

Code-a-phone[®]



MODEL 210DC

SERVICE MANUAL

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FORD INDUSTRIES INC.

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SECTION I

DESCRIPTION

GENERAL

The Code-a-phone Model 210DC is an automatic tape recorder designed primarily to transmit announcements through a telephone central office intercept trunk. It has capabilities for transmitting an announcement of up to three minutes duration into one hundred telephone lines simultaneously. In addition, the Model 210DC is able to reproduce announcements directly into loudspeakers, public address amplifiers, and radio transmitters, allowing it to be used for many special applications.

The Model 210DC utilizes a plug-in tape deck which may be easily removed for servicing. The tape deck provides a

maximum recording capacity of three minutes and incorporates a variable cycle feature to set the announcement length each time it is recorded. Announcements are recorded and checked with a telephone-type handset or headset, provided by the user.

The Model 210DC requires a 48 volt D.C. supply for power. The machine is designed especially for applications where continued operation is essential after failure of the local A.C. power source.

SPECIFICATIONS

GENERAL

WEIGHT	12-1/2 pounds (shipping weight 15-1/2 pounds)
FRONT PANEL DIMENSIONS	19" wide (fits standard 19" rack) 5-1/4" wide
DIMENSIONS BEHIND	
FRONT PANEL	16-7/8" wide 5-1/8" high 5-1/2" deep
STANDARD EQUIPMENT	Phone Plug

ELECTRICAL

POWER REQUIREMENTS	44 - 52 volts, direct current only 0.7 amperes @ 48 volts (maximum) 0.02 amperes @ 48 volts (in standby AUTO.)
AMBIENT TEMPERATURE	
OPERATING RANGE	0° F. to 120° F.
RECORDING CAPACITY	3 minutes
REWIND TIME	1/6 of announcement time
TAPE SPEED	1-5/8 ips
FREQUENCY RESPONSE	300 - 3000 Hz
HARMONIC DISTORTION	Less than 3%
WOW AND FLUTTER	Less than 1%
SIGNAL TO NOISE RATIO	Better than 35 DB

TELEPHONE LINE

OUTPUT IMPEDANCE	4 Ω , internally loaded
AUDIO POWER OUTPUT	1 watt
ANNOUNCEMENT LEVEL	-3 DBM, average. Unchanged when loaded with up to 100 600 Ω telephone lines.

SECTION II

OPERATING INSTRUCTIONS

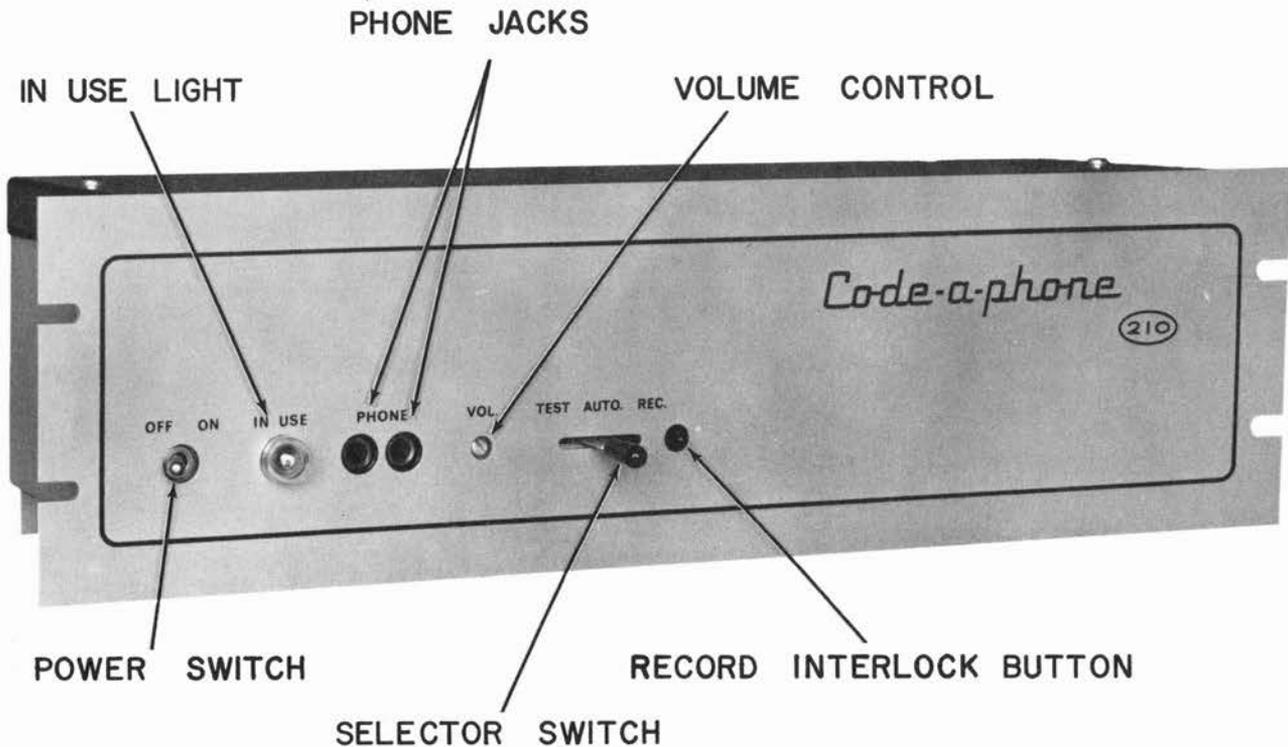


FIGURE 2-1 MODEL 210DC FRONT VIEW

TO RECORD AN ANNOUNCEMENT

1. Plug the handset or headset phone plug into the PHONE JACKS.
2. Set the POWER SWITCH to ON position.
3. While lifting the RECORD INTERLOCK BUTTON, hold the SELECTOR SWITCH in REC. position.
4. When the IN USE light comes on (in about 2 seconds), dictate the announcement. The previous announcement will be erased as the new one is being recorded.
5. When the announcement is completed, release the SELECTOR SWITCH. The announcement length will be set automatically and the tape deck will rewind.

TO TEST THE ANNOUNCEMENT

1. Plug the handset or headset phone plug into the PHONE JACKS.
2. Set the POWER SWITCH to ON position.
3. Hold the SELECTOR SWITCH in TEST position. The announcement will be reproduced through the handset or headset.

AUTOMATIC INTERCEPT

Set the POWER SWITCH to ON position. The Model 210DC will reproduce the announcement at telephone line terminals 1

and 2 (fig. 3-1) whenever terminals 5 and 7 are shorted momentarily.

SECTION III INSTALLATION

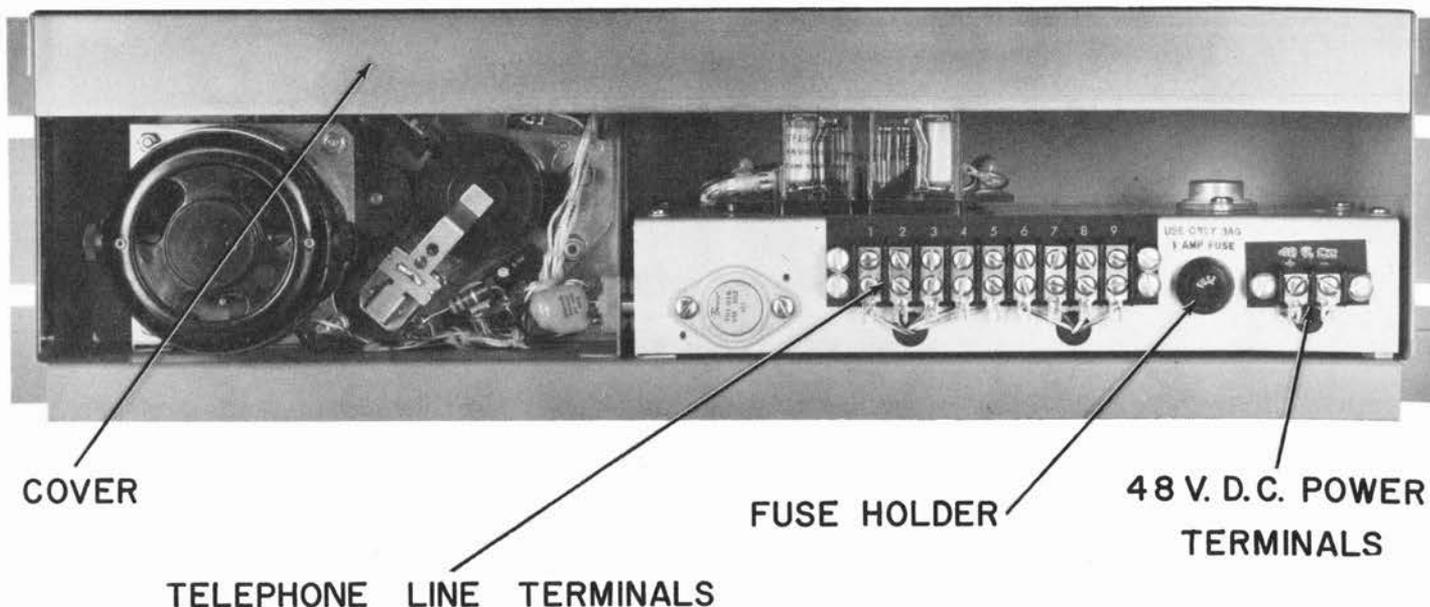


FIGURE 3-1 MODEL 210DC REAR VIEW

LOCATION

Mount the Model 210DC in a standard 19" relay rack. Choose an area of low background noise, so that room sounds will not be recorded along with the announcement.

CONNECTIONS

1. Connect a telephone-type handset or headset to the phone plug supplied with the Model 210DC. Connect as shown in fig. 3-2. Polarity is not critical, and one side of the microphone and receiver may be common.
2. The Model 210DC is intended to operate with an Intercept Trunk, a part of a telephone Central Office that accesses the Selector or Connector level of switching. There are many types of Intercept Trunks, and the Model 210DC connections must be determined individually for each installation.

Fig. 3-3 shows the control terminations provided in the Model 210DC. Any of the terminals may be grounded to the chassis, providing that the positive (+) terminal of the 48 volt D.C. supply is connected to chassis ground in the relay rack. If the negative (-) terminal of the 48 volt D.C.

supply is connected to the relay rack, do not ground terminals 5, 6, 7, 8, or 9, or severe damage to the Model 210DC will result. It is all right, in any case, to ground terminals 1, 2, 3, or 4.

The low (4 Ω) audio output impedance of the Model 210DC allows it to be matched electrically to any audio line by adding external resistors. For example, adding a 250 Ω resistor in series with each audio lead will provide a source impedance of 500 Ω . Fig. 3-3 shows the method for matching the output to several 600 Ω lines.

Connect a 44 to 52 volt D.C. battery or power supply to the POWER TERMINALS (fig. 3-1). Make sure that the correct polarity is observed, or the Model 210DC will be damaged.

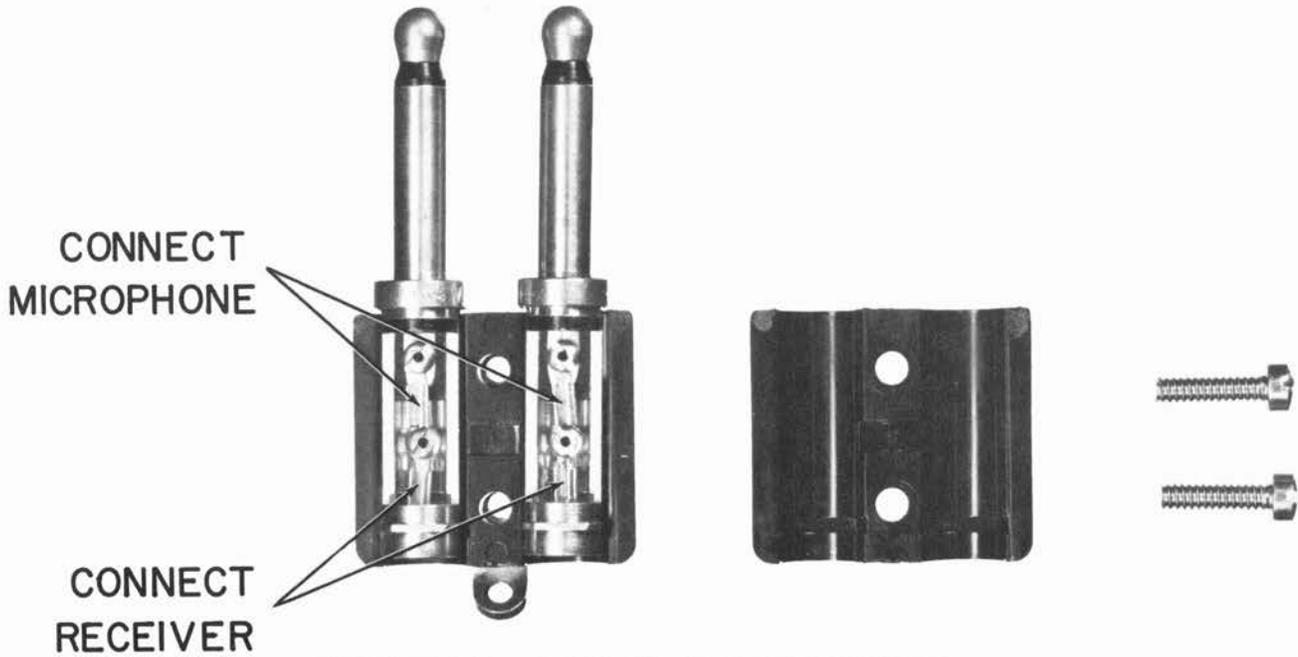


FIGURE 3-2 PHONE PLUG DISASSEMBLED

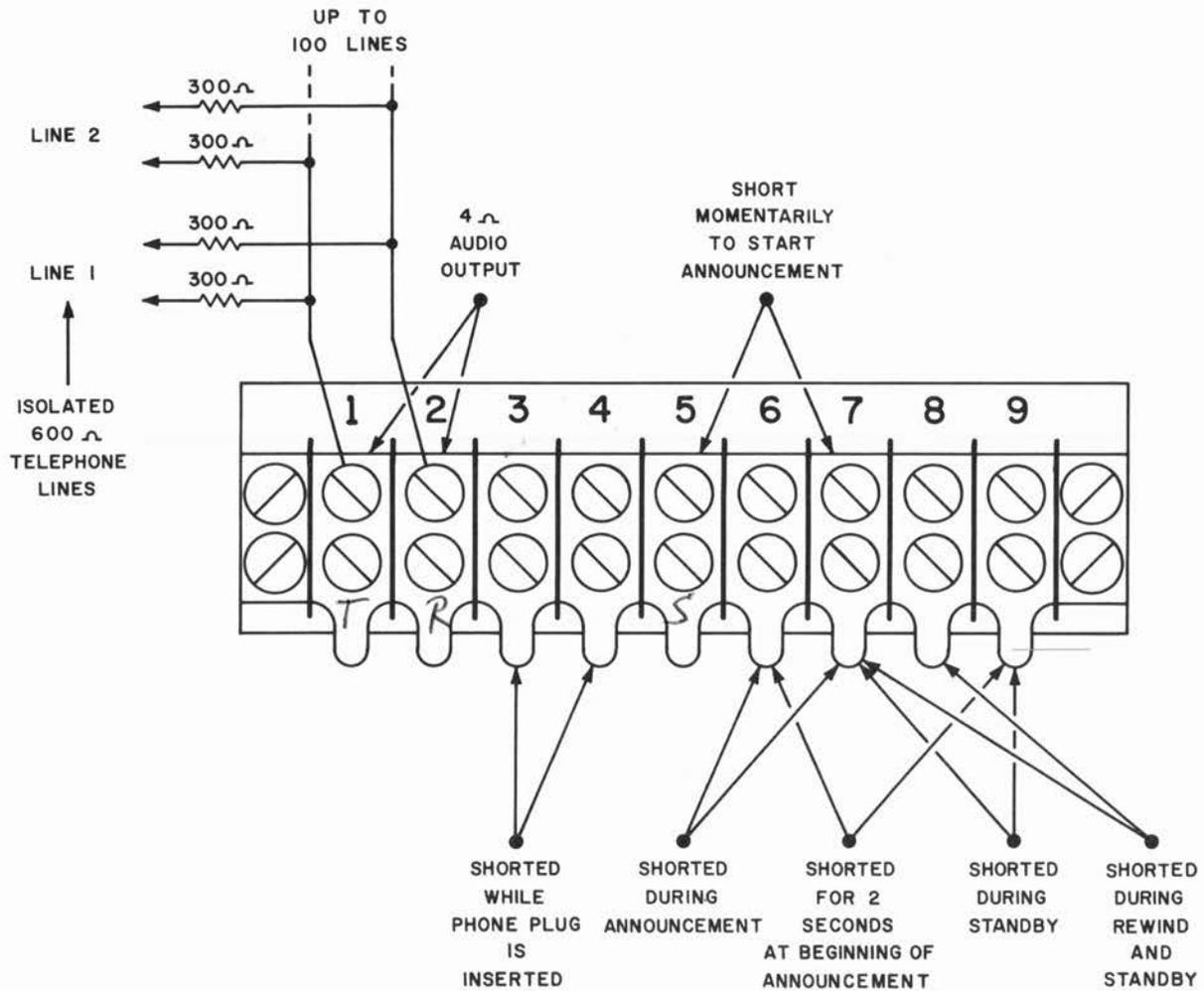


FIGURE 3-3 TELEPHONE LINE TERMINALS

SECTION IV MAINTENANCE

PREVENTIVE MAINTENANCE

The Model 210DC was designed to operate for long periods without requiring maintenance attention. Machine parts have been selected carefully for their ability to resist wear and aging, and all components operate at far below their ratings. With the exception of the carbon motor brushes, wear and deterioration are not anticipated for the normal life of the machine.

However, a slow but inevitable building up of recording tape oxide on the tape deck mechanism will gradually reduce the audio quality of the recorded announcements. Under normal conditions, the oxide residue should be cleaned from the tape deck every one thousand hours of machine operation. This will occur every six weeks if the machine is operating continuously, every three months if the machine is operating 50% of the time, every 14 months if the machine is operating 10% of the time, etc.

It must be noted that severe environments of heat, cold, or chemical- or dust-laden air will shorten the interval for which preventive maintenance is required.

In addition, the condition of the carbon motor brushes should be checked every thousand hours of machine operation. Although brush life is expected to be much longer than this period, checking the brushes is an important safety precaution, as the motor rotor will be damaged if the brushes are allowed to wear completely out.

A Model 210DC can be maintained in top working condition by cleaning the tape deck (page 4-4), checking the motor brushes (page 4-2), and performing the CHECK-OUT (page 4-2) every one thousand hours of machine operation.

SERVICE PROCEDURE

Service of an "out of order" Model 210DC should follow four steps:

1. **Location of Trouble:** The quickest way to locate a trouble is to substitute, one by one, the plug-in components. If this method fails, study the CIRCUIT DESCRIPTION (starting on page 5-1), and compare the actions of the malfunctioning machine with the correct operation outlined.

Troubles in the amplifier and power regulator can be located by employing normal troubleshooting techniques, such as signal tracing and measuring voltages at critical points. The correct voltages are marked on the MODEL 210DC SCHEMATIC, on the last page of this manual. Note that the chassis is isolated from electrical ground by capacitor C101. Thus, D.C. voltages cannot be measured with reference to the chassis.

2. **Repair:** Often the best way to repair a Model 210DC is to

simply replace the faulty plug-in component. This allows the machine to be returned to service with a minimum of delay. The faulty component may then be repaired, tested, and returned to the spare parts stock at a later time.

Parts that are replaced in a Model 210DC must be of Telephone Grade quality or better. The Code-a-phone factory is the only **sure** source of quality repair parts. See page 6-1 for information on ordering.

3. **Adjustment:** If an electronic part is replaced, it is likely to change the amplifier adjustment. Re-adjust the amplifier (page 4-6) to restore the factory setting.

If a solenoid is replaced in the tape deck, adjust the plunger travel as described on page 4-5.

4. **Test:** Always test all functions of a Model 210DC after repairs are made. Follow the CHECK-OUT procedure below.

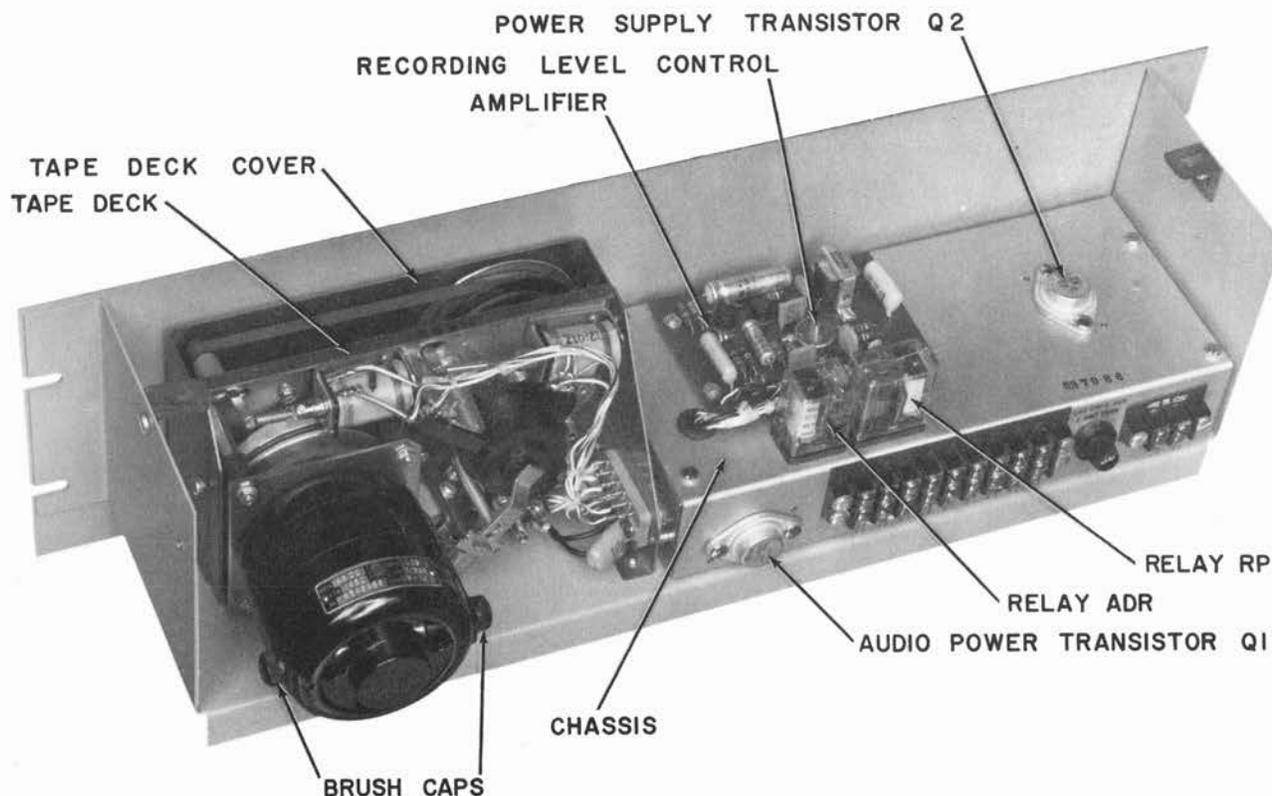


FIGURE 4-1 MODEL 210DC REAR VIEW, COVER REMOVED

CHECK-OUT

1. Connect the Model 210DC to a 48 volt D.C. power source.
2. Plug the handset or headset phone plug into the PHONE JACKS (fig. 2-1).
3. Referring to the OPERATING INSTRUCTIONS on page 2-1, record a test announcement. Make sure that the IN USE light works (fig. 2-1).
4. TEST the announcement with the handset or headset.
5. Connect a telephone-type receiver, telephone instrument, or any speaker across telephone line terminals 1 and 2 (fig. 3-1).
6. Momentarily short terminals 5 and 7. The announcement will play through the device connected in step 5.
7. Use an ohmmeter or continuity checker to verify the indications shown in fig. 3-3.
8. Erase the test announcement as follows:
 - a. Unplug the handset or headset.
 - b. Operate the Model 210DC in the REC. function.

DISASSEMBLY

1. MOTOR BRUSHES:
 - a. Unscrew brush cap (fig. 4-1) and remove motor brush and brush tension spring.
 - b. **Be sure** that brushes are replaced so that the concave contact surface matches the motor rotor.
2. AUDIO POWER TRANSISTOR Q1:
 - a. Remove 2 screws and unplug transistor.
 - b. **Be sure** to use the mica insulating washer when replacing transistor.
3. POWER SUPPLY TRANSISTOR Q2:
 - a. Remove 2 screws from top of machine and lift off cover (fig. 3-1).
 - b. Remove 2 screws and unplug transistor.
 - c. **Be sure** to use the mica insulating washer when replacing transistor.
4. RELAYS RP AND ADR:
 - a. Remove 2 screws from top of machine and lift off cover (fig. 3-1).
 - b. Release hold-down clip and unplug desired relay.

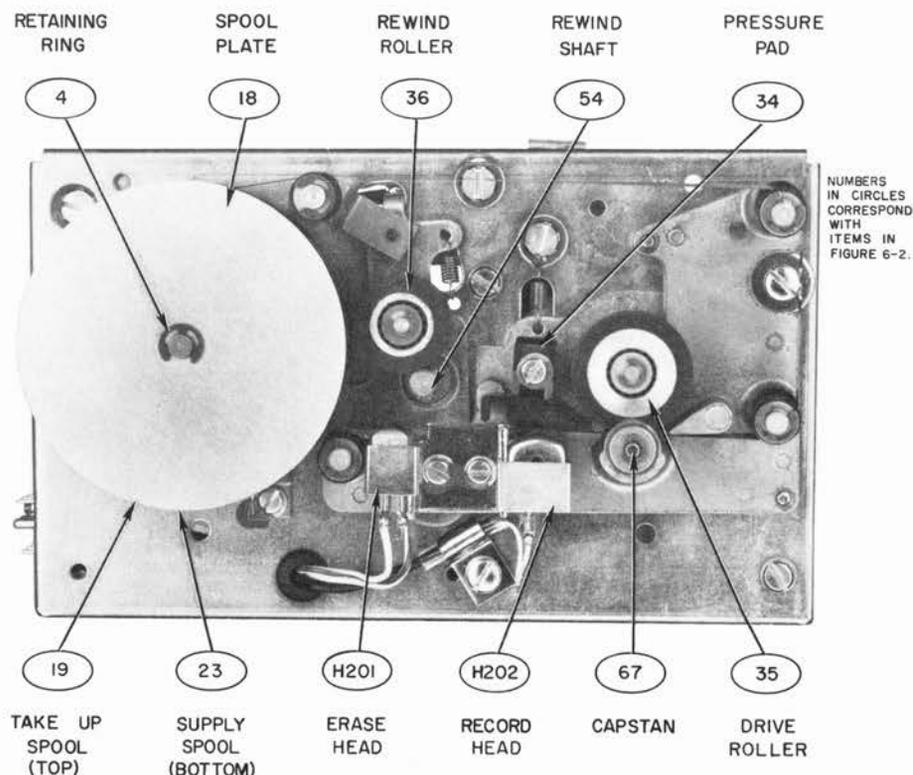


FIGURE 4-2 TAPE DECK FRONT VIEW, COVER REMOVED

5. TAPE DECK:

- a. Disconnect Model 210DC from 48 volt D.C. power source.
- b. Remove 2 screws from top of machine and remove cover (fig. 3-1).
- c. Remove 3 screws from bottom of machine that secure tape deck.
- d. Carefully unplug and lift out tape deck.

6. CHASSIS:

- a. Remove all connections from telephone line terminals (fig. 3-1).
- b. Remove tape deck (above).
- c. Unscrew to remove selector switch knob (fig. 2-1).
- d. Remove 4 screws from bottom of machine that secure chassis.
- e. Carefully remove chassis, being careful not to lose the two plastic bushings around the phone jacks (item 9 on fig. 6-1).

TAPE DECK MAINTENANCE

1. RECORDING TAPE:

a. Removal:

- (1) Remove tape deck from machine (page 4-3).
- (2) Remove three 6-32 x 5/32" screws and tape deck cover (fig. 4-1).
- (3) Remove retaining ring and spool plate (fig. 4-2).

- (4) Rotate spools clockwise to wind tape onto supply spool until end of tape is visible.
- (5) Disconnect tape from take up spool and carefully allow take up spool to rotate until clock spring inside is relaxed.
- (6) Carefully remove take up spool and take up clock spring together (items 24 and 25 on fig. 6-2). Leave clock spring inside spool.

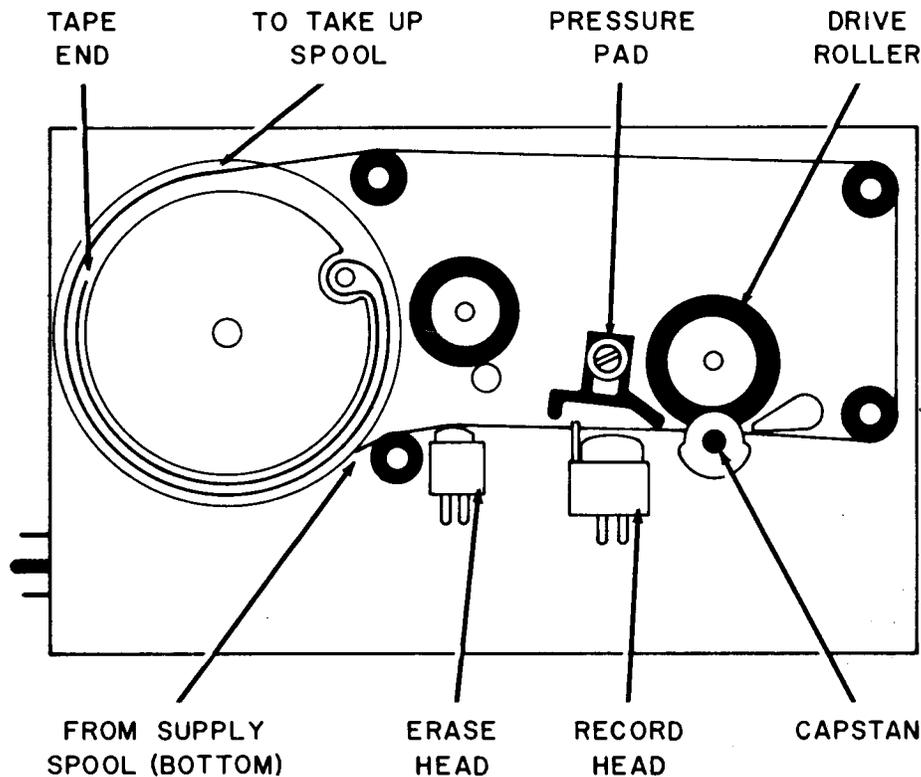


FIGURE 4-3 RECORDING TAPE PATH

(7) Remove plastic washer.

(8) Remove supply spool with recording tape.

b. Replacement:

(1) Wind 35 feet or 64 turns of 3M Brand No. 591 recording tape onto supply spool. Connect to spool in the manner shown in fig. 4-3, but wind the tape counterclockwise, with the oxide (dull) side facing outwards.

A Recording Tape Assembly, consisting of a supply spool wound with the proper amount of tape, is available as Code-a-phone part number 30-00-010.

(2) **Make sure** that timer roller on timer gear is midway between rewind limit switch and counter gear (fig. 4-4).

(3) Replace supply spool, making sure that it meshes with its drive pin. Leave approximately 2 feet of tape free.

(4) Thread tape as shown in fig. 4-3. Do not secure free end yet.

(5) Replace plastic washer.

(6) Replace take up spool, making sure that end of clock spring hooks onto pin on supply spool.

(7) Holding supply spool, wind take up spool clockwise to wind up clock spring until definite resistance is felt (25 to 30 turns) then unwind 10 turns.

(8) Connect free end of tape as shown in fig. 4-3.

(9) Rotate spools counterclockwise to wind tape 10 turns onto take up spool.

(10) Replace tape deck cover with three 6-32 x 5/32"

2. CLEANING:

a. Parts of the tape deck that come into contact with the recording tape will accumulate oxide from the tape that must be removed occasionally to prevent loss of recording quality. Clean as follows after every one thousand operating hours:

(1) Remove tape deck from machine (page 4-3).

(2) Remove three 6-32 x 5/32" screws and tape deck cover (fig. 4-1).

(3) With cloth or swab moistened in alcohol, clean the erase and record heads, pressure pad, pressure roller, and capstan (fig. 4-2).

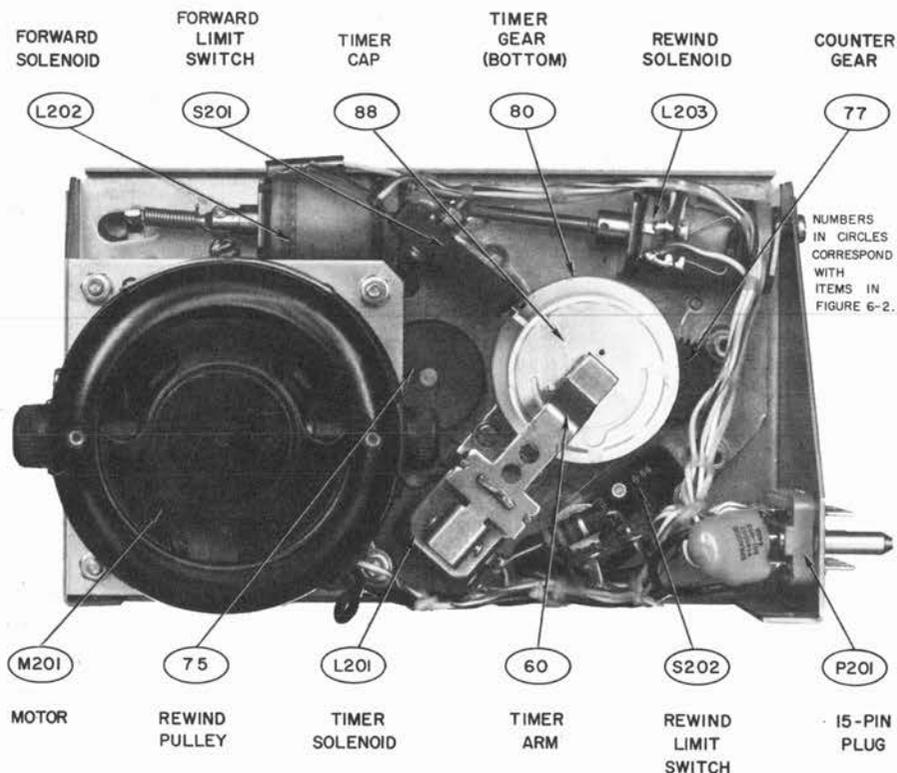


FIGURE 4-4 TAPE DECK REAR VIEW

b. After long use, an oil residue may accumulate on the belts and pulleys. Clean as follows:

- (1) Remove 4 nuts from motor plate (fig. 4-4). Remove motor, disengaging motor belt.
- (2) Remove flywheel belt.
- (3) With cloth moistened in alcohol, clean flywheel, motor pulley, rewind pulley, and both belts.

3. LUBRICATION:

The Tape Deck will **not** require lubrication for the service life of the Model 210DC. The rotating shafts operate in Teflon-impregnated Delrin sleeves or sealed ball bearings. The motor bearings contain large oil reservoirs that are charged at the factory. The recording tape is impregnated with a dry Silicone lubricant as part of the manufacturing process.

Lubricating the Tape Deck in the field **will not** increase bearing life, but **will** increase the hazard of getting oil on surfaces (belts, tapes, drive rollers, etc.) that **must** operate without oil.

4. ADJUSTMENTS:

a. Pressure pad (fig. 4-2):

Operate forward solenoid (fig. 4-4) by depressing

plunger by hand. Loosen clamp screw and adjust pressure pad so that tape wraps lightly around record head. Be sure that tape will not pinch between pressure pad and record head or head mount.

b. Forward solenoid (fig. 4-4):

Operate solenoid by depressing plunger with sharp instrument. Plunger should travel 1/32" before bottoming after pressure roller contacts capstan. To increase travel, screw plunger into link spring. To decrease travel, hold tail of link spring with pliers and screw plunger out.

c. Rewind solenoid (fig 4-4):

Operate solenoid by depressing plunger by hand. Plunger should travel 1/16" to 1/8" before bottoming after rewind roller contacts supply spool. To increase travel, hold link spring with fingers and screw plunger into it. To decrease travel, hold tail of link spring with pliers and screw plunger out.

d. Timer solenoid (fig. 4-4):

Operate machine in REC. function. When selector switch is held in REC. position, timer cap should lift 1/32" to 3/64" to disengage from timer gear. Adjust by bending timer arm (fig. 4-4).

AMPLIFIER ADJUSTMENT

1. EQUIPMENT REQUIRED:

- a. A.C. Vacuum Tube Volt Meter. Must be able to read audio levels from 0.01 volts to 3.0 volts RMS.
- b. Audio Signal Generator. Must have sine wave output of 1000 cycles per second at a level of 0.01 volts into a 100 Ω load.
- c. Shielded test leads.
- d. Double Phone Plug, H01-012 (as supplied with each Model 210DC).

2. PREPARATION:

- a. Connect a shielded test lead between the Audio Signal Generator and the Phone Plug terminals marked "CONNECT MICROPHONE" on fig. 3-2.
- b. Remove 2 screws from top of Model 210DC and lift off machine cover.
- c. Connect the Model 210DC to a D.C. power source and set the POWER switch to ON position.

3. PROCEDURE:

a. Set recording level:

- (1) Insert the Phone Plug (connected to the Signal Generator above) into the Model 210DC PHONE JACKS (fig. 2-1), **making sure** that the ground (shield) lead connects to the **left side** jack (closest to the IN USE light).
- (2) Connect the AC VTVM to the Signal Generator to monitor the signal level.
- (3) Set the Signal Generator for an output of 1000 Hz at a level of 0.01 volts (as read on the AC VTVM).
- (4) Lift the RECORD INTERLOCK BUTTON and hold the SELECTOR SWITCH in the REC. position (fig. 2-1).
- (5) When the IN USE light comes on (in about 2 seconds) re-adjust the Signal Generator output to 0.01 volts. The tape deck will record this tone.

(6) **Without releasing the SELECTOR SWITCH**, disconnect the AC VTVM from the Signal Generator and connect the AC VTVM to the Model 210DC as follows:

- (a) Connect the ground (shield) lead to the machine chassis.
- (b) Connect the other lead to the outer case (collector) of AUDIO POWER TRANSISTOR Q1 (fig. 4-1). The AC VTVM will read the output of the recording amplifier.

(7) Adjust the RECORDING LEVEL CONTROL (fig. 4-1) for a reading of 3.0 volts on the AC VTVM.

(8) Release the SELECTOR SWITCH. The tape deck will stop and rewind.

b. Set playback level:

- (1) Connect the AC VTVM across telephone line terminals 1 and 2 (fig. 3-1).
- (2) Lift the RECORD INTERLOCK button and hold the SELECTOR SWITCH in the REC. position (fig. 2-1). The Model 210DC will again record the 0.01 volt tone.
- (3) After about 15 seconds, pull the Phone Plug out to record silence.
- (4) After an additional 15 seconds, release the SELECTOR SWITCH. The The tape deck will stop and rewind.
- (5) Momentarily short telephone line terminals 5 and 7 (fig. 3-1). The Model 210DC will play back the tone into the AC VTVM.
- (6) Adjust the front panel VOLUME CONTROL (fig. 2-1) for a reading of 2.0 volts on the AC VTVM.
- (7) When the silent portion of the recording is reached, the AC VTVM reading should drop to 0.035 volts or less. This is the noise reading.
- (8) Disconnect the AC VTVM and replace the machine cover.

SECTION V

CIRCUIT DESCRIPTION

ANNOUNCEMENT RECORD

This function is enabled by setting power switch S2 to ON position and inserting phone plug P1 into phone jacks J2 and J3. Inserting the plug into jack J3 shorts telephone line terminals 3 and 4, indicating to possible external circuits that the machine is "in use."

The announcement record cycle is initiated by lifting the mechanical record interlock button and holding selector switch S1 in REC. position.

Switch S1 in REC. position:

1. Connects record head H202 to recording output "B" of amplifier.
2. Applies +16 volts to erase head H201.
3. Operates timer solenoid L201, releasing timer cap from its mating timer gear to reset the variable forward limit switch actuator to its zero position (fig. 4-4).
4. Operates forward solenoid L202 to pull pressure roller into contact with recording tape and capstan (fig. 4-2).
5. Applies 48 volts D.C. to motor M201 (through diode CR2), causing the capstan to rotate.
6. Operates relay RP to connect erase head H201, record solenoid L201, and relay RP to alternate source of power.

The recording tape winds from the supply spool, past erase head H201 and record head H202, and onto the take up spool (fig. 4-3). The supply and take up spools are mechanically coupled internally through a clock spring to maintain proper tension on the tape. After approximately 2 seconds, the timer roller on the timer gear releases rewind limit switch S202 (fig. 4-4).

Switch S202 released:

1. Lights IN USE light E1.
2. Applies +16 volts to "K" on amplifier.
3. Applies D.C. voltage to tip of jack J3 to bias carbon microphone in handset or headset.
4. Operates relay ADR to provide alternate source of power to motor M201.

Lighting of IN USE light E1 indicates that recording is occurring. Voltage dividing resistors R110 and R4 provide approximately 0.15 volts dc bias to the handset or headset microphone. Speech dictated into the microphone causes the

resistance of the carbon element to fluctuate rapidly, resulting in an audio signal which is coupled through "H" on the amplifier, capacitor C107, RECORDING LEVEL control R111, "F" on the amplifier, selector switch S1, "D" on the amplifier, and amplified by driver transistor Q103. Resistors R111 and R108 bias the base of the transistor, with resistor R108 also providing negative feedback to reduce distortion in this very high gain stage. The amplified signal is coupled through driver transformer T101 and "A" on the amplifier, to audio power transistor Q1. Resistor R109 and diode CR101 bias the base of this transistor, with resistor R1 aiding temperature stability. The output of this stage is coupled through "C" on the amplifier, capacitors C109 and C108, and resistor R113 to "B" on the amplifier, where resistor R112 adds 120 microamperes dc bias current from the power supply. The signal is then sent through switch S1 section "E" to record head H202 to be recorded onto the tape. The previous message is erased progressively as the tape passes over erase head H201.

The announcement record cycle is terminated by releasing selector switch S1, allowing its internal spring to return it to AUTO. position.

Switch S1 released:

1. Disconnects record head H202 from recording output of amplifier.
2. Disconnects erase head H201 from power.
3. Releases timer solenoid L201 to lock timer drum to timer gear (fig. 4-4). This sets the variable limit switch actuator so that subsequent message reproduction is limited to the recorded interval only.

The tape deck continues to drive forward for a short time (less than 1 second) until the variable limit switch actuator operates forward limit switch S201, releasing relay RP.

Relay RP released:

1. Releases forward solenoid L202, stopping the tape.
2. Operates rewind solenoid L203, pulling rewind roller into contact with rim of supply spool (fig. 4-2). This drives the supply spool and rewinds the tape at six times the forward speed.

When the tape has been completely rewound, the timer roller on the timer gear operates rewind limit switch S202 (fig. 4-4).

Switch S202 operated:

1. Releases rewind solenoid L203, stopping the tape.
2. Releases relay ADR, which removes power from motor M201.
3. Removes power from amplifier.
4. Removes bias voltage from tip of jack J3.
5. Extinguishes IN USE light E1.

This terminates the normal announcement record cycle.

If selector switch S1 is held in REC. position for longer than 3 minutes, the 3 minute pin on the timer gear (item 80, fig. 6-2), presses against a tab on the timer cap (item 88), operating forward limit switch S201 to release relay RP.

Relay RP released:

1. Releases timer solenoid L201 to set the 3-minute message length.
2. Disconnects erase head H201 from power.
3. Machine operations continues as described under "Replay RP released:", above.

ANNOUNCEMENT TEST

This function is enabled by setting power switch S2 to ON position and inserting phone plug P1 into phone jacks J2 and J3. Inserting the plug into jack J3 shorts telephone line terminals 3 and 4, indicating to possible external circuits that the machine is "in use."

The announcement test cycle is initiated by holding selector switch S1 in TEST position.

1. Connects record head H202 to playback input "L" of amplifier.
2. Connects preamplifier output ("E" on amplifier) to driver input ("D" on amplifier).
3. Operates forward solenoid L202 to pull pressure roller into contact with recording tape and capstan (fig. 4-2).
4. Applies 48 volts D.C. to motor M201 (through diode CR2), causing the capstan to rotate.
5. Operates relay RP.

Relay RP operated:

1. Completes latching circuit to hold relay RP and forward solenoid L202 operated until the variable limit switch actuator (set during the announcement record cycle) operates forward limit switch S201.
2. Connects amplifier output to sleeves of phone jacks J2 and J3.

The recording tape winds from the supply spool, past record head H202, and onto the take up spool (fig. 4-3). The supply and take up spools are mechanically coupled internally through a clock spring to maintain proper tension on the tape. After approximately 2 seconds, the timer roller on the timer gear releases rewind limit switch S202 (fig. 4-4).

Switch S202 released:

1. Lights IN USE light E1.
2. Applies +16 volts to "K" on amplifier.

3. Operates relay ADR to provide alternate source of power to motor M201.

The message on the recording tape induces an audio signal of approximately 0.0005 volts RMS across record head H202. The signal is coupled through "L" on the amplifier and capacitor C102 to 1st preamplifier Q101. Resistors R101 and R102 bias the base of this transistor, which is directly coupled to transistor Q102. Emitter resistors R103 and R106 aid in temperature stability of these amplifier stages, and resistor R102 provides dc feedback to improve the overall stability. Bypass capacitor C103 limits the low frequency response of the amplifier to approximately 300 Hz. Resistor R107 and capacitor C104 decouple the preamplifier stages from the +16 volt supply and its various loads. Signal from transistor Q102 is coupled through capacitor C105 and front panel VOL. control R5 to driver transistor Q103. Resistors R5 and R108 bias the base of the transistor, with resistor R108 also providing negative feedback to reduce distortion in this very high gain stage. The amplified signal is coupled through driver transformer T101 and "A" on the amplifier to audio power transistor Q1. Resistor R109 and diode CR101 bias the base of this transistor, with resistor R1 aiding temperature stability. The output of this stage is coupled through output transformer T2, resistor R3, and the sleeves of jacks J2 and J3 and is reproduced in the handset or headset receiver. Capacitor C1 limits the high frequency response of the amplifier to approximately 3000 Hz.

At the end of the announcement, the variable limit switch actuator on the timer cap operates forward limit switch S201 to release relay RP.

Relay RP released:

1. Releases forward solenoid L202, stopping the tape.
2. Operates rewind solenoid L203, pulling rewind roller into contact with rim of supply spool (fig. 4-2). This drives the supply spool and rewinds the tape.

When the tape has been completely rewound, the timer roller on the timer gear operates rewind limit switch S202 (fig. 4-4).

Switch S202 operated:

1. Releases rewind solenoid L203, stopping the tape.
2. Releases relay ADR, which removes power from motor M201.

3. Removes power from amplifier.
4. Extinguishes IN USE light E1.

This terminates the announcement test cycle.

AUTOMATIC INTERCEPT

This function is enabled by setting power switch S2 to ON position. Selector switch S1 normally rests in AUTO. position.

Switch S1 in AUTO. position:

1. Connects record head H202 to playback input "L" of amplifier.
2. Connects preamplifier output ("E" on amplifier) to driver input ("D" on amplifier).
3. Shorts telephone line terminals 7, 8, and 9, indicating to possible external circuits that Model 210DC is in standby condition.

The automatic intercept cycle is initiated by momentarily shorting terminals 5 and 7.

Terminals 5 and 7 shorted:

1. Operates forward solenoid L202 to pull pressure roller into contact with recording tape and capstan (fig. 4-2).
2. Applies 48 volts dc to motor M201, causing capstan to rotate.
3. Operates relay RP.

Relay RP operated:

1. Completes latching circuit to hold relay RP and forward solenoid L202 operated until the variable limit switch actuator (set during the announcement record cycle) operates forward limit switch S201.
2. Connects amplifier output to terminals 1 and 2.
3. Opens terminals 7 and 8 and shorts terminals 6, 7 and 9 to indicate to possible external circuits that the automatic intercept cycle has started.

The recording tape winds from the supply spool, past record head H202, and onto the take up spool (fig. 4-3). After approximately 2 seconds, the timer roller on the timer gear releases rewind limit switch S202 (fig. 4-4).

Switch S202 released:

1. Lights IN USE light E1.
2. Applies +16 volts to "K" on amplifier.
3. Opens terminals 6 and 9 to complete the 2-second "announcement begins" pulse
4. Operates relay ADR.

Relay ADR operated:

1. Applies alternate source of power to motor M201.
2. Disables start circuit so that the automatic intercept cycle cannot be initiated again until the tape deck is completely rewound.

The announcement on the recording tape is detected by record head H202, amplified by transistors Q101, Q102, Q103, and Q1, and coupled through transformer T1 to be reproduced across terminals 1 and 2. Resistor R2 loads the amplifier so that external loads (of up to 100 600 Ω telephone lines) have slight effect on the output level.

At the end of the announcement the variable limit switch actuator on the timer cap operates forward limit switch S201 to release relay RP.

Relay RP released:

1. Releases forward solenoid L202, stopping the tape.
2. Operates rewind solenoid L203, pulling rewind roller into contact with rim of supply spool (fig. 4-2). This drives the supply spool and rewinds the tape.
3. Opens terminals 6 and 7 and shorts terminals 7 and 8, indicating to possible external circuits that the announcement is completed and the tape is rewinding.

When the tape has been completely rewound, the timer roller on the timer gear operates rewind limit switch S202 (fig. 4-4).

Switch S202 operated:

1. Releases rewind solenoid L203, stopping the tape.
2. Removes power from amplifier.
3. Extinguishes IN USE light E1.
4. Shorts terminals 7 and 9, indicating to possible external circuits that the Model 210DC is in standby condition.
5. Releases relay ADR.

Relay ADR released:

1. Removes power from motor M201.
2. Enables start circuit.

This terminates the automatic intercept cycle.

SECTION VI REPLACEMENT PARTS

ORDERING INFORMATION

Place all parts orders directly with the Code-a-phone factory at the following address.

	Customer Service Department Ford Industries, Inc.
Mailing address:	Post Office Box 06459 Portland, Oregon 97206
Shipping address:	5001 S.E. Johnson Creek Boulevard Portland, Oregon
Telephone number:	(503) 774-1104
TELEX number:	03-6520

When ordering, specify the PART number, complete description, and quantity desired. Parts orders can usually be processed more quickly when received on a Purchase Order.

Code-a-phone recommends that commonly available parts, such as resistors, fuses and hardware be obtained locally.

We at Ford Industries have a firm policy of continually improving the quality, features, and serviceability of Code-a-phone telephone answering equipment. For this reason, Ford Industries, Inc. reserves the right to substitute on parts orders in cases where the substituted component will give equivalent or improved performance in the instrument.

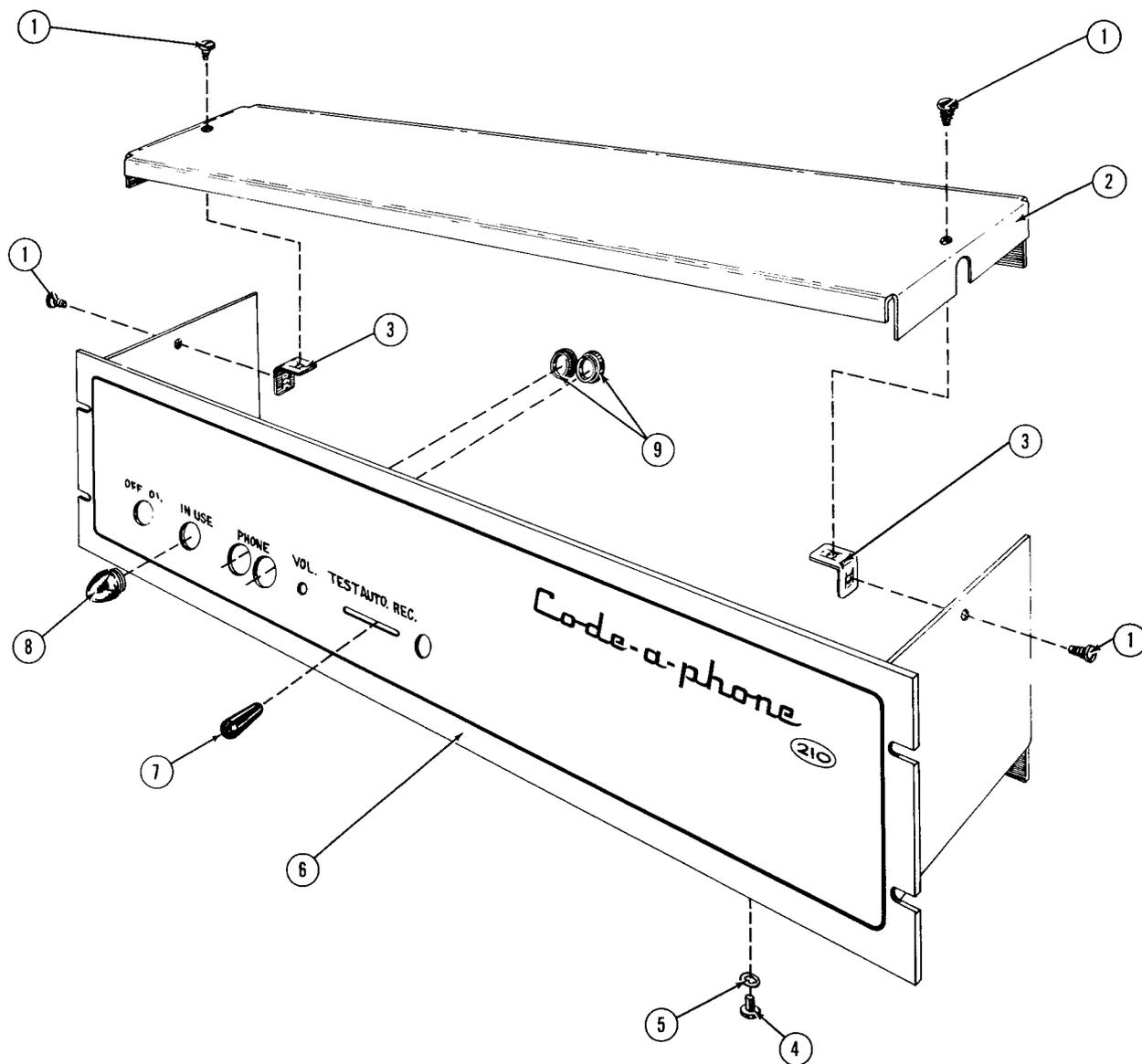


FIGURE 6-1 CASE EXPLODED VIEW

CASE PARTS

Item No.	Part No.	Qty.	Description
1	F23-106	4	8-32 x 1/4" Sheet Metal Screw
2	M00-183	1	Cover
3	F07-541	2	#8 "L" Nut
4	F15-390	7	6-32 x 1/4" Pan Head Screw
5	F03-361	7	#6 Lock Washer
6	30-00-133	1	Housing
7	H03-002	1	Selector Switch Knob
8	E00-007	1	IN USE Light Cover
9	P00-069	2	Phone Jack Bushing
	N13-007		1/2 Pint Can Olive Grey Paint

TAPE DECK PARTS

Item No.	Part No.	Qty.	Description	Item No.	Part No.	Qty.	Description
	X00-098		Tape Deck (Complete)				
1	F15-384	5	# 6-32 x 5/32" Screw	29	A00-099	2	Lever Pin
2	F03-361	24	# 6 Lockwasher	30	30-00-049	1	Drive Lever
3	M00-037	1	Tape Deck Cover	32	P00-003	6	Bearing Pad
4	F04-013	6	Retaining Ring	33	F05-003	5	# 4 Flat Washer
5	F31-150	8	Fibre Washer	34	30-00-206	1	Pressure Pad
6	P00-185	4	Tape Roller	35	30-00-022	1	Drive Roller
7	F04-007	3	Retaining Ring	36	30-00-023	1	Rewind Roller
8	F05-607	1	Flat Washer	37	F30-210	2	Mylar Washer
9	F03-620	1	Spring Washer	38	F04-034	1	Retaining Ring
10	F05-505	1	Flat Washer	39	S00-003	1	Lever Return Spring
12	B00-013	1	Ball Bearing	40	F15-398	2	# 6-32 x 3/8" Screw
13	B00-014	1	Ball Bearing	41	F05-709	1	Flat Washer
14	H02-038	4	Tape Head Connector	42	30-00-050	1	Rewind Lever
15	F03-331	11	# 4 Lock Washer	43	30-00-242	2	Lever Guide
16	F15-186	5	# 4-40 x 3/16" Screw	44	F15-190	2	# 4-40 x 1/4" Screw
17	F30-148	1	Mylar Washer	45	F07-701	1	Cable Clamp
18	M00-017	1	Spool Plate	46	S00-001	1	Lever Tension Spring
19*	P00-062	1	Take Up Spool	47	F15-390	8	# 6-32 x 1/4" Screw
20*	S00-005	1	Take Up Clock Spring	48	30-00-046	1	Deck Plate
21*	30-00-335	1	Take Up Spool Assembly	49	F15-194	2	# 4-40 x 5/16" Screw
22*	F30-156	1	Mylar Washer	50	F04-016	2	Retaining Ring
23	30-00-010	1	Supply Spool/Tape Assembly	51	S00-039	1	Forward Solenoid Link
24	F30-145	8	Mylar Washer	52	F16-386	4	# 6-32 x 3/16" Flat Head Screw
25	A00-218	1	Tape Roller Post	53	F03-375	4	# 6 Cup Lock Washer
26	30-00-047	1	Head Bracket (Includes Items # 12 and # 13)	54	30-00-244	1	Rewind Shaft
27	F30-090	3	Mylar Washer	55	30-00-379	1	Timer Plate (Includes Item # 54)
28	F30-175	2	Mylar Washer	56	30-00-043	1	Forward Solenoid Plunger

(Continued on page 6-5)

*Items # 19, # 20 and # 22 are replaced by Items # 21 and # 24 on machines with serial number 21-DC-0241 and higher. Item # 21 may be used on all Tape Decks.

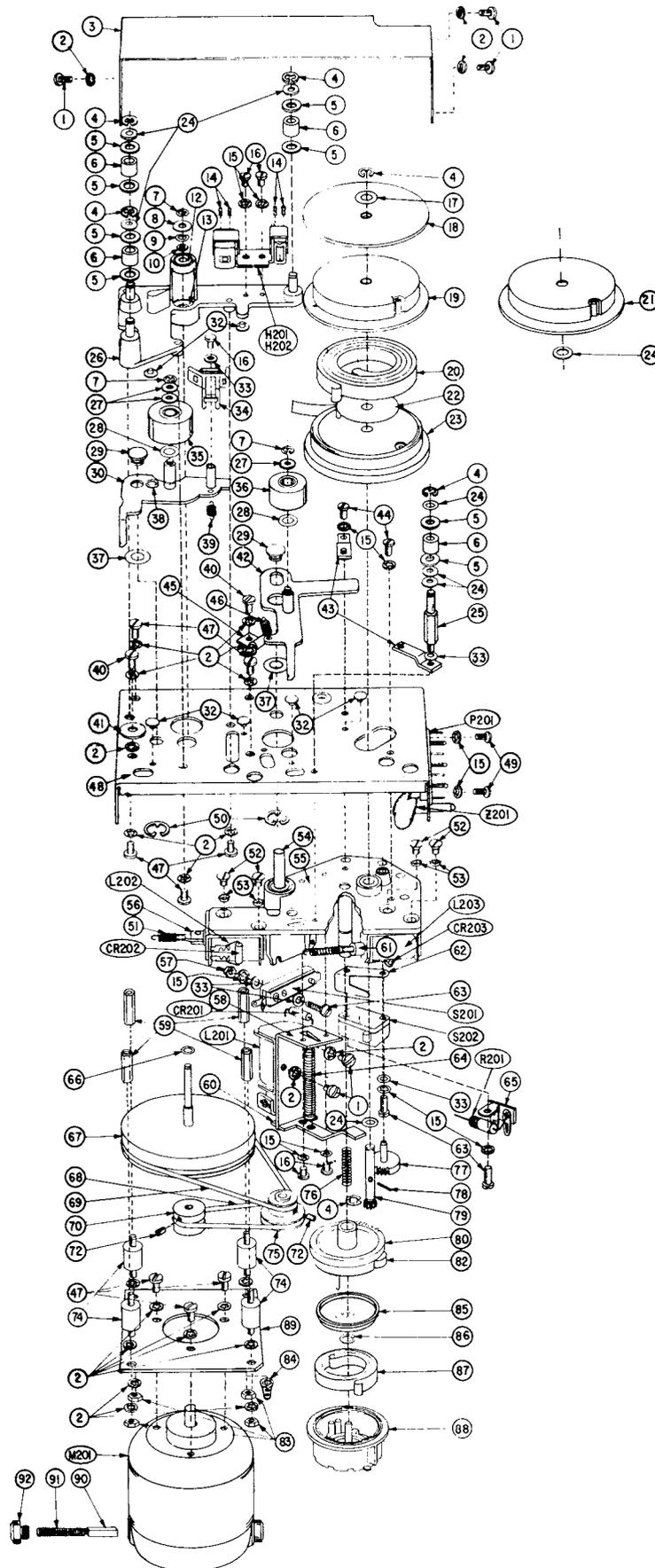


FIGURE 6-2 TAPE DECK EXPLODED VIEW

TAPE DECK PARTS

(Continued)

Item No.	Part No.	Qty.	Description	Item No.	Part No.	Qty.	Description
57	F03-031	1	# 4-40 Hex Nut	88	30-00-053	1	Timer Cap (Includes Item # 87)
58	M00-019	1	Timer Arm Bracket	89	M00-225	1	Motor Plate
59	A00-185	4	Motor Post	90	X10-023	2	Motor Brush
60	30-00-044	1	Timer Arm	91	X10-024	2	Brush Tension Spring
61	30-00-240	1	Rewind Solenoid Plunger	92	X10-025	2	Brush Cap
62	H00-020	1	Switch Actuator	CR201	T02-002	1	T158 Silicon Diode
63	F15-210	3	# 4-40 x 5/8" Screw	CR202	T02-002	1	T158 Silicon Diode
64	S00-008	1	Timer Arm Spring	CR203	T02-002	1	T158 Silicon Diode
65	H05-022	1	2 Lug Tie Point	H201,			
66	F05-615	1	Flat Washer	H202	30-00-008	1	Tape Head Assembly
67	30-00-054	1	Flywheel/Capstan Assembly	L201	30-00-295	1	Timer Solenoid
68	J00-018	1	Motor Belt	L202	30-00-295	1	Forward Solenoid
69	J00-019	1	Flywheel Belt	L203	30-00-293	1	Rewind Solenoid
70	A00-186	1	Motor Pulley	M201	L01-027	1	48 volt D.C. Motor (Includes Items # 90, 91 and 92)
72	F02-024	2	# 4-40 x 1/8" Allen Set Screw	P201	H01-017	1	15-Pin Plug
74	J00-025	4	Motor Mount	R201	R21-003	1	3.3k Ω \pm 10% 1 W Resistor
75	A00-093	1	Rewind Pulley	S201	30-00-397	1	Forward Limit Switch
76	S00-007	1	Timer Cap Lift Spring	S202	H00-019	1	Rewind Limit Switch
77	P00-005	1	Intermediate Gear	Z201	E01-002	1	Motor Arc Supsressor
78	F09-208	1	Supply Spool Drive Pin				
79	30-00-051	1	Spool Shaft				
80	30-00-052	1	Timer Gear				
82	P00-054	1	Timer Roller				
83	F03-061	4	# 6-32 Hex Nut				
84	F07-385	1	# 6 Solder Lug				
85	P00-021	1	Timer Gear Plate				
86	F04-036	1	Retaining Ring				
87	S00-006	1	Timer Cap Clock Spring				

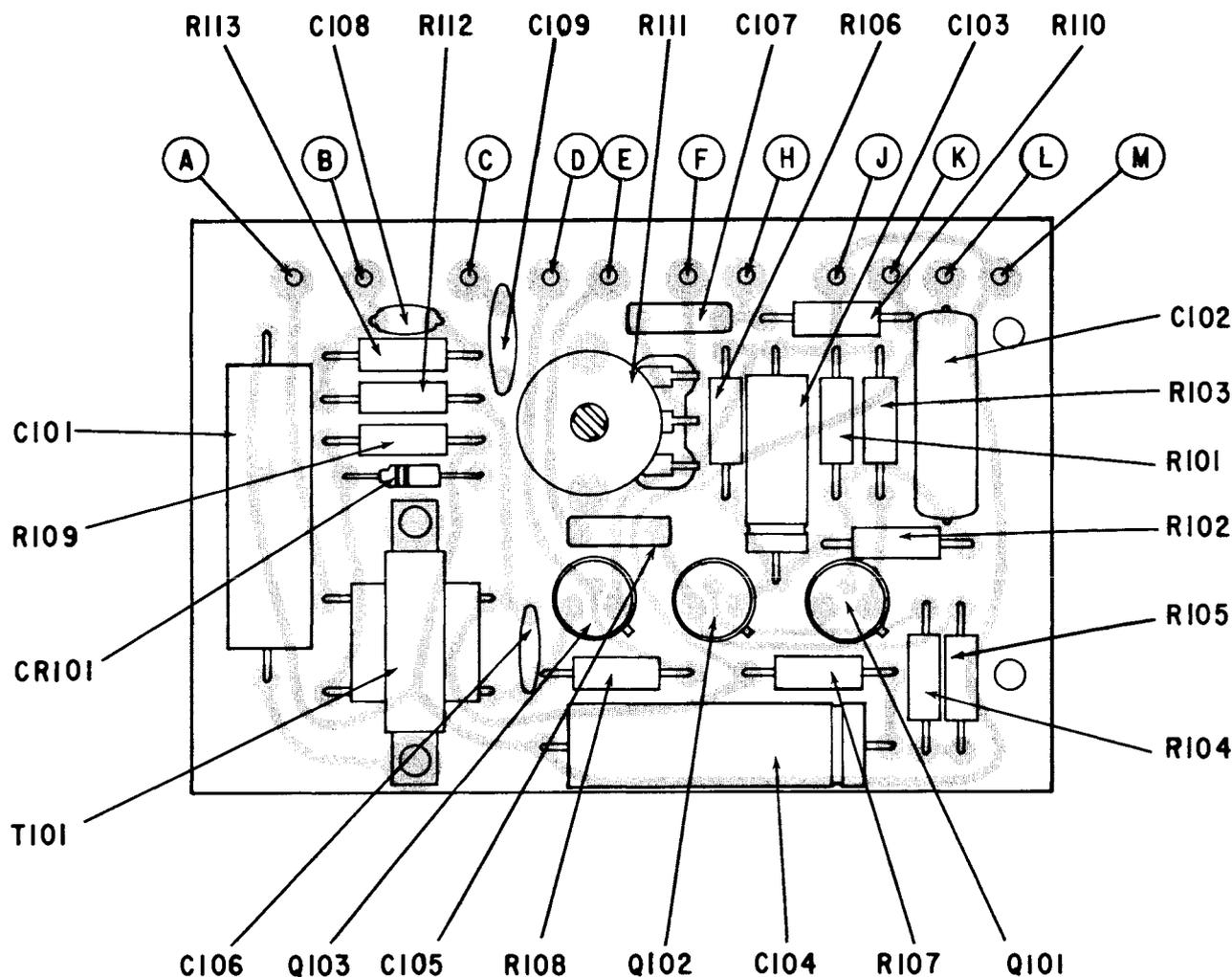


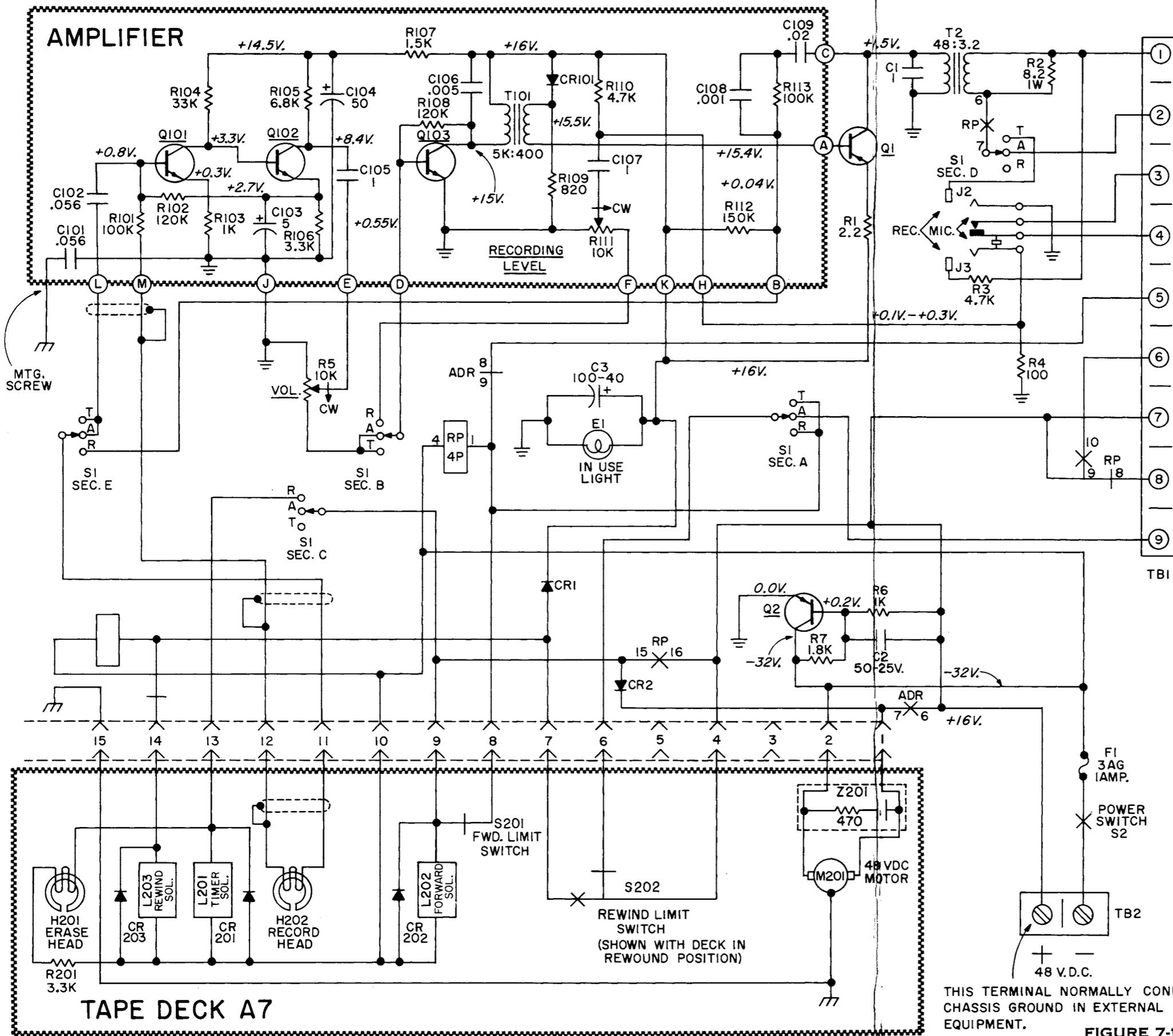
FIGURE 6-3 AMPLIFIER CIRCUIT BOARD, COMPONENT SIDE

AMPLIFIER CIRCUIT BOARD PARTS

Circuit No.	Part No.	Description	Circuit No.	Part No.	Description
	30-00-019	Amplifier Circuit Board (complete)	Q103	T01-014	Silicon NPN Transistor (Driver)
C101	C05-003	.056 μ F 200 V Mylar Capacitor	R101	R12-039	100 k Ω \pm 10% 1/2 W Resistor
C102	C05-003	.056 μ F 200 V Mylar Capacitor	R102	R12-042	120 k Ω \pm 10% 1/2 W Resistor
C103	C03-047	5 μ F 6 V Electrolytic Capacitor	R103	R11-006	1 k Ω \pm 10% 1/2 W Resistor
C104	C03-035	50 μ F 25 V Electrolytic Capacitor	R104	R12-014	33 k Ω \pm 10% 1/2 W Resistor
C105	C02-004	1 μ F 25 V Ceramic Capacitor	R105	R11-020	6.8 k Ω \pm 10% 1/2 W Resistor
C106	C02-020	.005 μ F 100 V Ceramic Capacitor	R106	R11-021	3.3 k Ω \pm 10% 1/2 W Resistor
C107	C02-004	1 μ F 25 V Ceramic Capacitor	R107	R11-023	1.5 k Ω \pm 10% 1/2 W Resistor
C108	C02-008	.001 μ F 500 V Ceramic Capacitor	R108	R12-042	120 k Ω \pm 10% 1/2 W Resistor
C109	C02-013	.02 μ F 100 V Ceramic Capacitor	R109	R10-031	820 Ω \pm 10% 1/2 W Resistor
CR101	T02-002	TI 58 Silicon Diode (Q1 Bias)	R110	R11-003	4.7 k Ω \pm 10% 1/2 W Resistor
Q101	T01-014	Silicon NPN Transistor (1st Preamp)	R111	R00-025	10 k Ω Potentiometer (RECORDING LEVEL)
Q102	T01-014	Silicon NPN Transistor (2nd Preamp)	R112	R12-043	150 k Ω \pm 10% 1/2 W Resistor
			R113	R12-039	100 k Ω \pm 10% 1/2 W Resistor
			T101	L00-026	Driver Transformer
				P00-070	Transistor Pad (3 req.)

CHASSIS PARTS

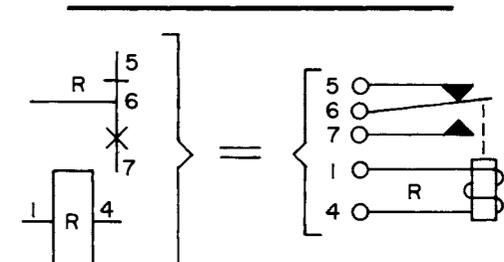
Circuit No.	Part No.	Description	Circuit No.	Part No.	Description
C1	C01-023	1 μ f 100 V Paper Capacitor	Q2	T01-021	Germanium PNP Transistor (Power Supply)
C2	C03-035	50 μ f 25 V Electrolytic Capacitor		H02-033	Transistor Socket (2 Required)
C3	C03-045	100 μ f 40 V Electrolytic Capacitor			
CR1	T00-011	1N1692 Silicon Diode	R1	R10-023	2.2 Ω \pm 5% 1/2W Resistor
CR2	T00-011	1N1692 Silicon Diode	R2	R20-008	8.2 Ω \pm 10% 1W Resistor
E1	E00-015	IN USE Light (G.E. # 757)	R3	R11-003	4.7 k Ω \pm 10% 1/2W Resistor
	H02-003	IN USE Light Socket	R4	R10-015	100 Ω \pm 10% 1/2W Resistor
F1	E00-010	3 AG 1 Ampere Fuse	R5	R00-009	10 k Ω Potentiometer (VOL.)
	H10-020	Fuse Holder	R6	R11-006	1 k Ω \pm 10% 1/2W Resistor
			R7	R21-004	1.8 k Ω \pm 10% 1W Resistor
J1	H02-017	Tape Deck Socket	S1	H00-010	Selector Switch (w/Knob)
J2	H02-022	Phone Jack	S2	H00-011	Power Switch
J3	H02-021	Phone Jack w/N.O. Switch	T1	L00-028	Output Transformer
	N05-019	Phone Jack Mounting Block	TB1	H04-024	Telephone Line Terminal Board
ADR	K00-019	2 P.D.T. 700 Ω Relay	TB2	H04-027	D.C. Power Terminal Board
	H02-025	Relay ADR Socket		P00-074	Record Interlock Lever
	S00-027	Relay ADR Hold Down Clip		F04-066	Record Interlock Lever Retaining Ring
RP	K00-018	4 P.D.T. 700 Ω Relay		S00-003	Record Interlock Lever Spring
	H02-023	Relay RP Socket			
	S00-026	Relay RP Hold Down Clip			
P1	H01-012	Double Phone Plug			
Q1	T01-021	Germanium PNP Transistor (Audio Power)			



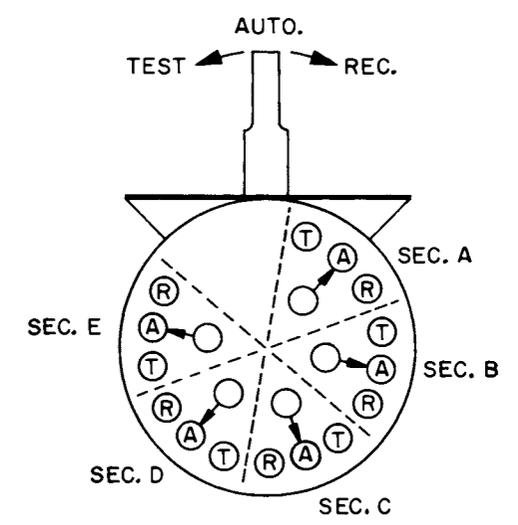
TELEPHONE LINE TERMINALS (SEE FIG. 3-3)

NOTES:

1. ALL RESISTORS 1/2 WATT, ±10% UNLESS OTHERWISE NOTED.
2. ALL CAPACITOR VALUES IN μF.
3. VOLTAGES MEASURED WITH 20KΩ PER VOLT D.C. VOLTMETER BETWEEN POINTS INDICATED AND GND.
4. VOLTAGES MEASURED WITH TAPE DECK RUNNING IN "REC".
5. VOLTAGES MAY VARY ±15%.



RELAY SYMBOLS



SELECTOR SWITCH S1 (BOTTOM)

THIS TERMINAL NORMALLY CONNECTED TO CHASSIS GROUND IN EXTERNAL TELEPHONE EQUIPMENT.

FIGURE 7-1 MODEL 210DC SCHEMATIC DIAGRAM

