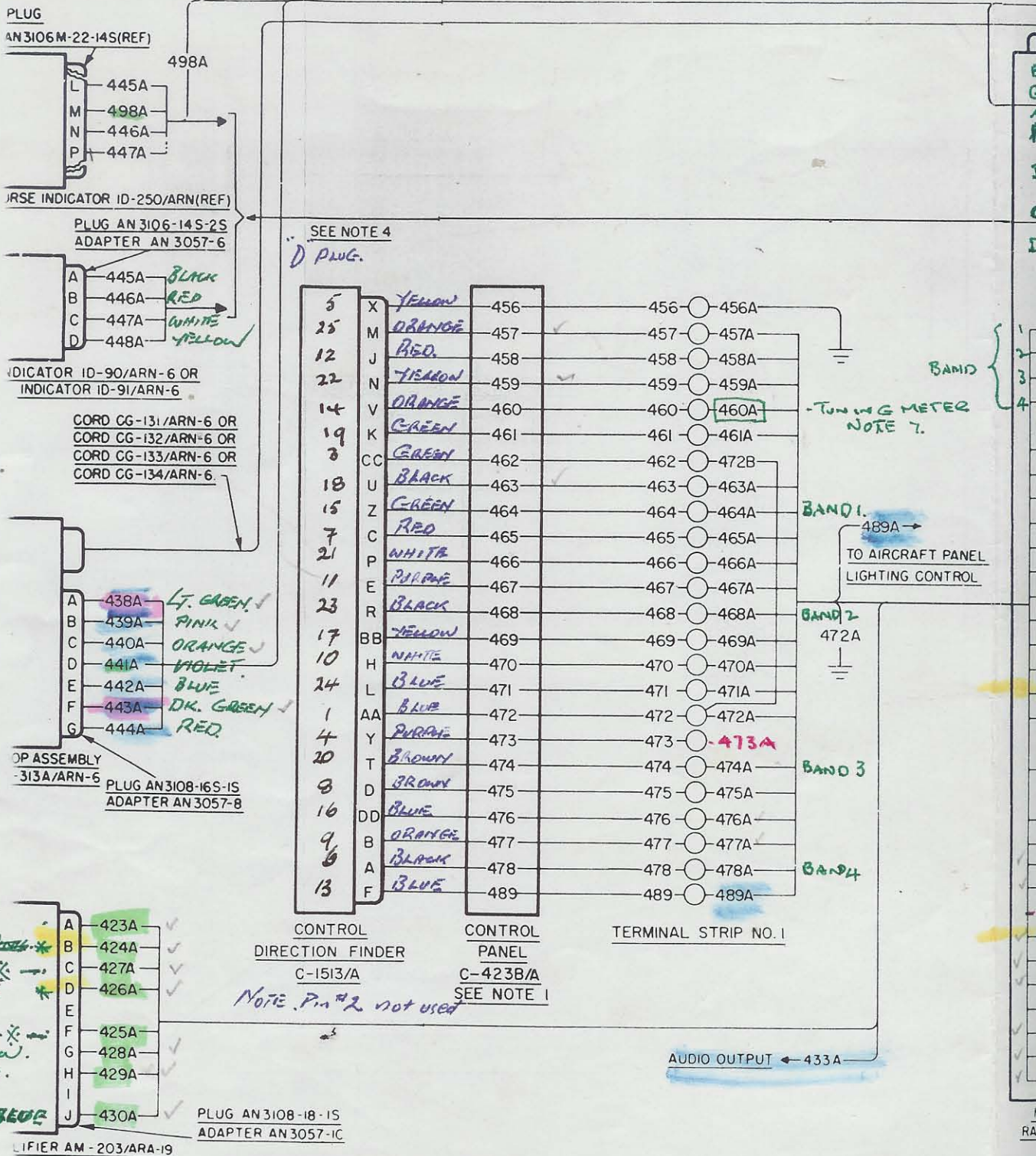


Figure 6-4A. Practical Wiring Diagram of Electronic Control Amplifier AM-1799/ARN-6



(THICK) ~~ORANGE~~ EARTH

GREEN PINK *

ORANGE *

RED *

(THIN) WHITE BROWN *

YELLOW *

BROWN *

THICK 28V BEEF

* = ~~SHROUDED~~ PAIR (B / F)

* = " (B / D)

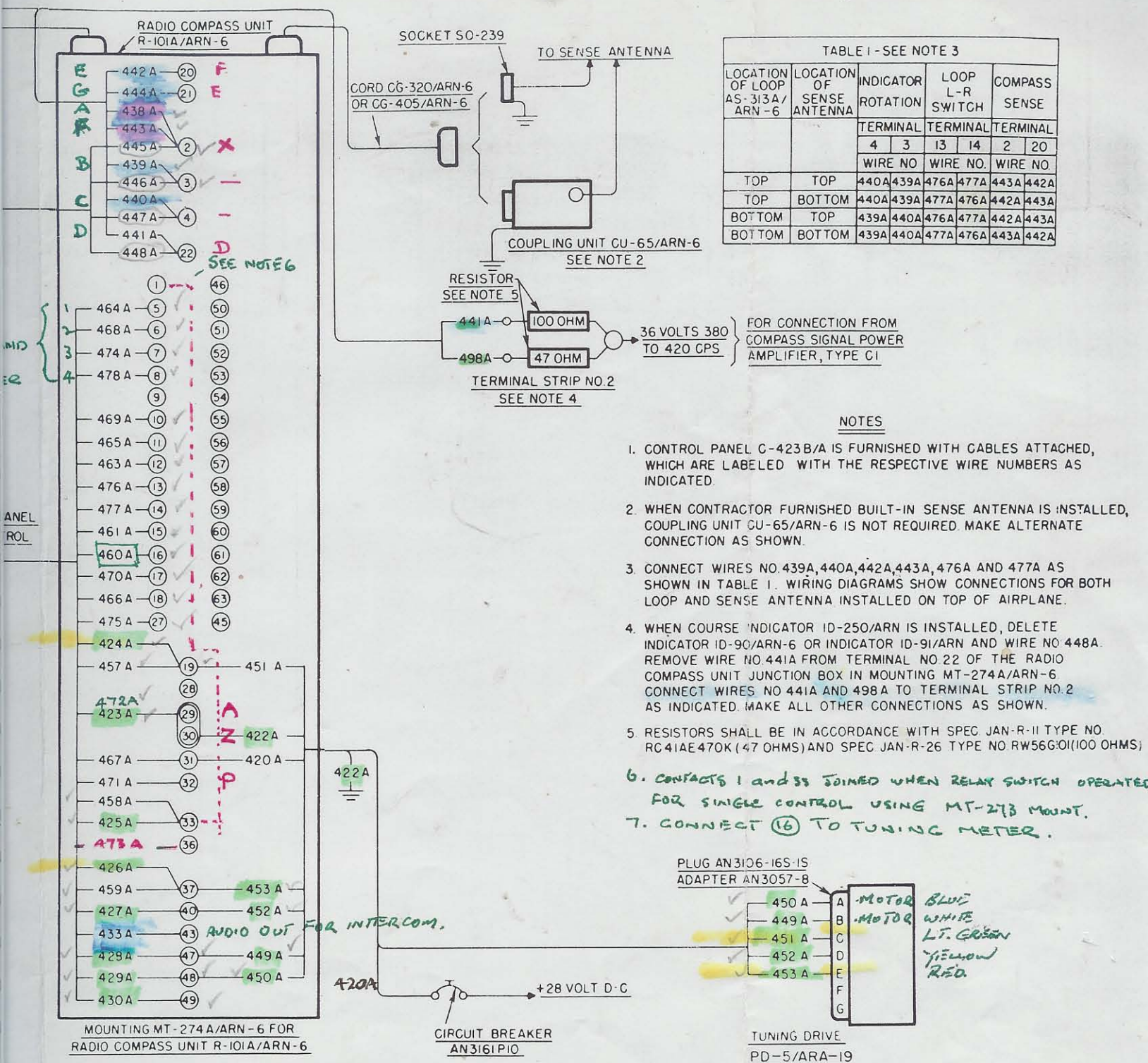
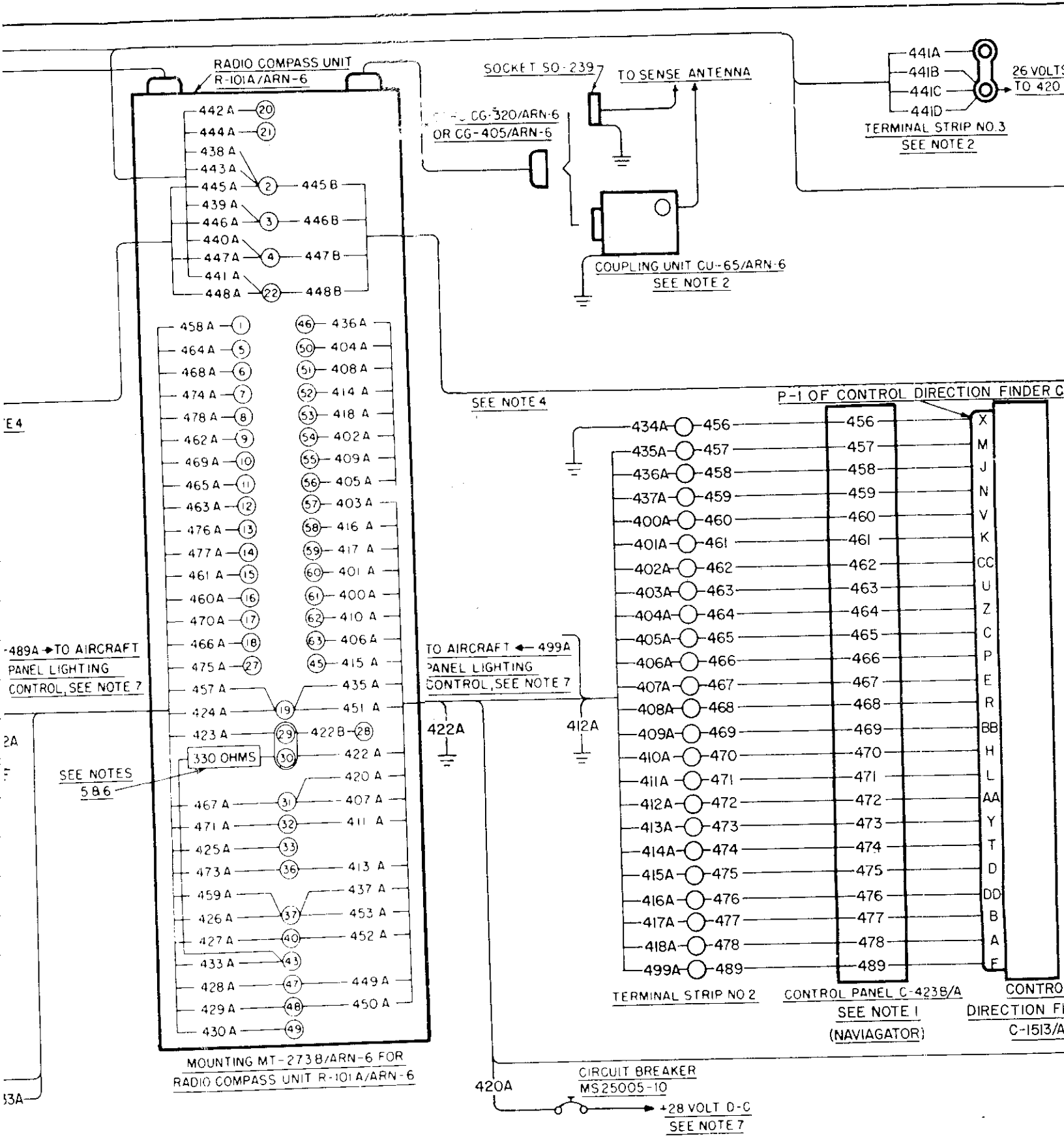


Figure 3-2. Wiring Diagram of Radio Compass AN/ARN-6 with Single Installation of Remote Tuning Group AN/ARA-19



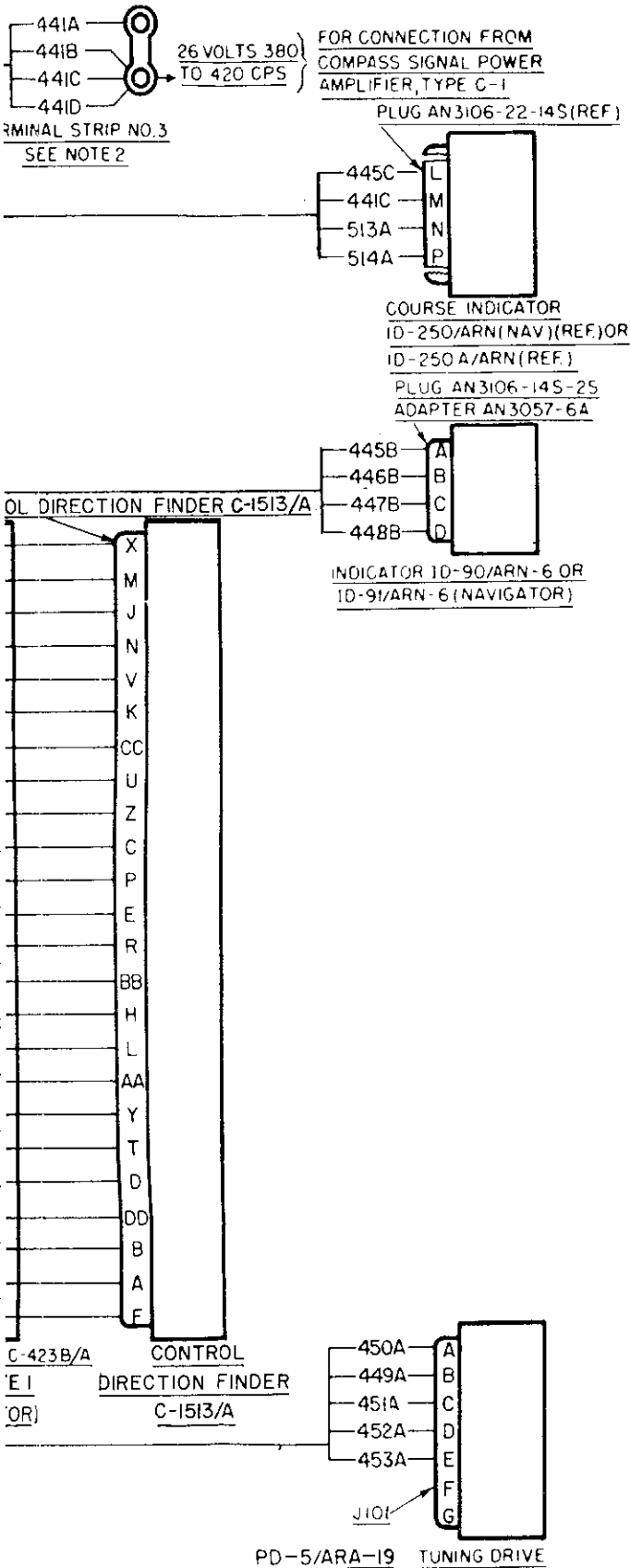


TABLE A- SEE NOTE 3

LOCATION OF LOOP AS-313A/ARN-6	LOCATION OF SENSE ANTENNA	INDICATOR ROTATION	LOOP LEFT-RIGHT SWITCH				COMPASS SENSE					
			PILOT		NAVIGATOR							
			TERMINAL 4	TERMINAL 3	TERMINAL 13	TERMINAL 14		TERMINAL 58	TERMINAL 59	TERMINAL 2	TERMINAL 20	
			WIRE NO	WIRE NO	WIRE NO	WIRE NO	WIRE NO	WIRE NO	WIRE NO	WIRE NO	WIRE NO	WIRE NO
TOP	TOP		440A	439A	476A	477A	416A	417A	443A	442A		
TOP	BOTTOM		440A	439A	477A	476A	417A	416A	442A	443A		
BOTTOM	TOP		439A	440A	476A	477A	416A	417A	442A	443A		
BOTTOM	BOTTOM		439A	440A	477A	476A	417A	416A	443A	442A		

NOTES

- CONTROL PANEL C-423B/A IS FURNISHED WITH CABLES ATTACHED, WHICH ARE LABELLED WITH THE RESPECTIVE WIRE NUMBERS AS INDICATED.
- WHEN CONTRACTOR FURNISHED BUILT-IN SENSE ANTENNA IS INSTALLED, COUPLING UNIT CU-65/ARN-6 IS NOT REQUIRED MAKE ALTERNATE CONNECTION AS SHOWN.
- CONNECT WIRES NO.416A, 417A, 439A, 440A, 442A, 443A, 476A, & 477A AS SHOWN IN TABLE A. WIRING DIAGRAMS SHOW CONNECTIONS FOR BOTH LOOP AND SENSE ANTENNA INSTALLED ON TOP OF AIRPLANE.
- WHEN COURSE INDICATORS ID-250/ARN OR ID-250A/ARN(PILOT), (CO-PILOT) & (NAVIGATOR) ARE INSTALLED, DELETE INDICATORS ID-90/ARN-6 OR INDICATORS ID-91/ARN-6(PILOT) & (NAVIGATOR) AND ASSOCIATED WIRING. REMOVE WIRE NO.441A FROM TERMINAL NO 22 OF THE RADIO COMPASS UNIT JUNCTION BOX IN MOUNTING MT-273A/ARN-6. CONNECT WIRES NO. 441A, 441B, 441C & 441D TO TERMINAL STRIP NO.3 AS INDICATED. MAKE ALL OTHER CONNECTIONS AS SHOWN.
- RESISTORS SHALL BE IN ACCORDANCE WITH SPEC. JAN-R-11 TYPE NO. RC21AE331K (330 OHMS) AND TYPE NO. RC41AE120K (12 OHMS).
- RESISTOR RC21AE331K IS ONLY REQUIRED WHEN RADIO COMPASS AN/ARN-6 IS USED WITH INTERCOMMUNICATION SET AN/AIC-10
- WHEN ONLY TWO COURSE INDICATORS ID-250/ARN*6 OR ID-250A/ARN ARE REQUIRED, DELETE COURSE INDICATOR ID-250/ARN OR ID-250A/ARN (CO-PILOT) AND ASSOCIATED WIRING; TERMINAL 11 AND ASSOCIATED RESISTOR; TERMINAL 6 AND ASSOCIATED RESISTOR OF TERMINAL STRIP NO.4.

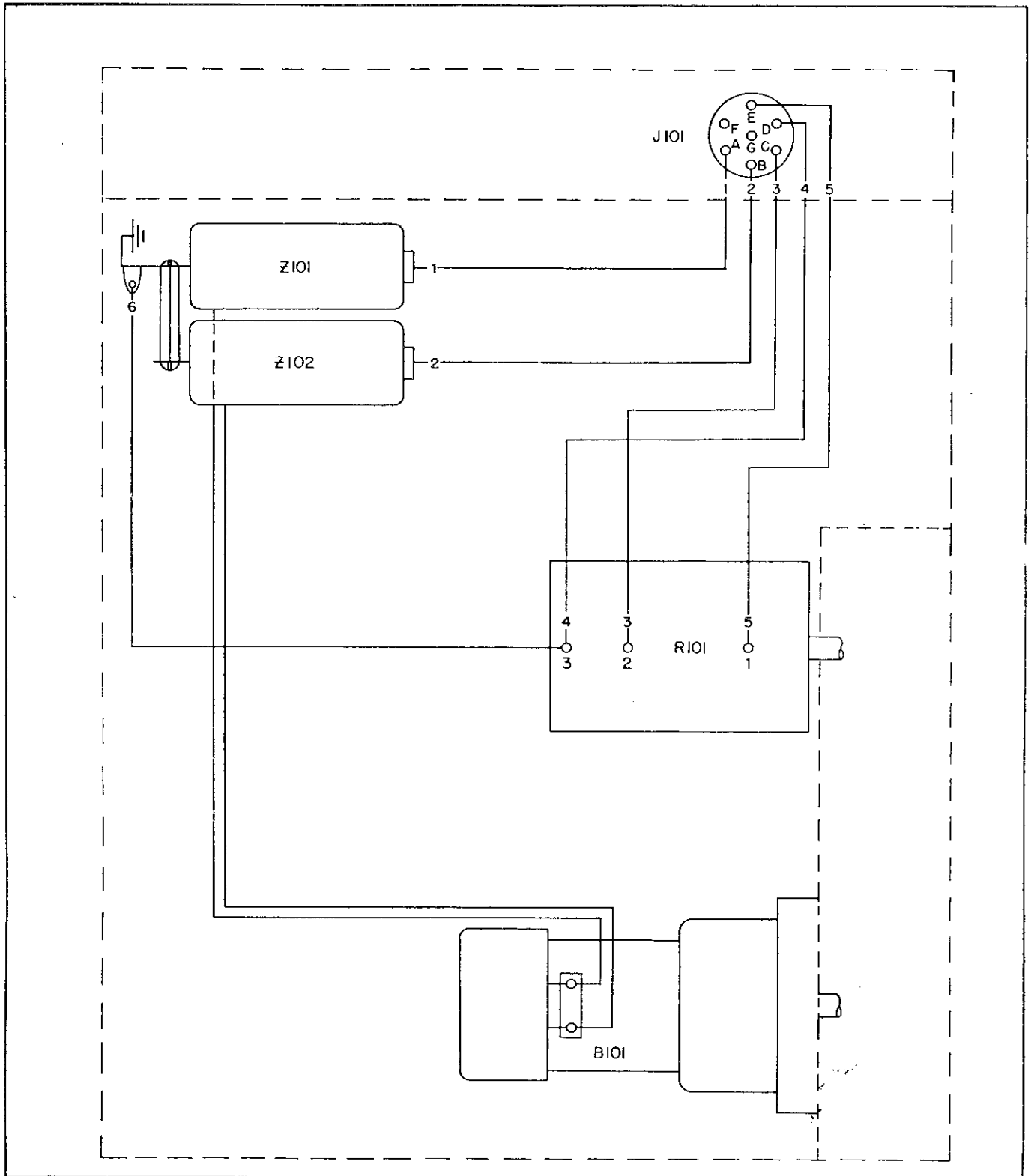


Figure 6-5. Practical Wiring Diagram of Tuning Drive PD-5A/ARA-19 or PD-5B/ARA-19

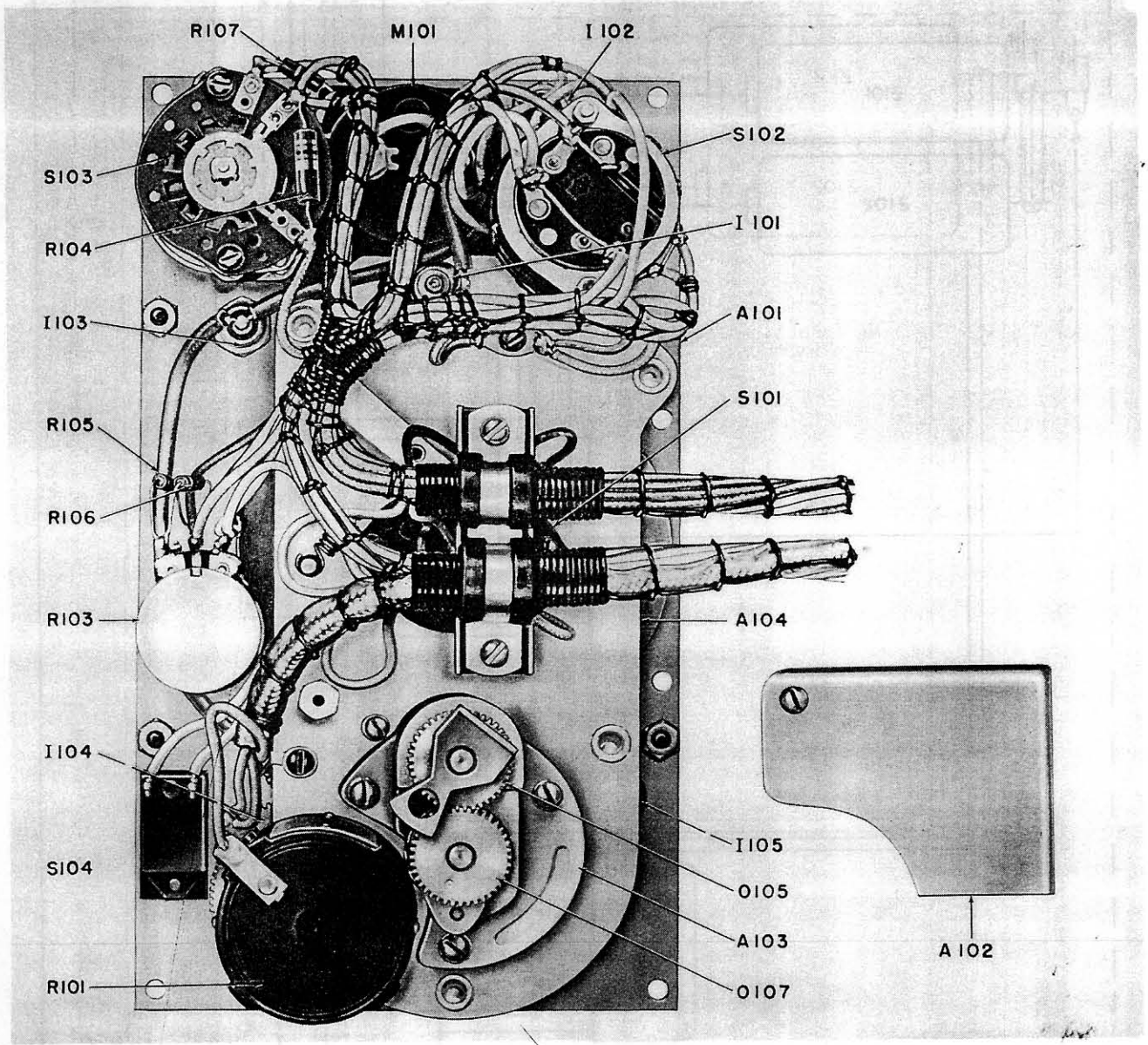


Figure 6-6. Rear View of Control Panel C-423B/A

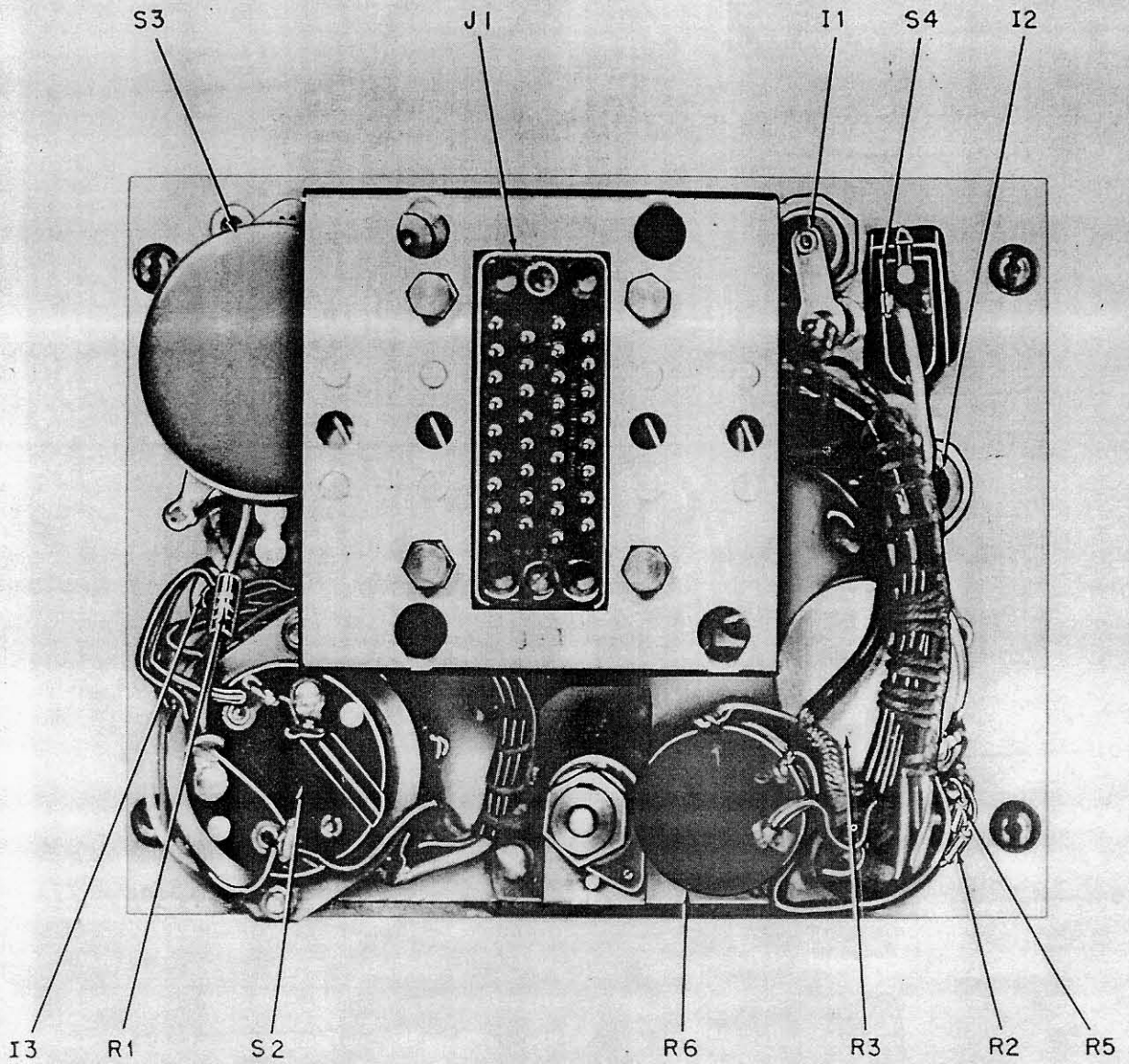


Figure 6-7. Rear View of Control Direction Finder C-1513/A

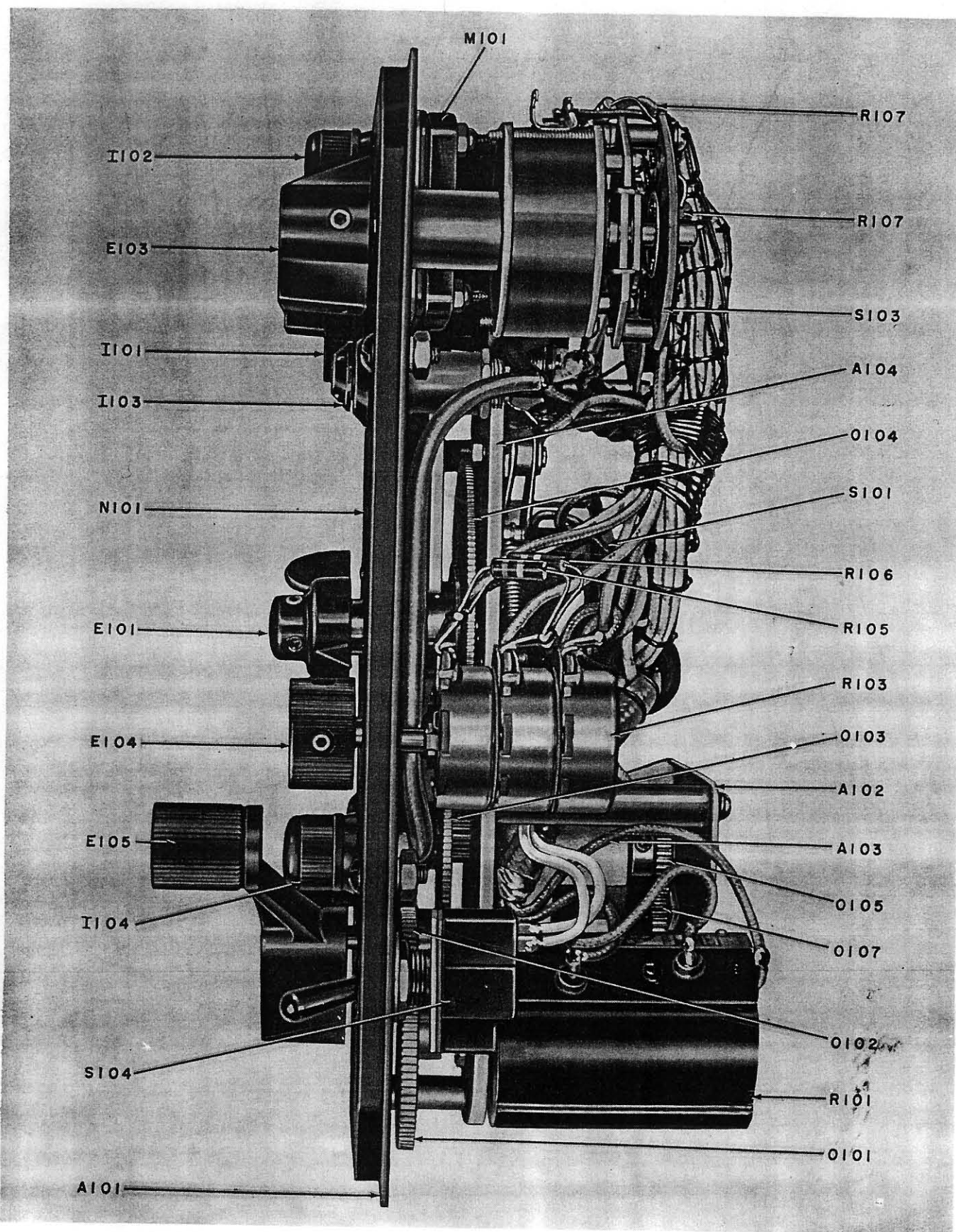


Figure 6-8. Right Side View of Control Panel C-423B/A

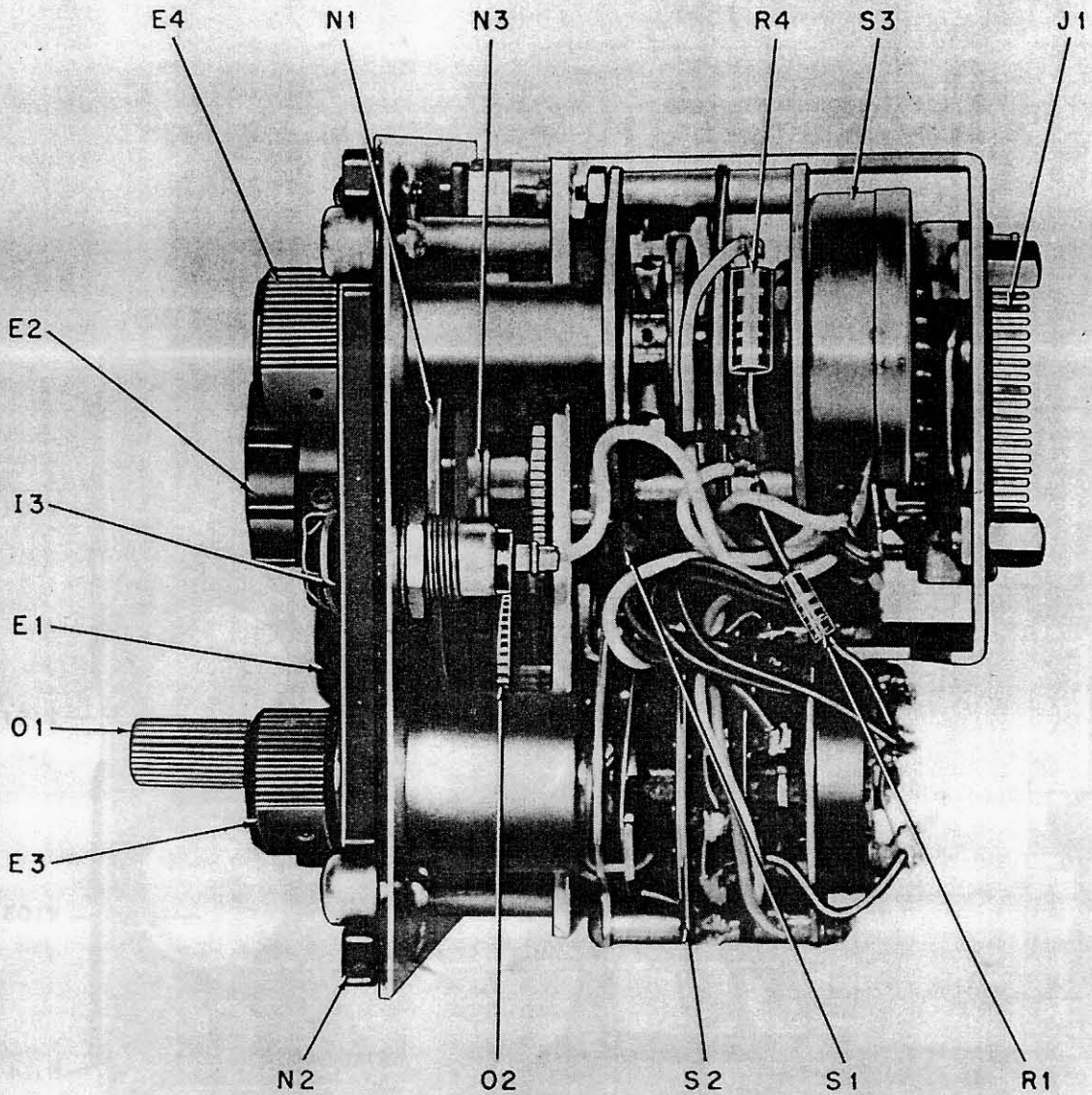


Figure 6-9. Right Side of Control Direction Finder C-1513/A

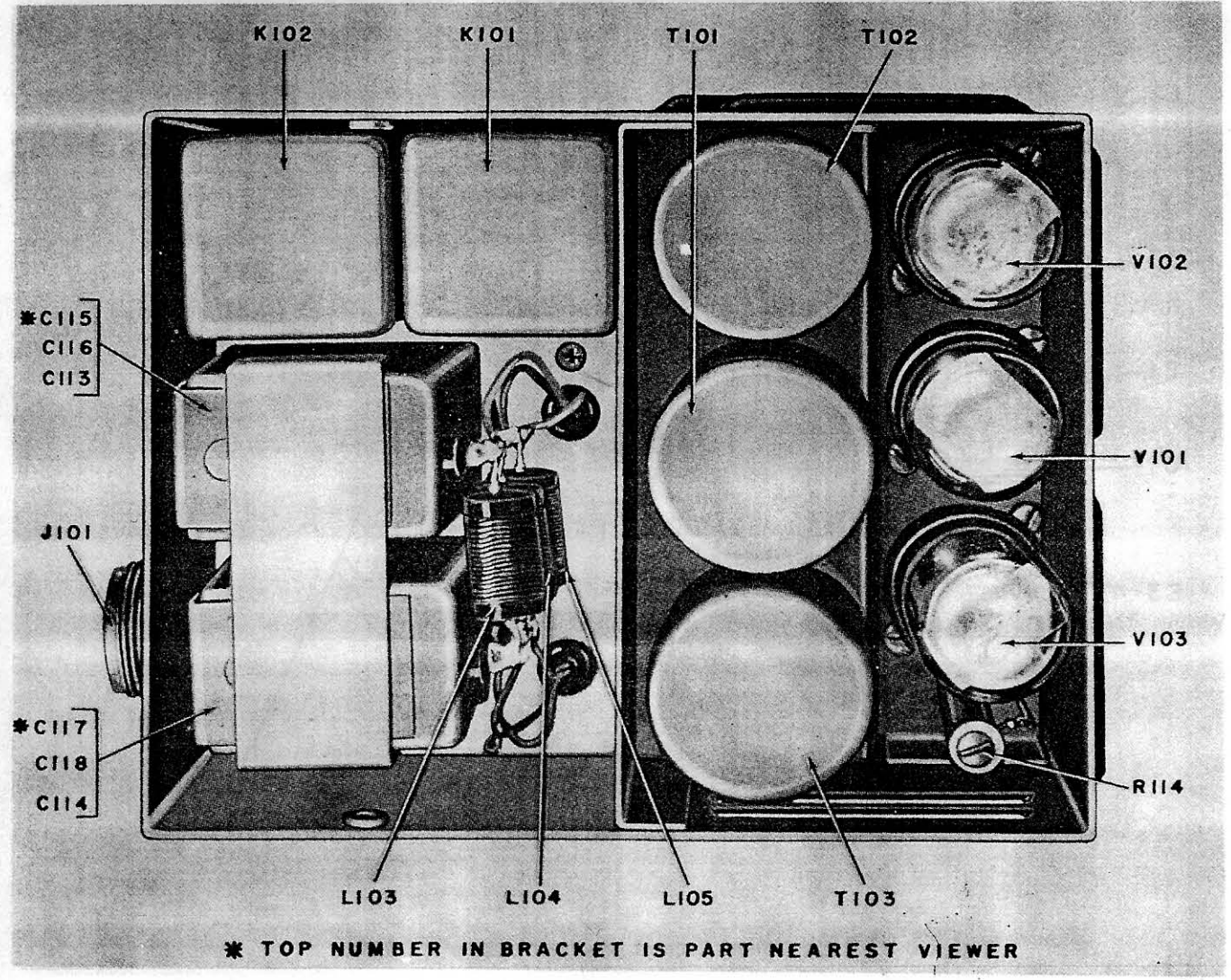


Figure 6-10. Top View of Amplifier AM-203/ARA-19

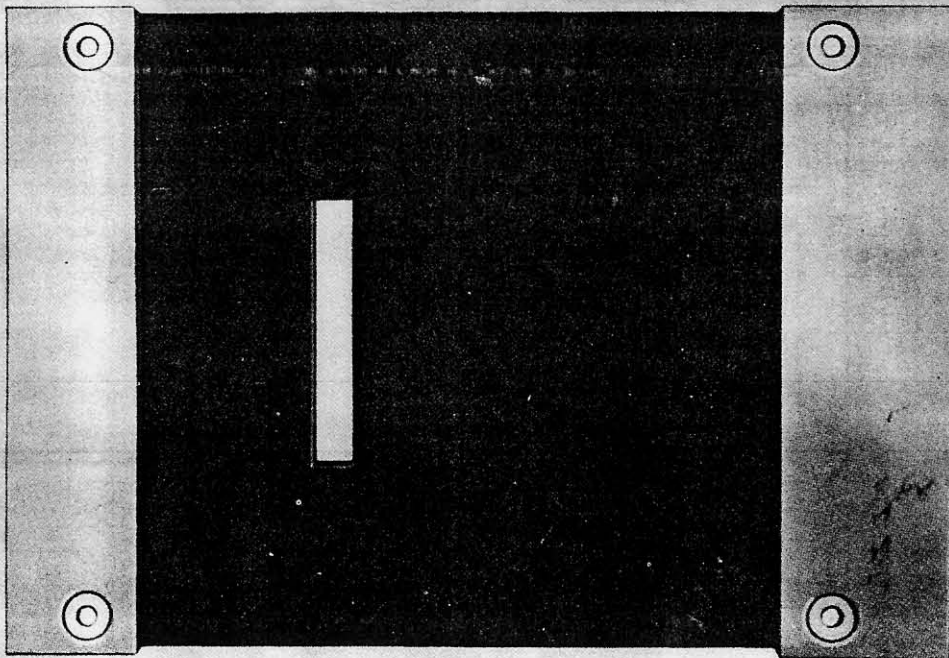
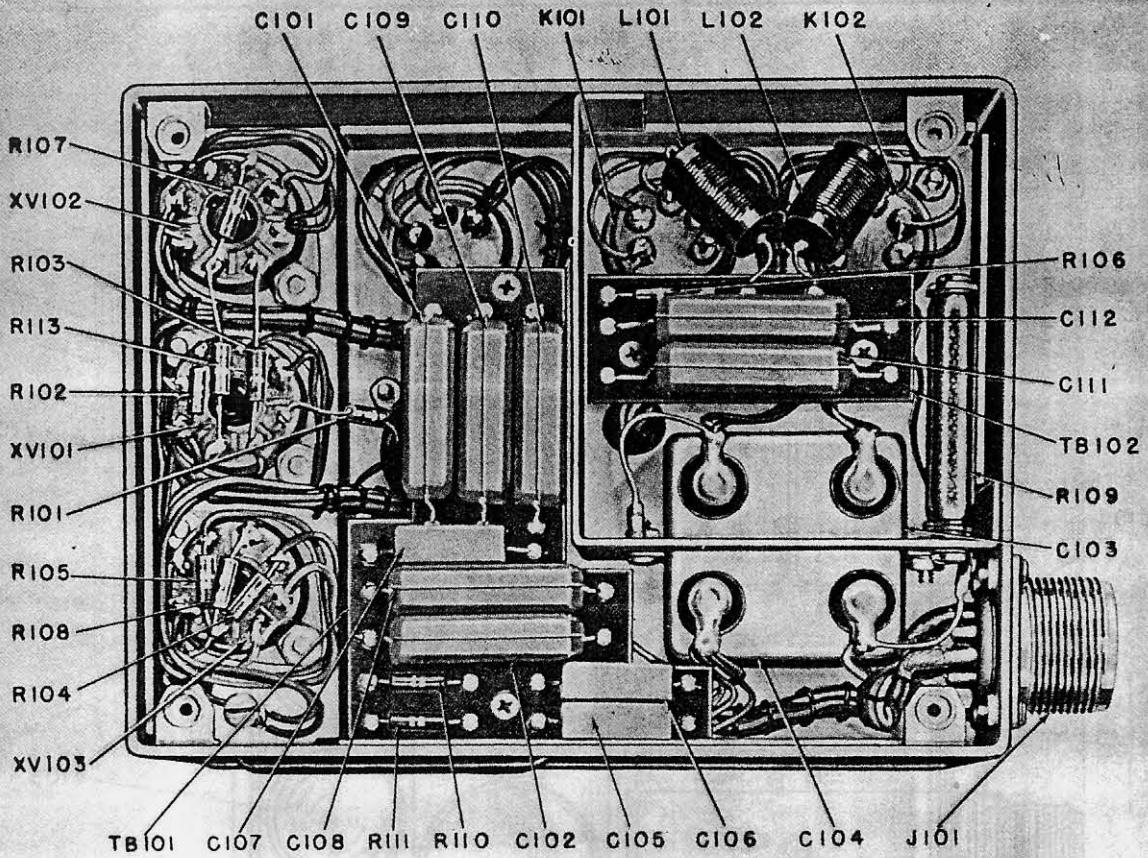


Figure 6-11. Bottom View of Amplifier AM-203/ARA-19

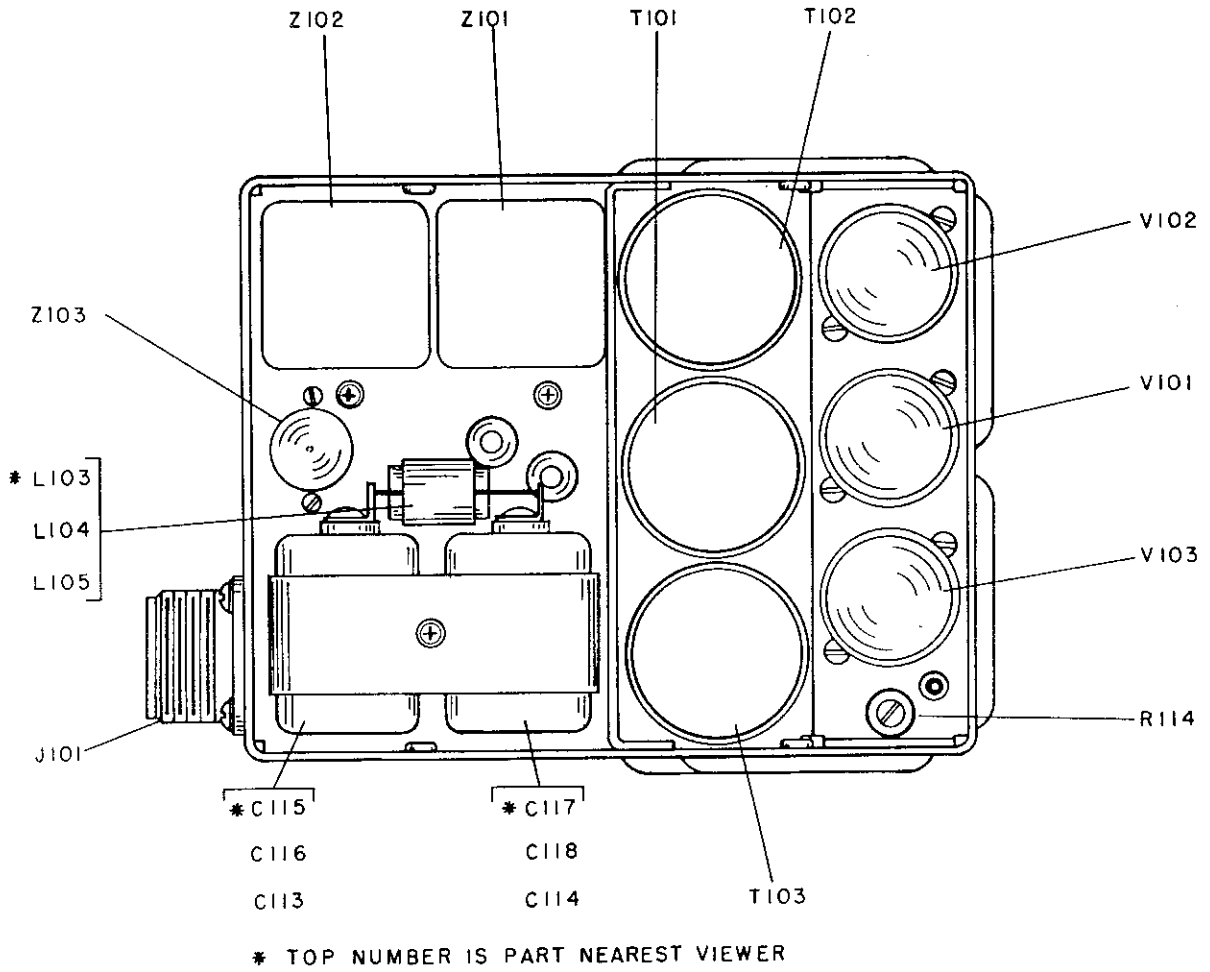


Figure 6-12. Top View of Amplifier AM-203B/ARA-19.

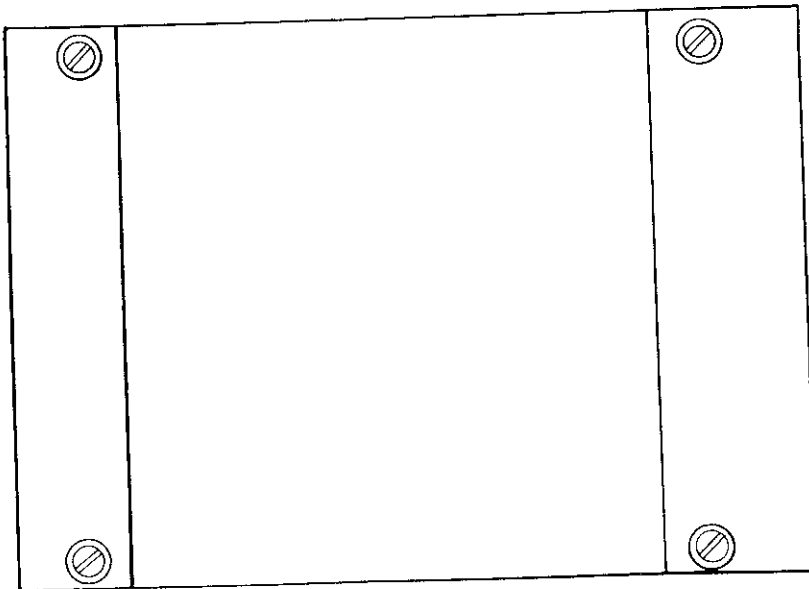
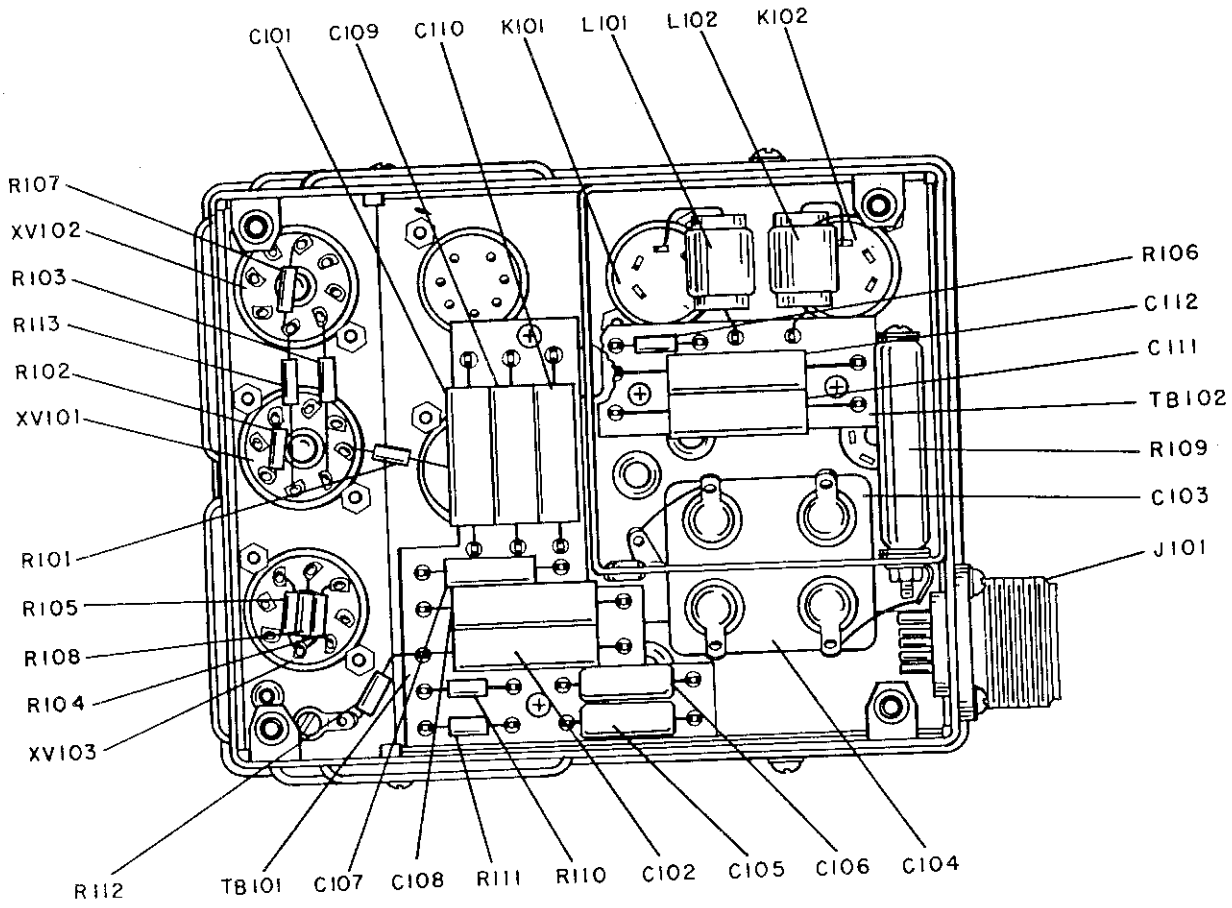
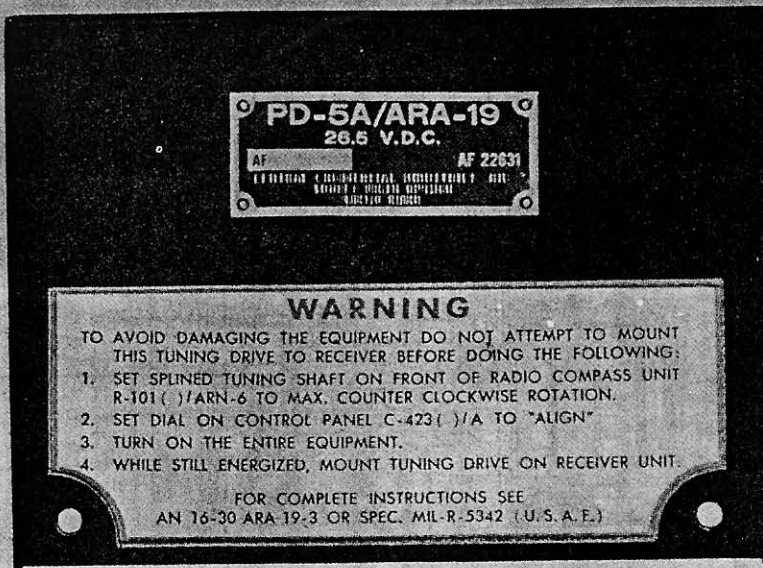


Figure 6-13. Bottom View of Amplifier AM-203B/ARA-19.



CABINET COVER

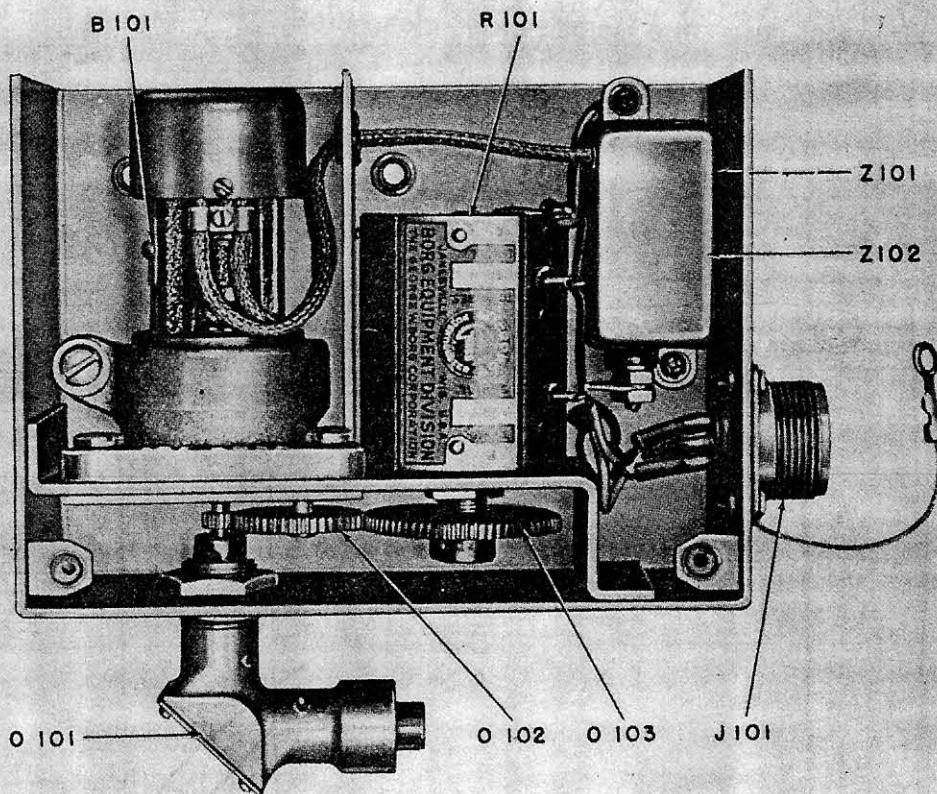


Figure 6-14. Front View of Tuning Drive PD-5A/ARA-19 or PD-5B/ARA-19.

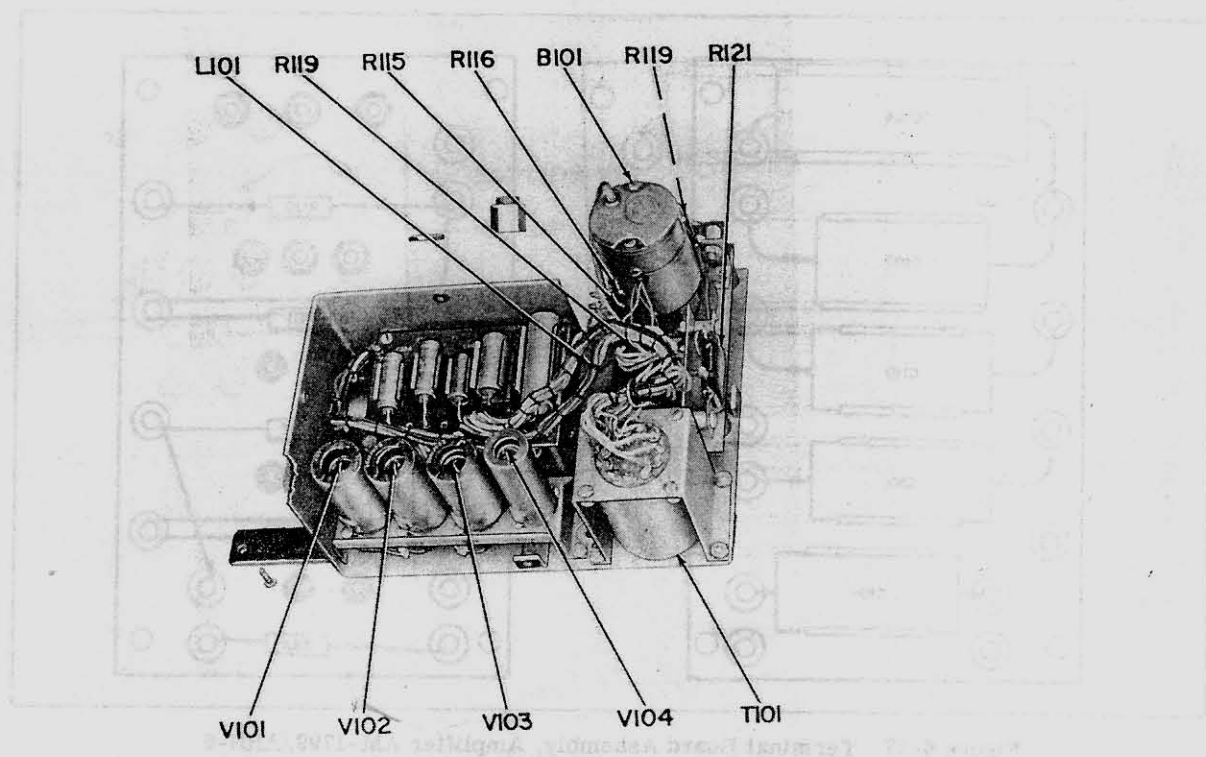


Figure 6-15. Top View of Electronic Control Amplifier AM-1799/ARN-6

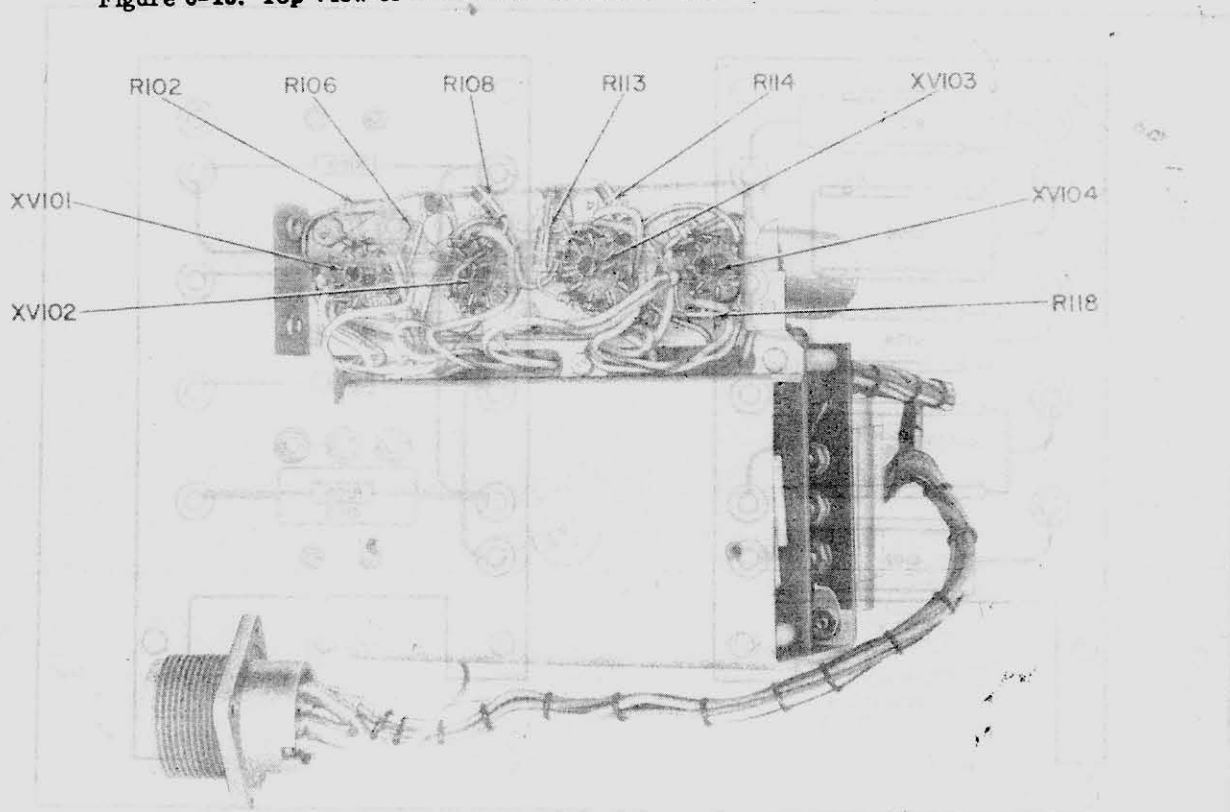


Figure 6-16. Bottom View of Amplifier Assembly, Amplifier AM-1799/ARN-6

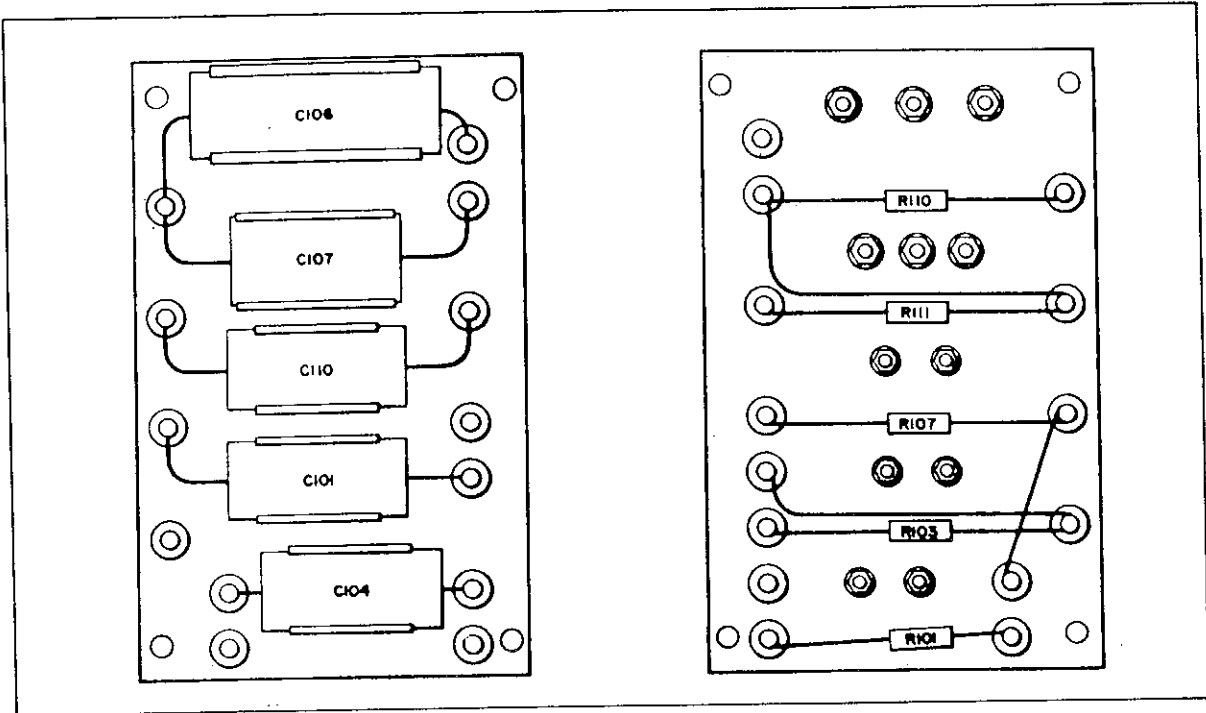


Figure 6-17. Terminal Board Assembly, Amplifier AM-1799/ARN-6

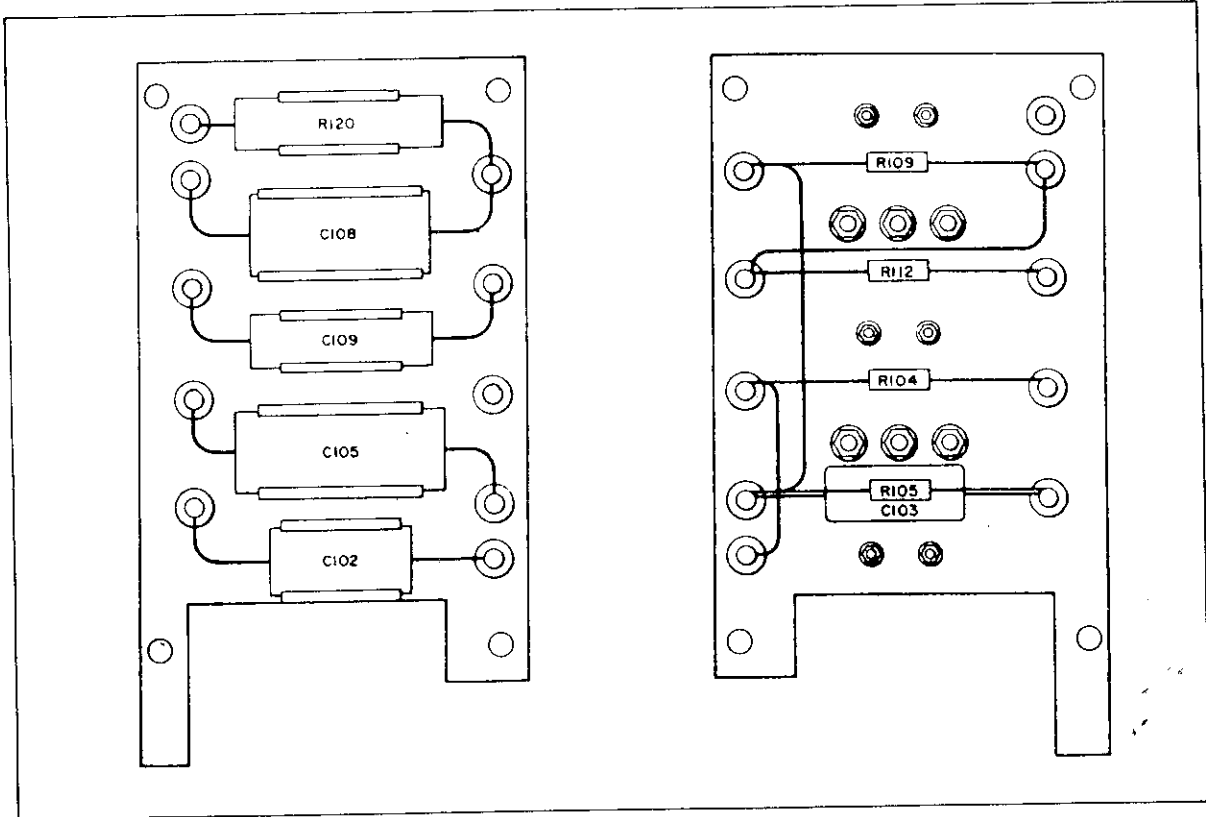


Figure 6-18. Terminal Board Assembly, Amplifier AM-1799/ARN-6

SECTION VII

DIAGRAMS

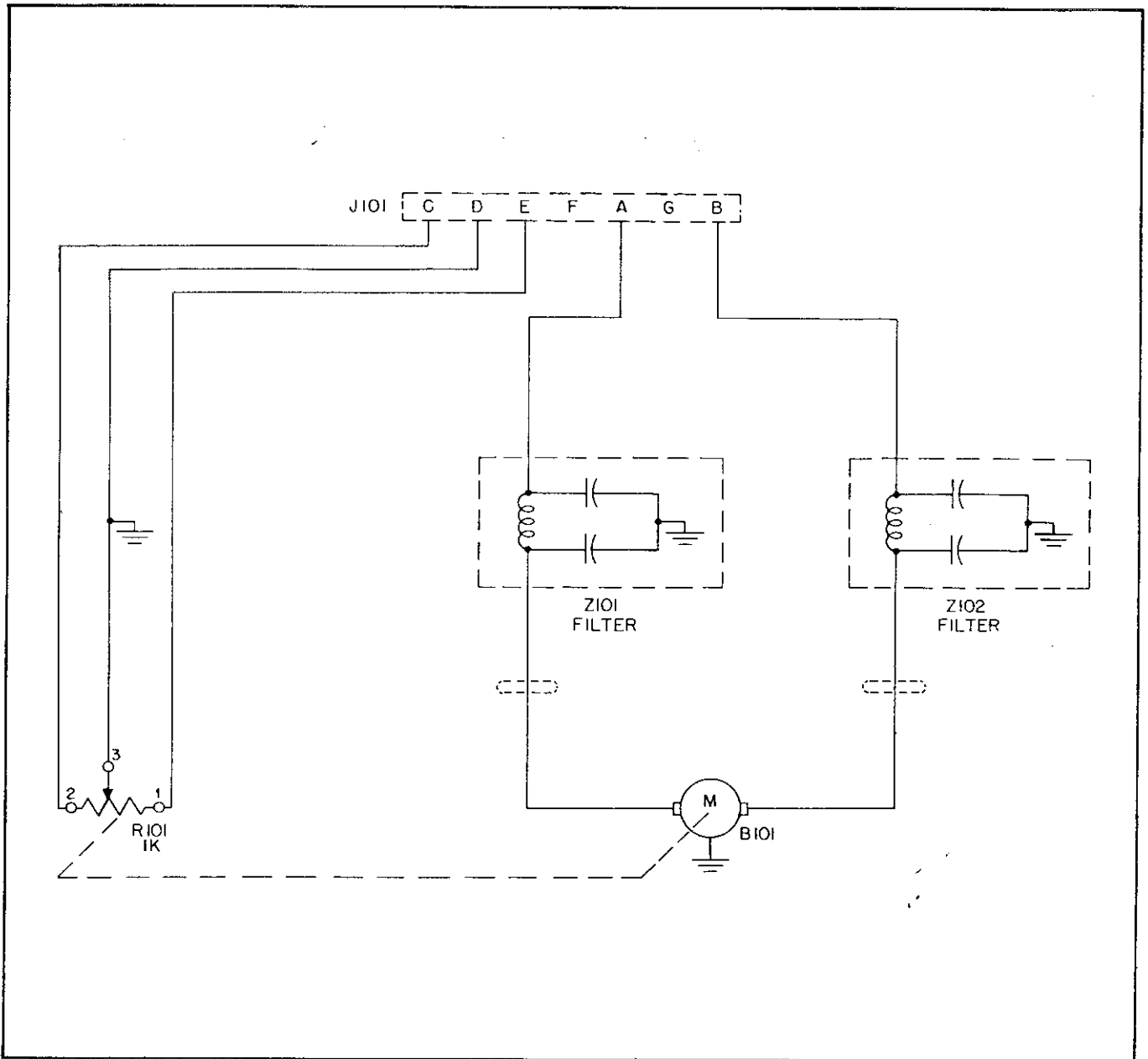


Figure 7-1. Schematic Diagram of Tuning Drive PD-5A/ARA-19 or PD-5B/ARA-19

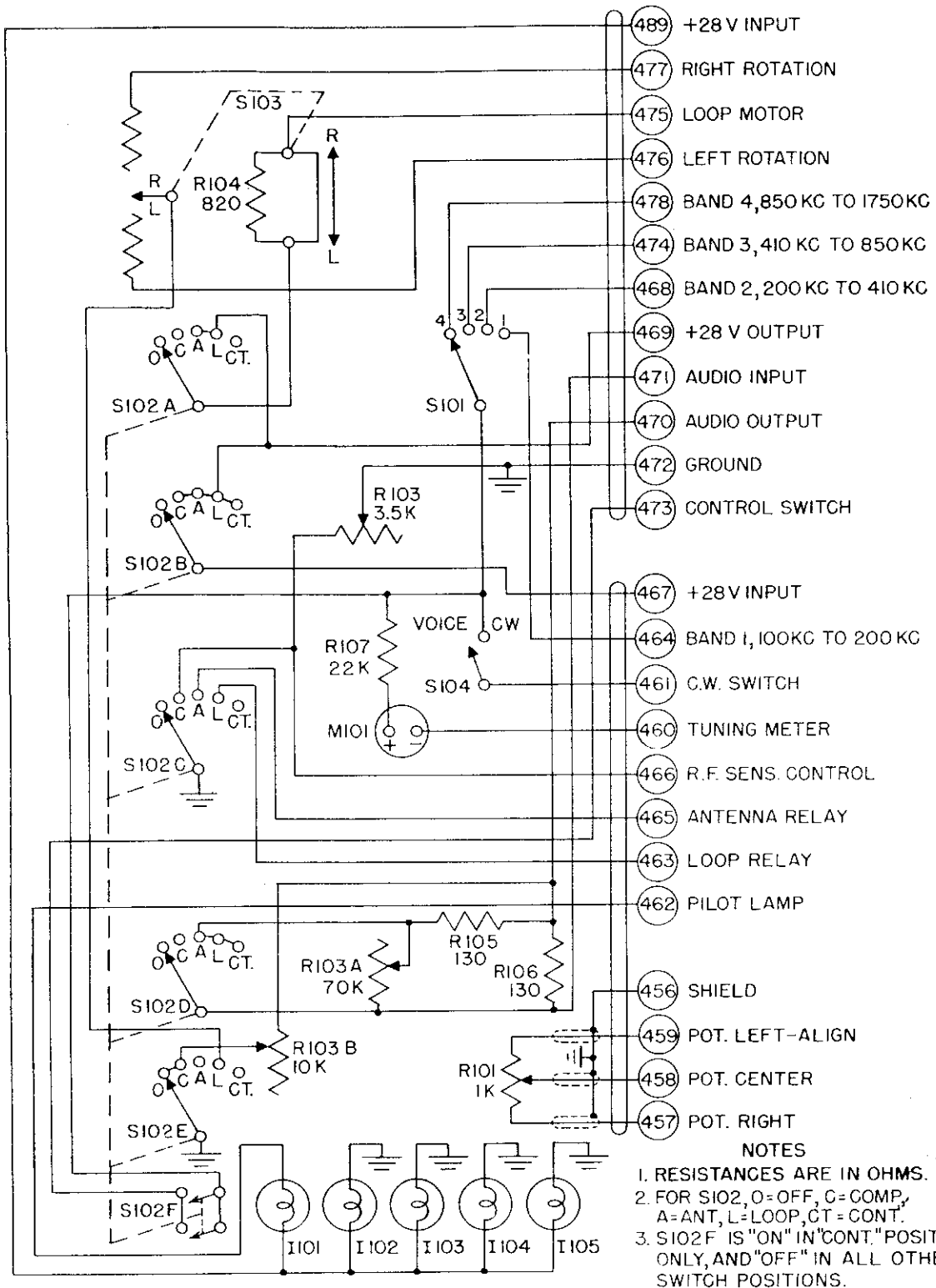


Figure 7-2. Schematic Diagram of Control Panel C-423B/A

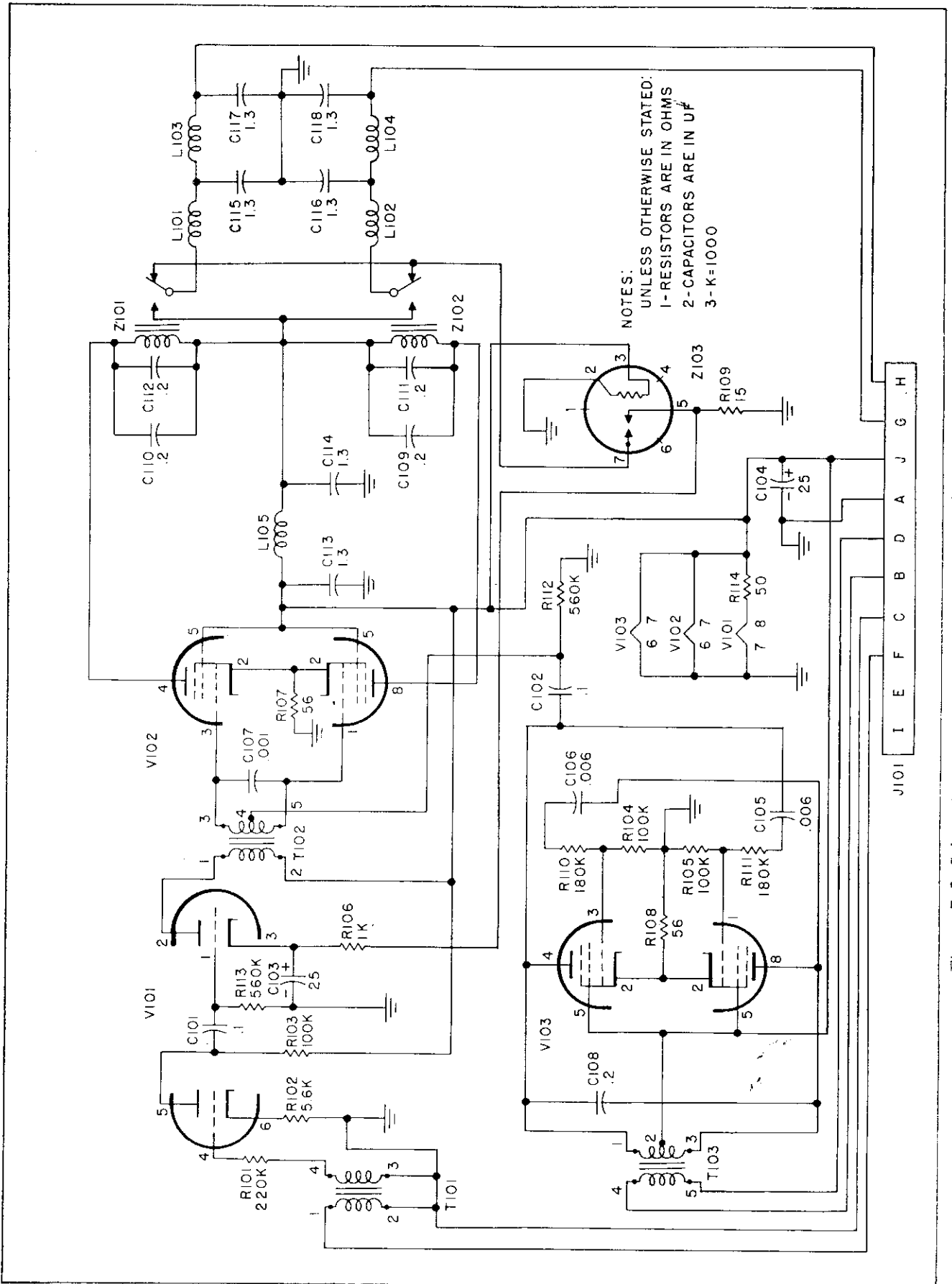


Figure 7-5. Schematic Diagram of Amplifier AM-203B/ARA-19.

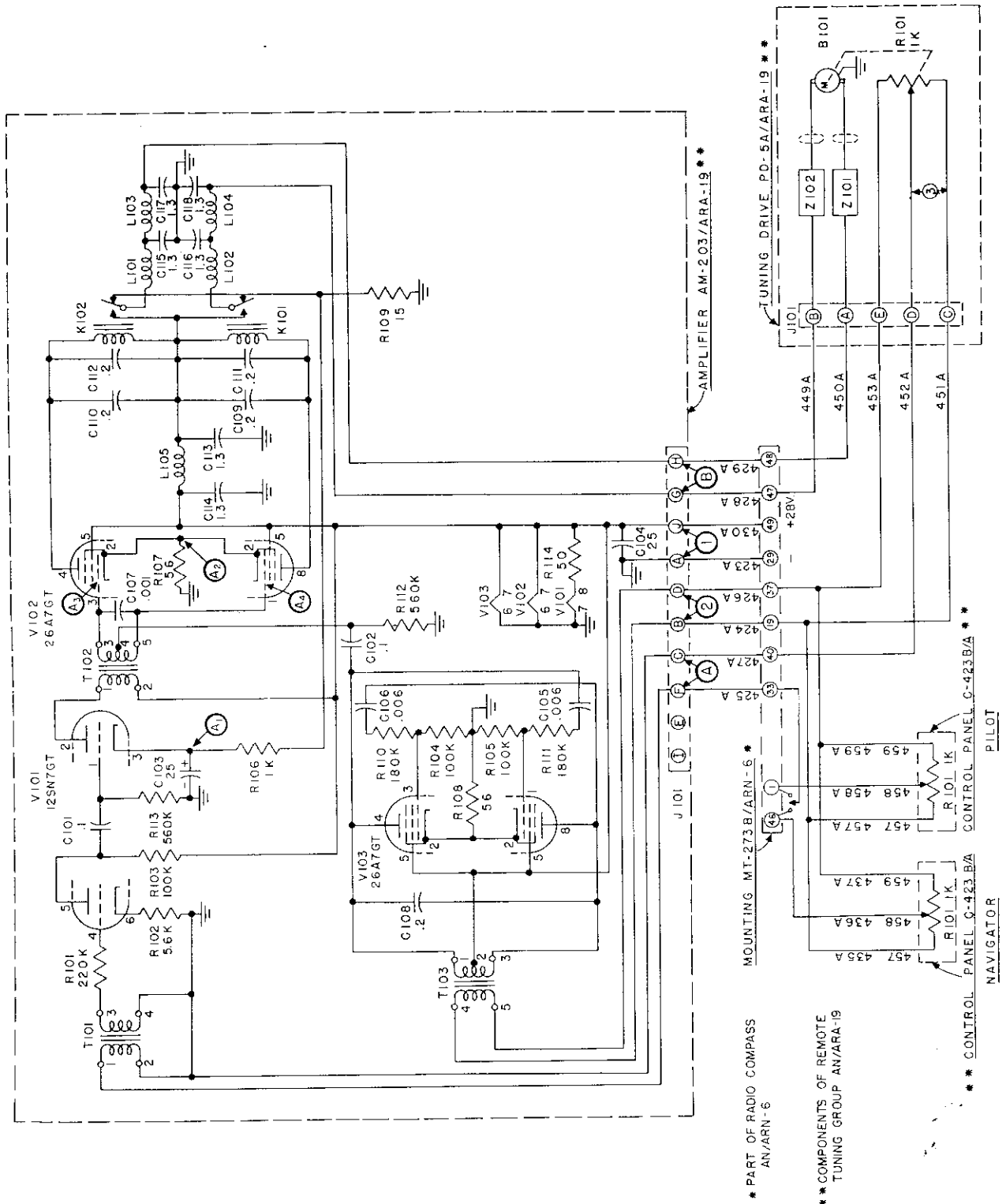


Figure 7-6. Schematic Diagram of Remote Tuning Group AN/ARA-19
 (Applicable to Central Commercial Industries Contract Numbers AF33(600)-26331 and AF33(600)-16340 only.)

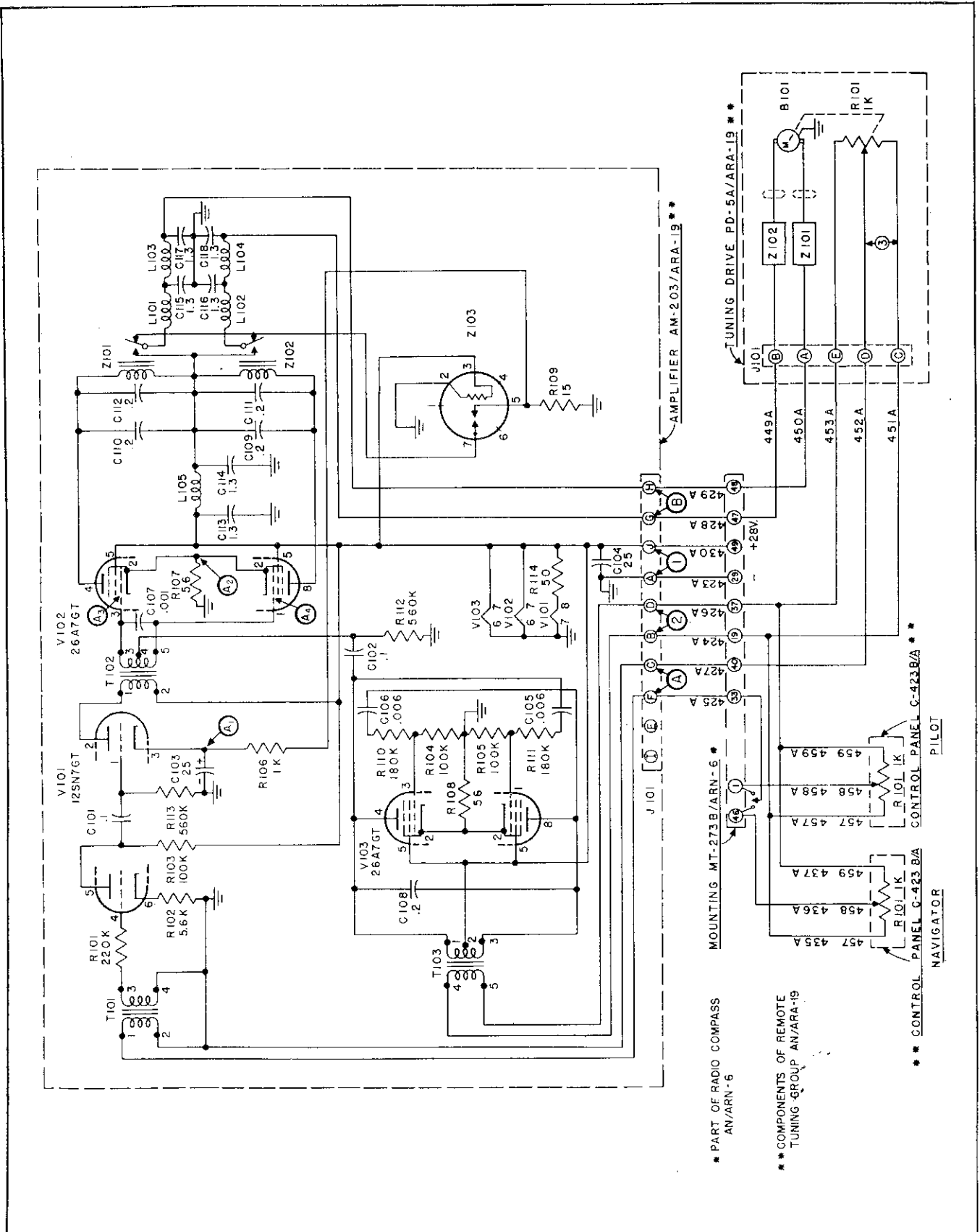


Figure 7-7. Schematic Diagram of Remote Tuning Group AN/ARA-19 (Applicable to Central Commercial Industries Contract Number AF33(600)-27279 only.)

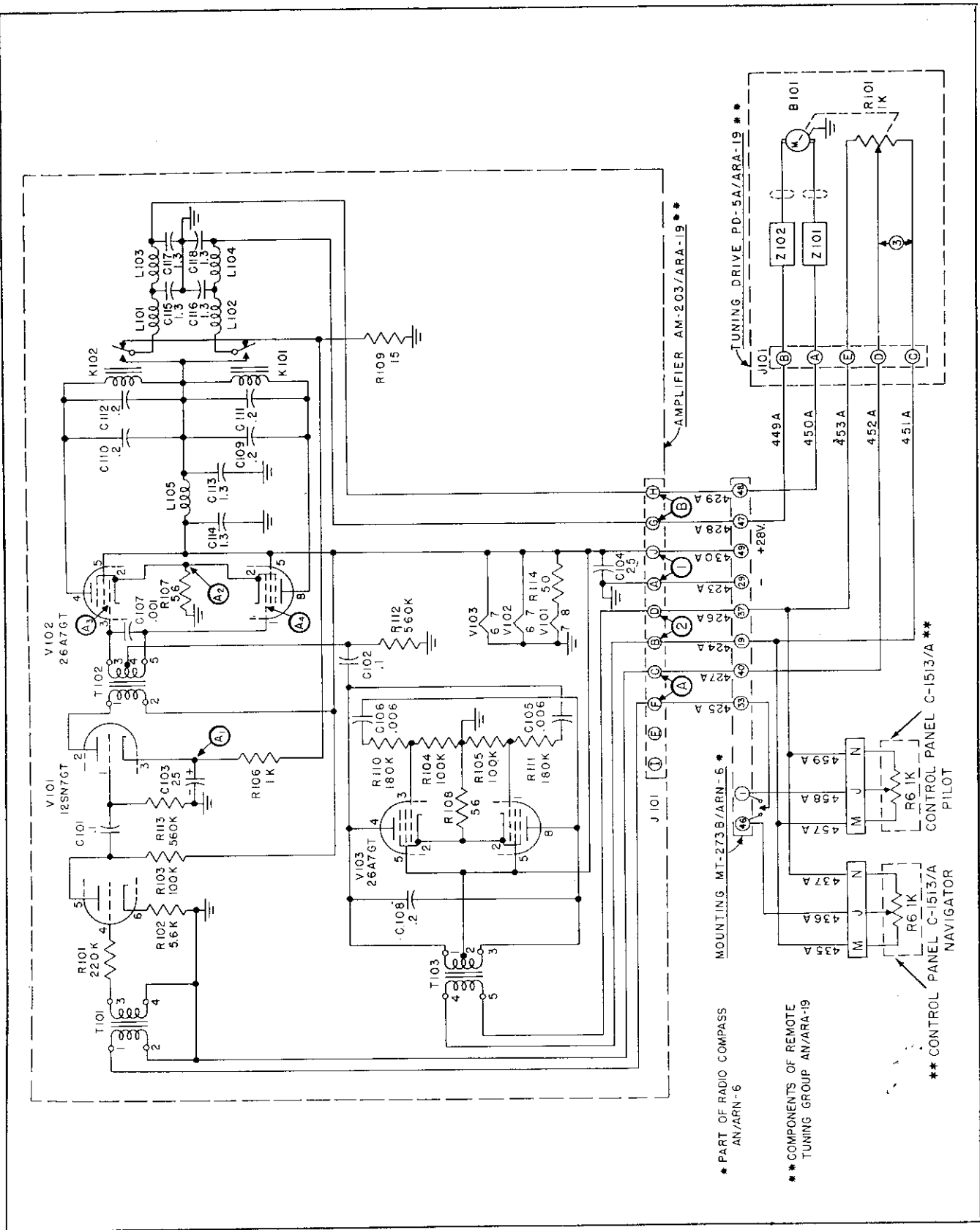


Figure 7-8. Schematic Diagram of Remote Tuning Group AN/ARA-19, Using Control Panel C-1513/A, Amplifier AM-203/ARA-19, and Tuning Drive PD-5A/ARA-19

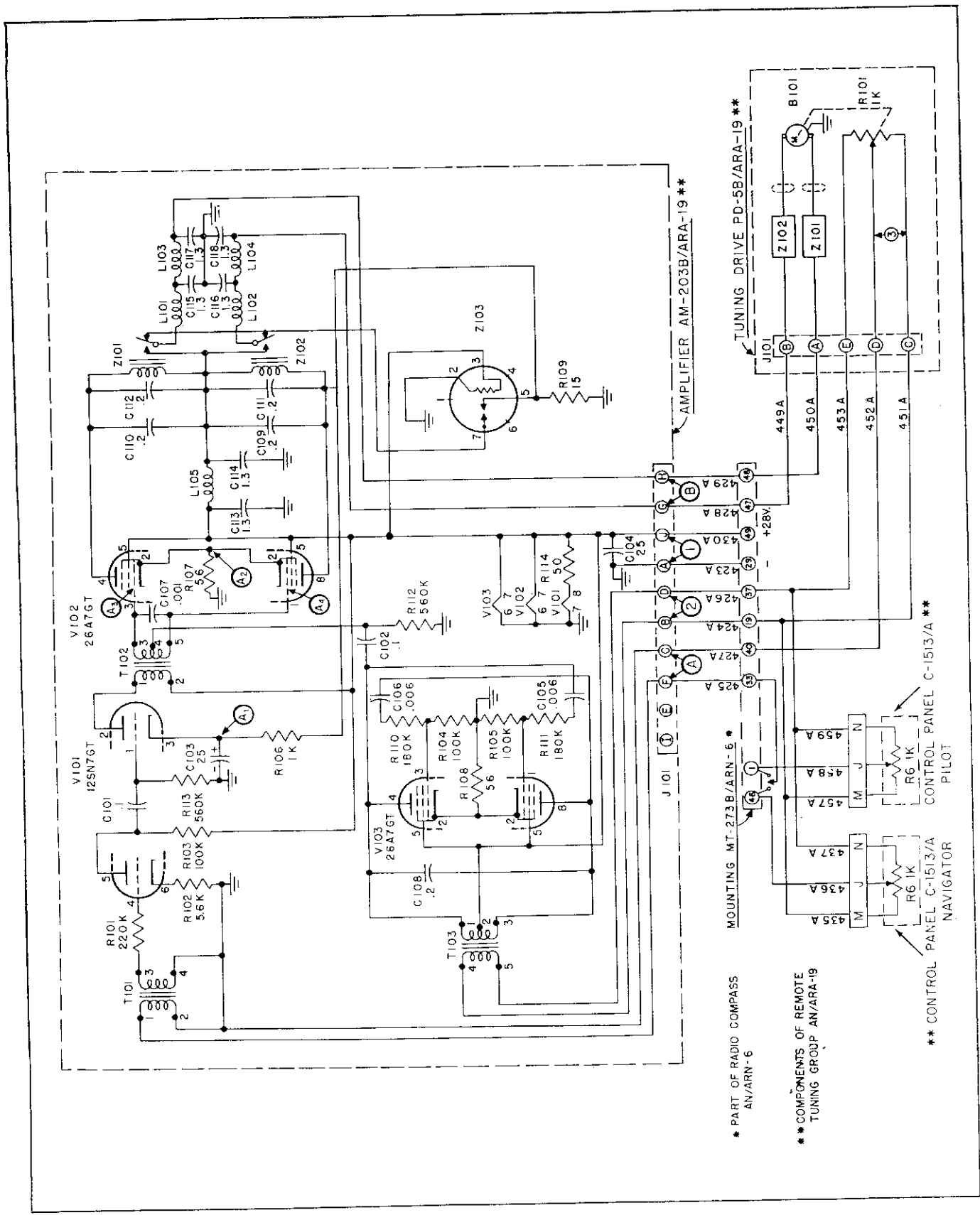
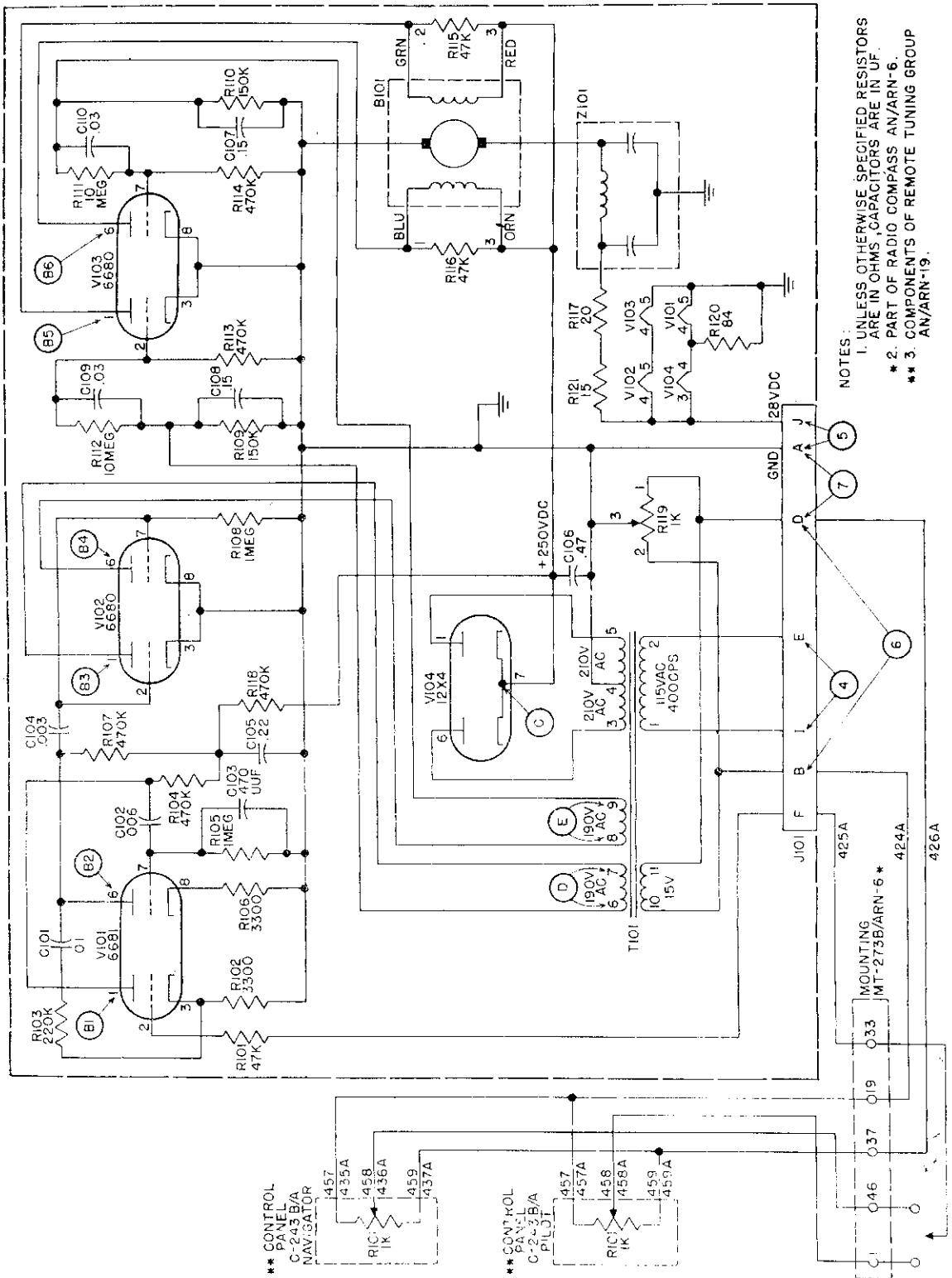


Figure 7-9. Schematic Diagram of Remote Tuning Group AN/ARA-19, Using Control Panel C-1513/A, Amplifier AM-203B/ARA-19, and Tuning Drive PD-5B/ARA-19



NOTES:
 1. UNLESS OTHERWISE SPECIFIED RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF.
 ** 2. PART OF RADIO COMPASS AN/ARN-6.
 *** 3. COMPONENTS OF REMOTE TUNING GROUP AN/ARN-19.

Figure 7-10. Schematic Diagram of Remote Tuning Group AN/ARA-19