

A.R. NOTT



instruction book

Cedar Rapids Division | Collins Radio Company, Cedar Rapids, Iowa

642A-2

# Tape Cartridge System

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Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory, transportation prepaid, provided

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- (c) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal or proper manner.

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- (B) Date of delivery of equipment
- (C) Date placed in service
- (D) Number of hours of service
- (E) Nature of trouble
- (F) Cause of trouble if known
- (G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
- (H) Item or symbol number of same obtained from parts list or schematic
- (I) Collins number (and name) of unit subassemblies involved in trouble
- (J) Remarks

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Cedar Rapids, Iowa

### INFORMATION NEEDED:

- (A) Quantity required
- (B) Collins part number (9 or 10 digit number) and description
- (C) Item or symbol number obtained from parts list or schematic
- (D) Collins type number, name and serial number of principal equipment
- (E) Unit subassembly number (where applicable)



## instruction book

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# Tape Cartridge System

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*This manual includes:*

<i>Tape Cartridge System</i>	523-0756575
<i>642A-2 Recorder/Playback Unit</i>	523-0756576
<i>216C-2 Recording Amplifier</i>	523-0756578
<i>Magnetic Tape Cartridges</i>	523-0755296
<i>313T-1/3/4 Remote Control Switching Units</i>	523-0755297

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**system instructions**

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# **Tape Cartridge System**

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# table of contents

Section		Page
1	GENERAL DESCRIPTION . . . . .	1
1.1	Purpose of Instruction Book . . . . .	1
1.2	Purpose of Equipment . . . . .	1
1.3	Description of System Units . . . . .	1
1.3.1	642A-2 Recorder/Playback Unit . . . . .	1
1.3.2	216C-2 Recording Amplifier . . . . .	2
1.3.3	Magnetic Tape Cartridges . . . . .	2
1.3.4	313T-1/3/4 Remote Control Switching Units . . . . .	2
1.4	System Specifications . . . . .	3
1.4.1	Physical . . . . .	3
1.4.2	Electrical . . . . .	3
1.4.3	Mechanical . . . . .	3
2	INSTALLATION . . . . .	4
2.1	Unpacking and Inspecting . . . . .	4
2.2	Installation Procedures . . . . .	4
2.2.1	General . . . . .	4
2.2.2	642A-2 Internal Connections . . . . .	4
2.2.3	Multiple 642A-2 Installation . . . . .	4
2.2.4	External Cue Connections . . . . .	4
2.2.5	642A-2/216C-2 Interconnection . . . . .	4
2.2.6	Remote Control Switching Unit Installation . . . . .	5
3	OPERATION . . . . .	14
3.1	Operating Controls and Indicators . . . . .	14
3.2	Operating Procedures . . . . .	14
3.2.1	Recording . . . . .	14
3.2.2	Playback . . . . .	14
4	PRINCIPLES OF OPERATION . . . . .	16
4.1	General . . . . .	16
5	MAINTENANCE . . . . .	17
5.1	System Trouble Shooting . . . . .	17

## list of illustrations

Figure		Page
1-1	Tape Cartridge System (C754-22-P) . . . . .	2
2-1	642A-2 Interconnection Diagram (C754-37-3) . . . . .	5
2-2	313T-1 Remote Control Switching Unit, Installation Diagram (C754-11-4) . . . . .	6
2-3	313T-3 Remote Control Switching Unit, Installation Diagram (C754-12-4) . . . . .	7
2-4	313T-4 Remote Control Switching Unit, Installation Diagram (C754-10-5) . . . . .	8
2-5	642A-2 Recorder/Playback Unit, Outline and Mounting Dimensions (C754-04-5) . . . . .	9
2-6	216C-2 Recording Amplifier, Outline and Mounting Dimensions (C754-05-5) . . . . .	10
2-7	313T-1 Remote Control Switching Unit, Outline and Mounting Dimensions (C754-01-4) . . . . .	11
2-8	313T-3 Remote Control Switching Unit, Outline and Mounting Dimensions (C754-02-4) . . . . .	12
2-9	313T-4 Remote Control Switching Unit, Outline and Mounting Dimensions (C754-03-4) . . . . .	13
3-1	216C-2 Recording Amplifier, Operating Controls and Indicators (C754-61-P) . . . . .	15
3-2	642A-2 Recorder/Playback Unit, Operating Controls and Indicators (C754-60-P). . . . .	15
4-1	Tape Cartridge System, Block Diagram (C754-17-3) . . . . .	16

## list of tables

Table		Page
1-1	Tape Cartridge System Units . . . . .	1
3-1	Operating Controls and Indicators on the 642A-2 Recorder/Playback Unit . . . . .	14
3-2	Operating Controls and Indicators on the 216C-2 Recording Amplifier . . . . .	14
5-1	System Trouble Shooting . . . . .	17

## general description

### 1.1 Purpose of Instruction Book.

This system instruction book contains directions for installing, operating, and trouble shooting the Collins Tape Cartridge System. More detailed information about the units that make up the system is contained in the unit instructions listed in table 1-1. These unit instructions are bound at the rear of this system instruction book.

### 1.2 Purpose of Equipment.

The Tape Cartridge System, shown in figure 1-1, provides complete facilities for recording and playback of program material on an endless magnetic tape that is enclosed in a plastic cartridge. No threading, cuing, or rewinding of tapes is required with this system. After playback, the tape is stopped automatically at the cued position by a stop-cue tone that is recorded on one track of a double-track tape at the same time program material is recorded on the other track. Other external-cue tones may be placed on the tape cue track during recording to cue miscellaneous external equipment during playback.

Recording audio inputs are provided for either 600-ohm balanced line or a 250-ohm microphone, or the two inputs may be mixed. The system may be controlled either from the front panel of the equipment or from any one of three types of remote switching units.

### 1.3 Description of System Units.

The units that make up the Tape Cartridge System are listed in table 1-1. These units are described briefly in the following paragraphs. For a more detailed description of each unit, refer to the applicable unit instructions listed in table 1-1.

#### 1.3.1 642A-2 RECORDER/PLAYBACK UNIT.

The 642A-2 Recorder/Playback Unit contains the tape transport mechanism, magnetic recording/playback heads, program and cue amplifier modules, and most of the control circuits for the Tape Cartridge System. This unit may be used alone to provide playback facilities only.

TABLE 1-1. TAPE CARTRIDGE SYSTEM UNITS

UNIT	UNIT PART NUMBER	UNIT INSTRUCTIONS PART NUMBER
642A-2 Recorder/Playback Unit	522-3497-00	523-0756576
216C-2 Recording Amplifier	522-3496-00	523-0756578
Magnetic Tape Cartridge	See table 1, unit instructions	523-0755296
313T-1 Remote Control Switching Unit or 313T-3 Remote Control Switching Unit or 313T-4 Remote Control Switching Unit	522-2550-00  522-2551-00  522-2552-00	523-0755297  523-0755297  523-0755297



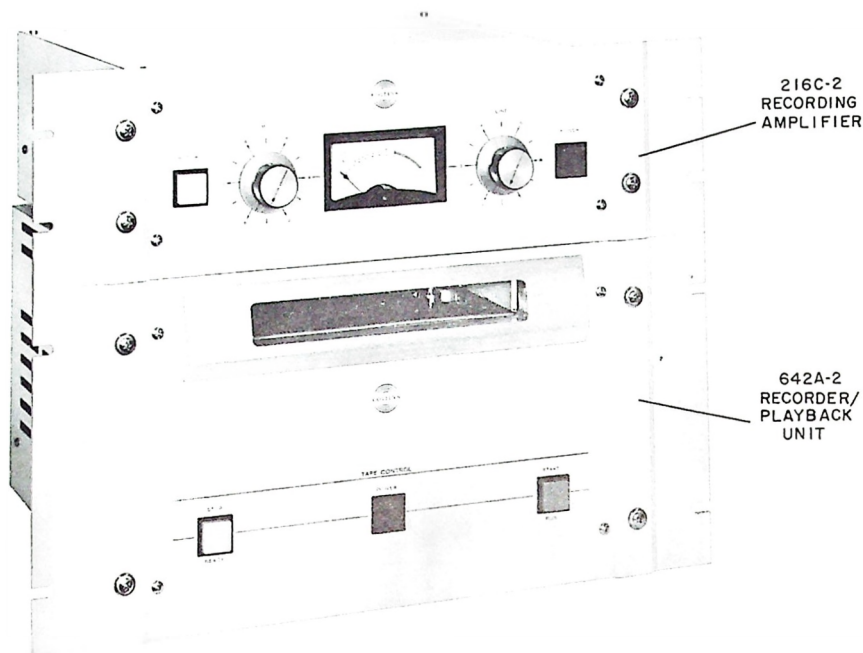


Figure 1-1. Tape Cartridge System

Automatic switching circuits in the 642A-2 allow a number of units to be connected to the same output line. When one of the units is started, the outputs of all the others are automatically disconnected from the line. Any unit that is running when another unit is started will continue to run until it is stopped either automatically or manually. All input, output, and power connections to the 642A-2 Recorder/Playback Unit are made at the rear of the unit.

### 1.3.2 216C-2 RECORDING AMPLIFIER.

The 216C-2 Recording Amplifier is used with the 642A-2 Recorder/Playback Unit to provide facilities for recording pre-erased tape cartridges. This unit contains preamplifiers for 600-ohm line and 250-ohm microphone inputs, input level controls, and output amplifier. The two inputs may be mixed if desired. A VU meter on the front panel of the 216C-2 indicates the recording level. This unit also contains record bias and cue-tone oscillators and amplifiers. The program, cue, and bias outputs from this unit are fed to the recording heads in the 642A-2 Recorder/Playback Unit.

All interconnections between the 216C-2 and 642A-2 are made with a cable that is supplied with the 216C-2.

All input, output, and power connections to the 216C-2 Recording Amplifier are made at the rear of the unit.

### 1.3.3 MAGNETIC TAPE CARTRIDGES.

The magnetic tape cartridges used with the Tape Cartridge System are plastic containers that hold the magnetic tape that is being recorded or played back. These cartridges are available in 3 sizes with 17 lengths of preloaded tape, ranging in running time from 40 seconds to 31 minutes. Blank cartridges that may be loaded with tape are also available.

### 1.3.4 313T-1/3/4 REMOTE CONTROL SWITCHING UNITS.

The 313T-1, 313T-3, and 313T-4 Remote Control Switching Units may be used with the 642A-2 Recorder/Playback Unit and 216C-2 Recording Amplifier to provide control of the start, stop, and record functions from the control console or some other remote point. The 313T-1 can control one 216C-2 and one 642A-2. The 313T-3 can control three 642A-2's. The 313T-4 can control one 216C-2 and four 642A-2's.

## 1.4 System Specifications.

## 1.4.1 PHYSICAL.

Size . . . . .	15 inches wide, 14 inches high, 13-3/4 inches deep (one unit mounted above the other).
Weight . . . . .	Approximately 55 pounds.
Mounting . . . . .	15-inch console or 19-inch rack with furnished extenders.
Ambient temperature range . . . . .	32°F (0°C) to 122°F (50°C).
Ambient humidity range . . . . .	Up to 95 percent relative humidity.
Altitude . . . . .	Up to 10,000 feet.

## 1.4.2 ELECTRICAL.

Power source . . . . .	105-125 volts, 50/60 cps, 1 phase.
Power requirements . . . . .	135 watts maximum.
Audio inputs . . . . .	Line: 600 ohms, balanced, -15 dbm to +10 dbm. Microphone: 250 ohms, unbalanced, -65 dbm to -35 dbm.
Audio output . . . . .	600 ohms, balanced, 0 dbm for 0-vu record.
Frequency response . . . . .	50 to 12,000 cps $\pm 2$ db (1000-cps reference). 50 to 15,000 cps $\pm 4$ db (1000-cps reference).
Equalization . . . . .	Conforms to NAB standard playback response curve for 15-inch-per-second playback $\pm 2$ db.
Signal-plus-noise to noise ratio . . . . .	Record to playback: 50 db minimum with a line input of 400 cps, -15 dbm, or a microphone input of 400 cps, -65 dbm. Playback only: 55 db minimum measured at 400 cps using a 3-percent total harmonic distortion tape as reference.
Harmonic distortion . . . . .	Record to playback: 2 percent maximum for 400-cps, 0-vu record level. Playback amplifier only: 1 percent maximum at 400 cps.

## 1.4.3 MECHANICAL.

Tape speed . . . . .	7-1/2 inches per second.
Tape drive motor . . . . .	Bodine type NYC12, 1/75 horsepower, synchronous.
Tape drive . . . . .	Solenoid-actuated, pressure tape drive; belt-driven capstan.
Tape start and stop time . . . . .	0.15 second maximum.
Flutter and wow . . . . .	0.2 percent rms maximum.
Timing accuracy . . . . .	0.4 percent or better for series 300 and 600 cartridges.

# section 2

## installation

### 2.1 Unpacking and Inspecting.

Remove all packing material and carefully lift the units from their boxes. Check equipment and packing slips to be sure that all equipment is included. Visually inspect units for any apparent damage and for missing components. Check for proper operation of front-panel controls. File any damage claims promptly with the transportation agency. If such claims are to be filed, keep all packing material.

### 2.2 Installation Procedures.

#### 2.2.1 GENERAL.

Plan placement of equipment and wiring carefully before starting installation work. Be sure to shield all low-level audio cables; keep such wiring separated from power and control wiring.

Refer to figures 2-5 through 2-9 for outline and mounting dimensions of all units in the Tape Cartridge System.

#### 2.2.2 642A-2 INTERNAL CONNECTIONS.

Check to see that the following cable connections are made in the 642A-2 Recorder/Playback Unit. All connectors on the 642A-2 chassis and modules are color coded with small color dots by the connectors. Join connectors coded with the same color dots with the connecting cables.

J102 to J201 - red dots  
J103 to J104 - yellow dots  
J105 to J301 - green dots  
J106 to J302 - white dots

#### 2.2.3 MULTIPLE 642A-2 INSTALLATION.

A number of 642A-2 Recorder/Playback Units may be connected to the same 600-ohm balanced output line. The interconnection of four typical units is shown in figure 2-1. With such interconnections, the output of only one unit can be connected to the output line at a time. If one unit is started while another is running, the output of the first unit is disconnected from the line, but that unit will continue to run until it is stopped either automatically or manually. The units may be started in any sequence.

The interconnections for a multiple 642A-2 installation may be generalized as follows:

- a. Remove the jumper between terminals 13 and 14 on TB101 of all units.
- b. Jumper terminals 10 and 13 on TB101 of all units.
- c. Jumper terminals 9 and 14 on TB101 of unit 1. Leave terminal 11 on TB101 of unit 1 unconnected.
- d. Interconnect all units with five wires. In each case, interconnect the terminals on TB101 as follows:

<u>Unit N</u>		<u>Unit N+1</u>
8	to	9
12	to	11
14	to	14
15	to	15
16	to	16

- e. Jumper terminals 8 and 12 on TB101 of the last unit.
- f. Connect terminals 15 and 16 on TB101 of any unit to the output line.

#### 2.2.4 EXTERNAL CUE CONNECTIONS.

External cue connections from the 642A-2 Recorder/Playback Unit to external equipment are made at terminals 5, 6, and 7 of TB101 on the 642A-2. Two wires should be used to make these connections. If a "make" cue is desired, connect the wires to terminals 6 and 7. If a "break" cue is desired, connect the wires to terminals 5 and 6.

If it is desired to have an external-cue tone on a tape in one unit start a tape in another unit, connect terminals 6 and 7 on unit N to terminals 3 and 4 on unit N+1. When using several 642A-2's with such connections, remember that the tape that is to be started by an external-cue tone on the tape in unit N must be placed in unit N+1. In such installations, it will be helpful to number the units in some manner so that the tape to be started is placed in the correct unit.

#### 2.2.5 642A-2/216C-2 INTERCONNECTION.

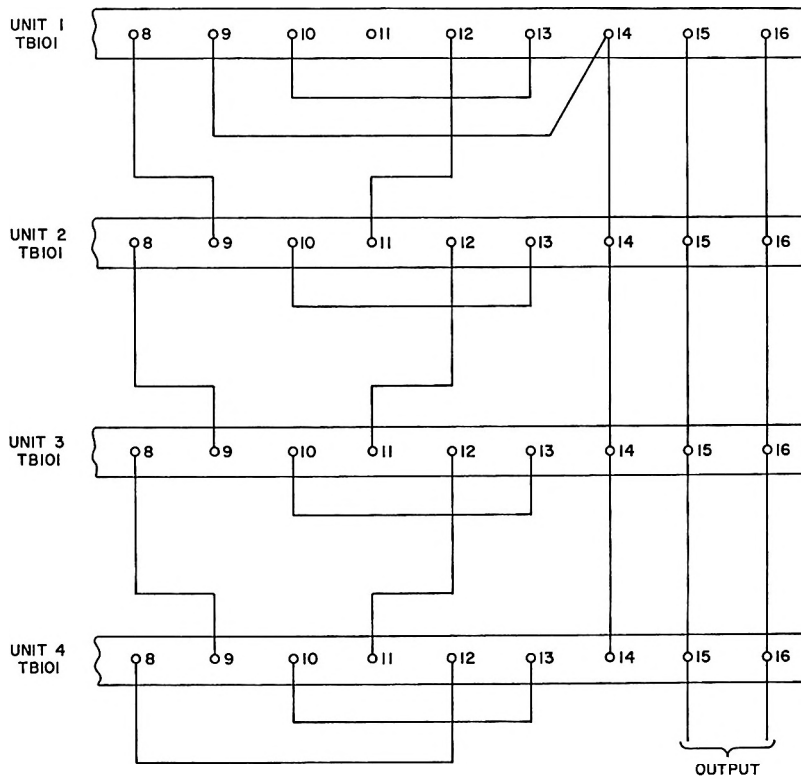
If the 642A-2 Recorder/Playback Unit and 216C-2 Recording Amplifier are used together, connect J101 on the rear of the 642A-2 to J402 on the rear of the 216C-2. Use the interconnecting cable supplied with the 216C-2.

2.2.6 REMOTE CONTROL SWITCHING UNIT  
INSTALLATION.

Mount the remote control switching unit in the desired location by cutting a rectangular hole in the

mounting panel just large enough to accommodate the rear of the unit. Refer to figures 2-7 through 2-9. Insert the unit into place and secure it by tightening the two screws in the mounting brackets. Refer to figures 2-2 through 2-4 for unit interconnection data.

642A-2 INTERCONNECTIONS



NOTE: REMOVE THE JUMPER BETWEEN TERMINALS 13 AND 14 OF ALL UNITS.

Figure 2-1. 642A-2 Interconnection Diagram

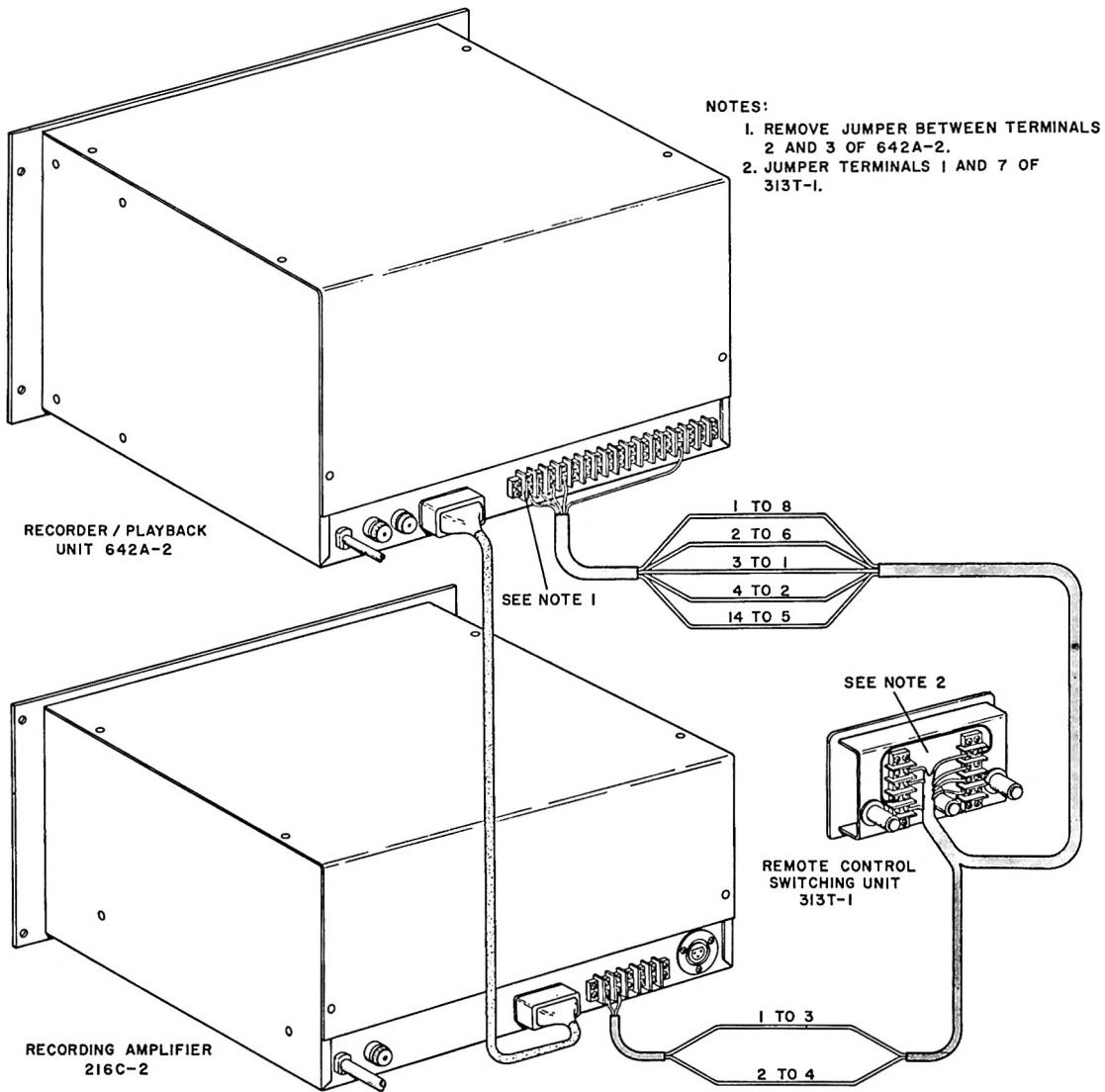


Figure 2-2. 313T-1 Remote Control Switching Unit, Installation Diagram

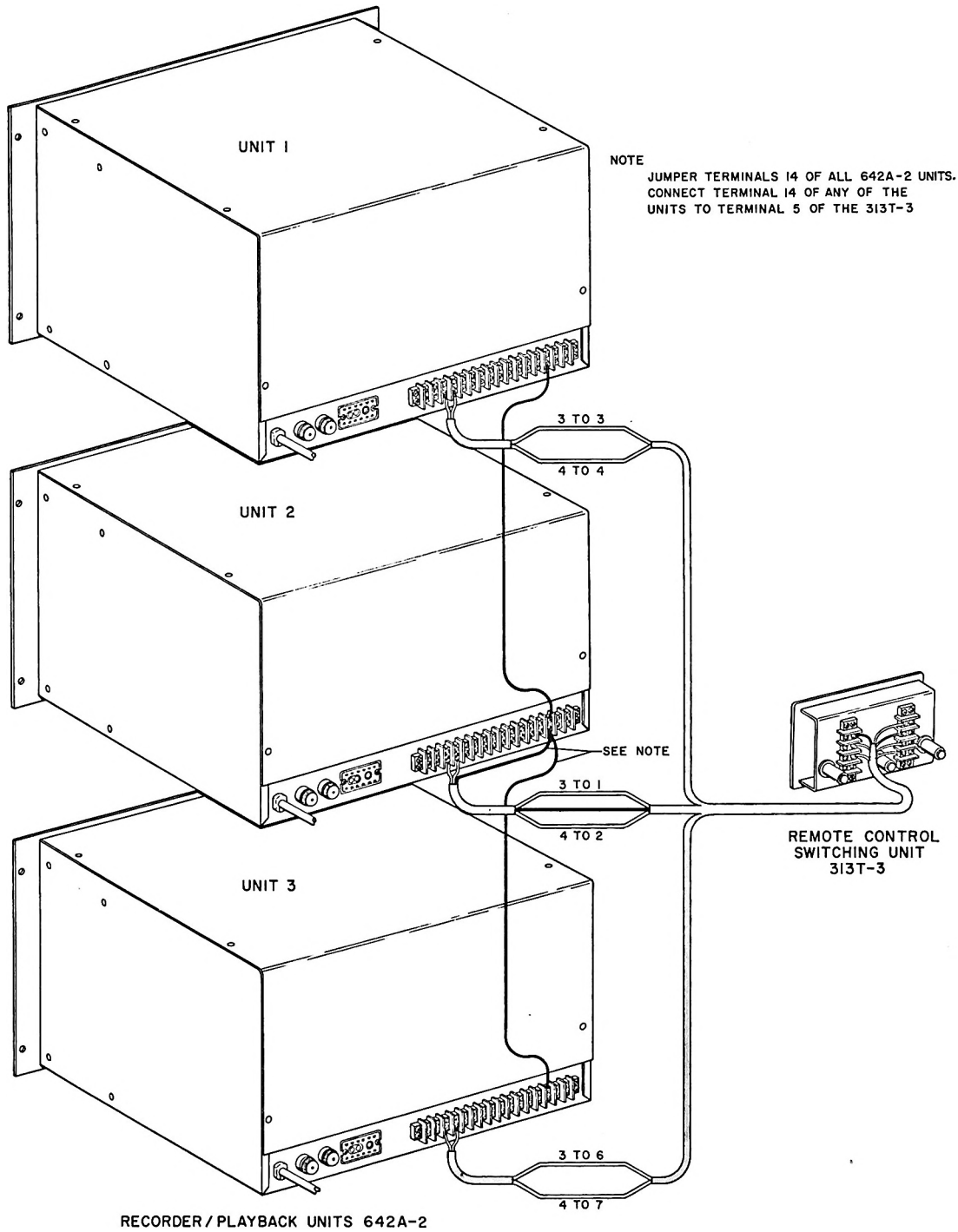
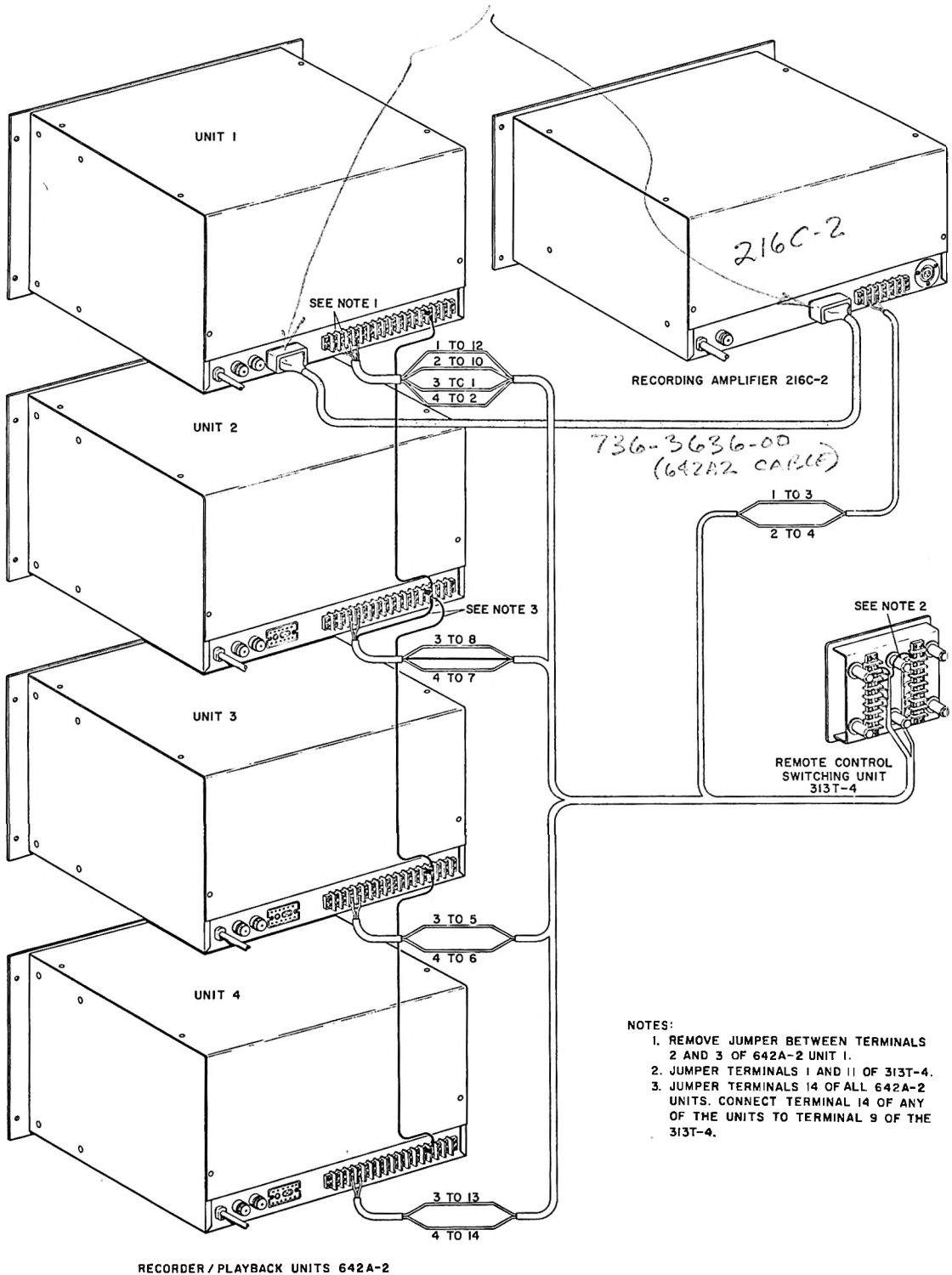


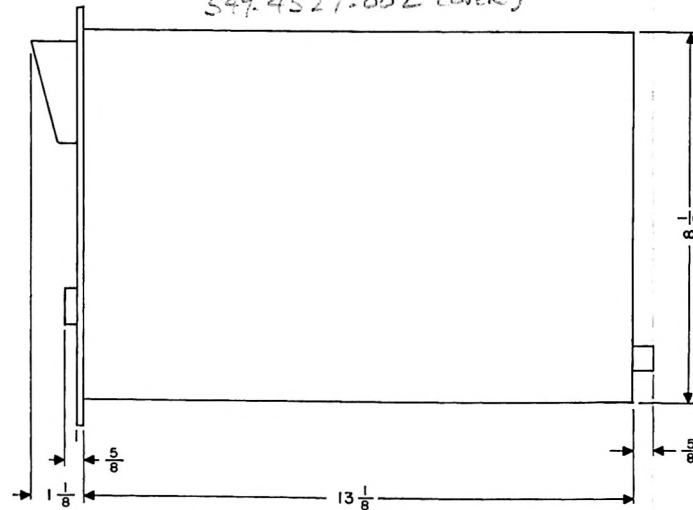
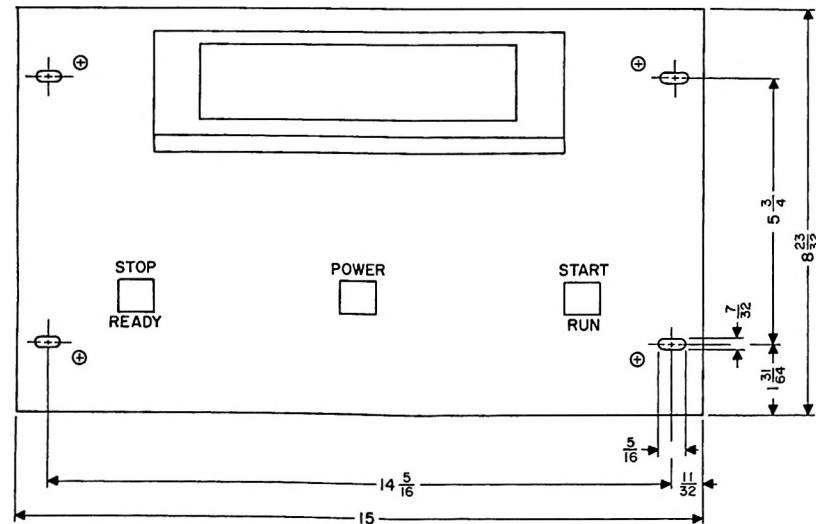
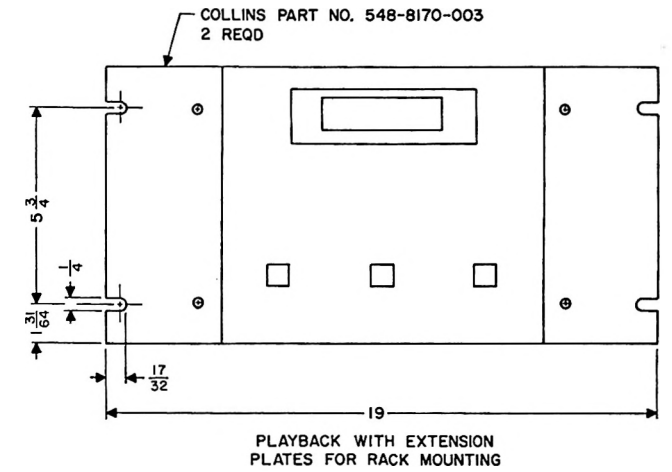
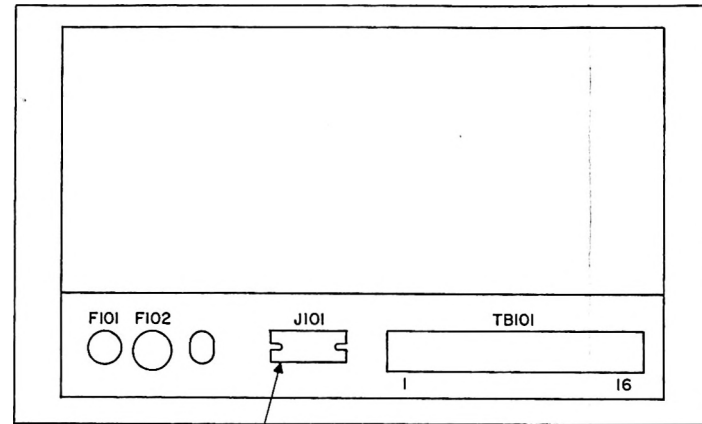
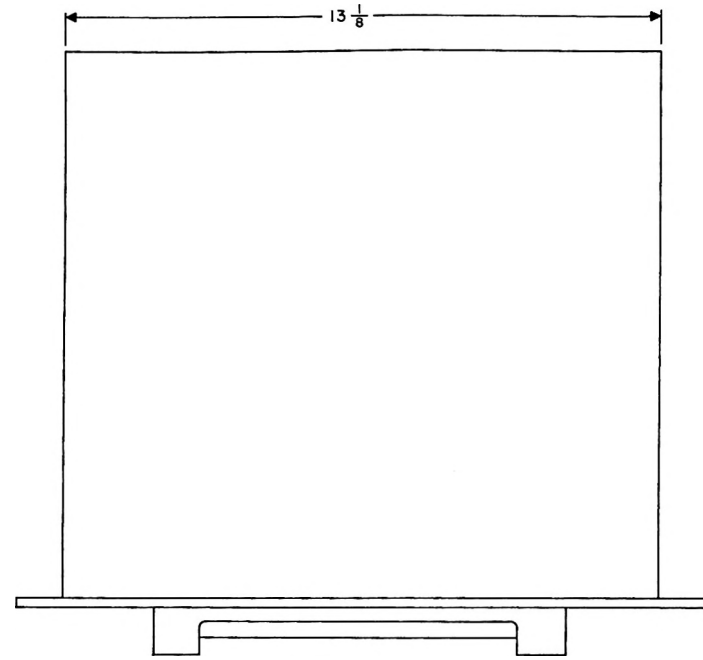
Figure 2-3. 313T-3 Remote Control Switching Unit, Installation Diagram

PLUGS 372-1079-00  
COVERS 549-4529-002



- NOTES:
1. REMOVE JUMPER BETWEEN TERMINALS 2 AND 3 OF 642A-2 UNIT 1.
  2. JUMPER TERMINALS 1 AND 11 OF 313T-4.
  3. JUMPER TERMINALS 14 OF ALL 642A-2 UNITS. CONNECT TERMINAL 14 OF ANY OF THE UNITS TO TERMINAL 9 OF THE 313T-4.

Figure 2-4. 313T-4 Remote Control Switching Unit, Installation Diagram



372-1079-00 Plug 2  
549.4529-002 COVER

J101	
PIN	FUNCTION
1	PROGRAM INPUT
2	CUE HEAD TRANSFER RELAY CONTROL IN
3	PROGRAM INPUT SHIELD
4	PROGRAM HEAD TRANSFER RELAY CONTROL IN
5	BIAS INTERLOCK OUT
6	RECORD SET OUT
7	CUE INPUT
8	RECORD LOCK OUT
9	CUE INPUT SHIELD
10	GROUND
11	CUE TONE DURATION CONTROL IN
12	CUE INTERLOCK
13	BIAS INTERLOCK IN
14	SPARE
15	GROUND

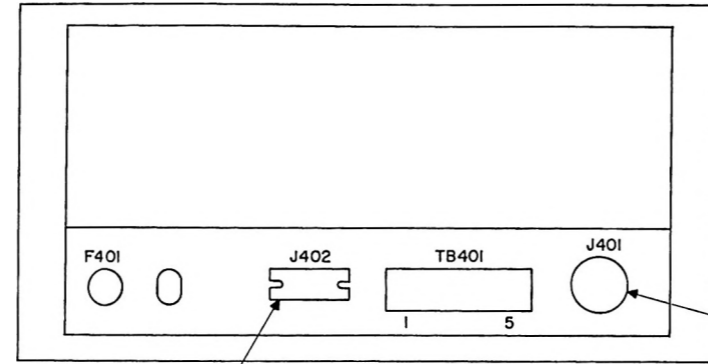
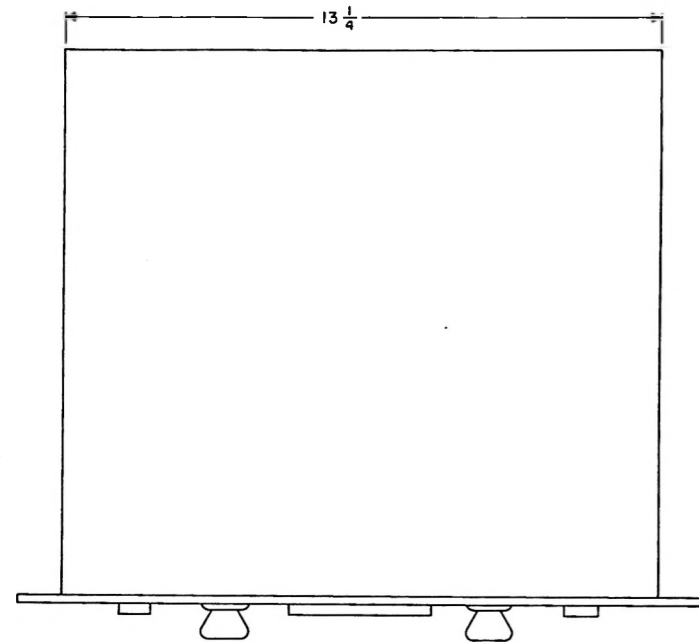
TBI01	
TERM.	FUNCTION
1	READY LIGHT
2	REMOTE STOP
3	REMOTE COMMON
4	REMOTE START
5	CUE STOP
6	CUE COMMON
7	CUE START
8	AUX. STOP
9	AUX. COMMON
10	AUX. START
11	OUTPUT SWITCHING
12	OUTPUT SWITCHING
13	OUTPUT SWITCHING
14	COMMON GROUND
15	OUTPUT
16	OUTPUT

NOTES:

1. WEIGHT, APPROX. 40LB.
2. POWER REQUIRED; 55W ON STANDBY, 90W ON OPERATE, 105-125V AC.

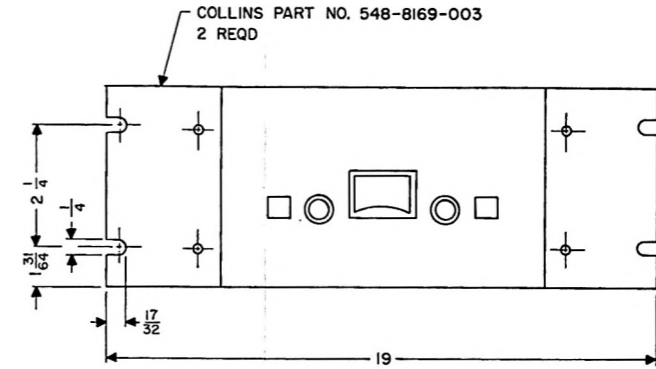
Figure 2-5. 642A-2 Recorder/Playback Unit, Outline and Mounting Dimensions



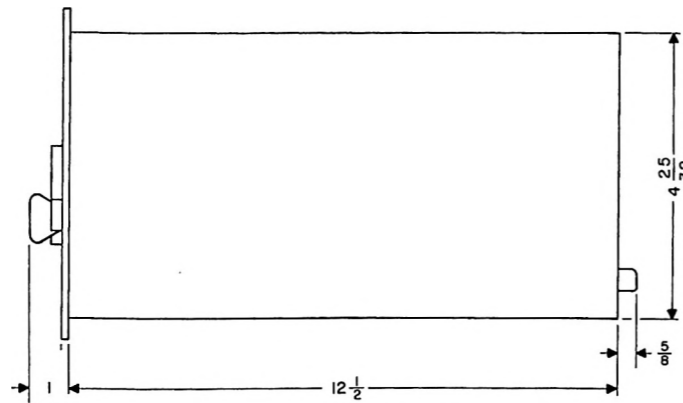
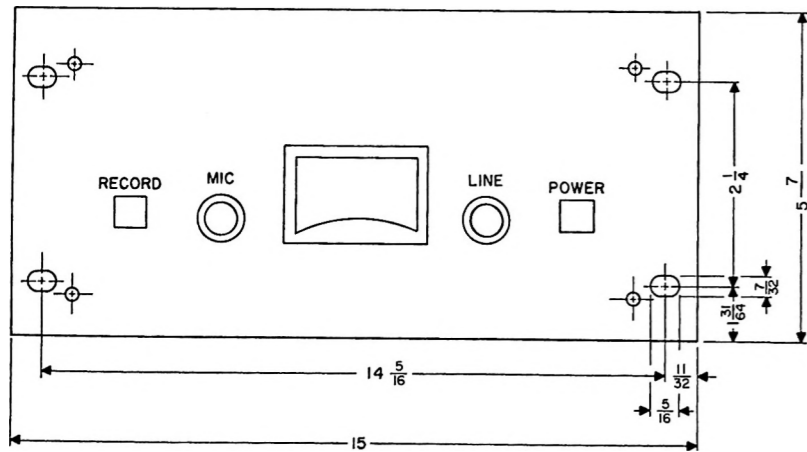


MATES WITH INTERCONNECTING CABLE,  
COLLINS PART NO. 548-8119-00 FOR  
216C-1 OR PART NO. 756-3636-00  
FOR 216C-2

MICROPHONE INPUT  
CANNON TYPE  
XLR-3-13



RECORD AMPLIFIER WITH  
EXTENSION PLATES FOR  
RACK MOUNTING



J402	
PIN	FUNCTION
1	PROGRAM OUTPUT
2	CUE HEAD TRANS RELAY CONTROL OUT
3	PROGRAM OUTPUT SHIELD
4	PROGRAM HEAD TRANS RELAY CONTROL OUT
5	BIAS INTERLOCK IN
6	RECORD SET IN
7	CUE OUTPUT
8	RECORD LOCK IN
9	CUE OUTPUT SHIELD
10	GROUND
11	CUE TONE DURATION CONTROL IN
12	CUE INTERLOCK
13	BIAS INTERLOCK OUT
14	SPARE
15	GROUND

SEE  
NOTE

4

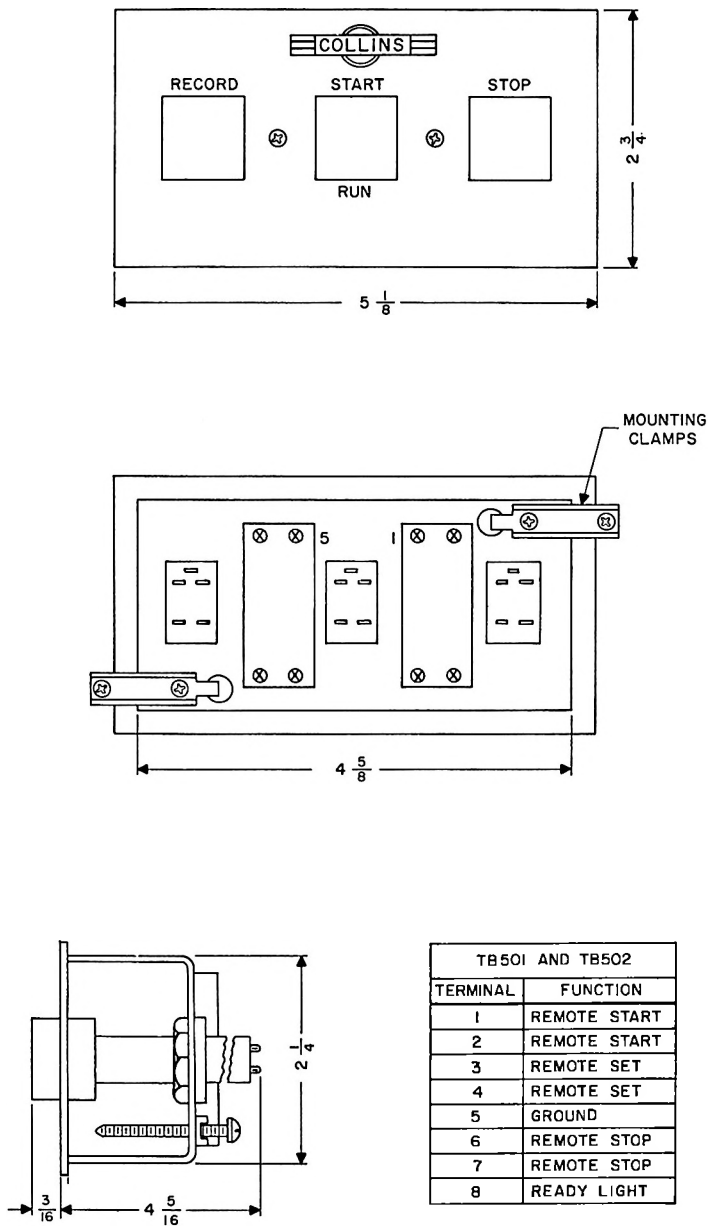
3

TB401	
TERM.	FUNCTION
1	REMOTE RECORD SET
2	REMOTE RECORD SET
3	COMMON GROUND
4	LINE AUDIO INPUT
5	LINE AUDIO INPUT

NOTES:

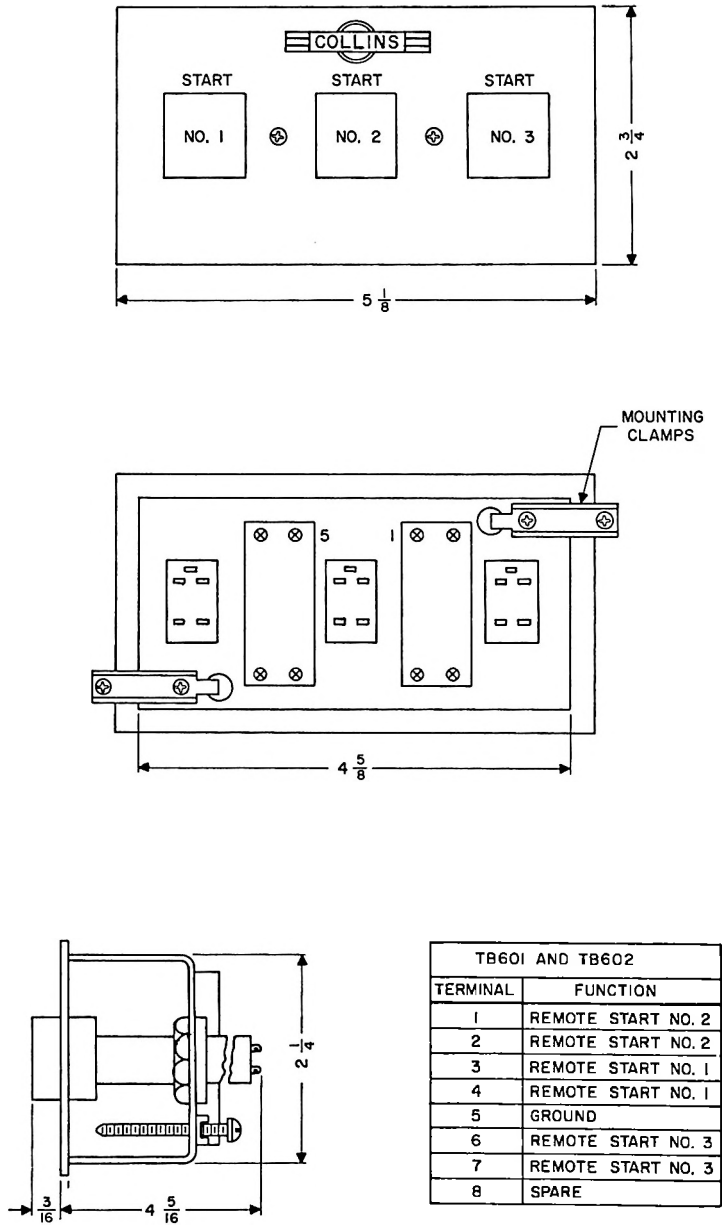
1. WEIGHT, APPROX 15LB.
2. POWER REQUIRED, 40 WATTS, 105-125V AC.
3. 216C-1 ONLY
4. 216C-2 ONLY

Figure 2-6. 216C-2 Recording Amplifier, Outline and Mounting Dimensions



TB501 AND TB502	
TERMINAL	FUNCTION
1	REMOTE START
2	REMOTE START
3	REMOTE SET
4	REMOTE SET
5	GROUND
6	REMOTE STOP
7	REMOTE STOP
8	READY LIGHT

Figure 2-7. 313T-1 Remote Control Switching Unit, Outline and Mounting Dimensions



TB601 AND TB602	
TERMINAL	FUNCTION
1	REMOTE START NO. 2
2	REMOTE START NO. 2
3	REMOTE START NO. 1
4	REMOTE START NO. 1
5	GROUND
6	REMOTE START NO. 3
7	REMOTE START NO. 3
8	SPARE

Figure 2-8. 313T-3 Remote Control Switching Unit, Outline and Mounting Dimensions

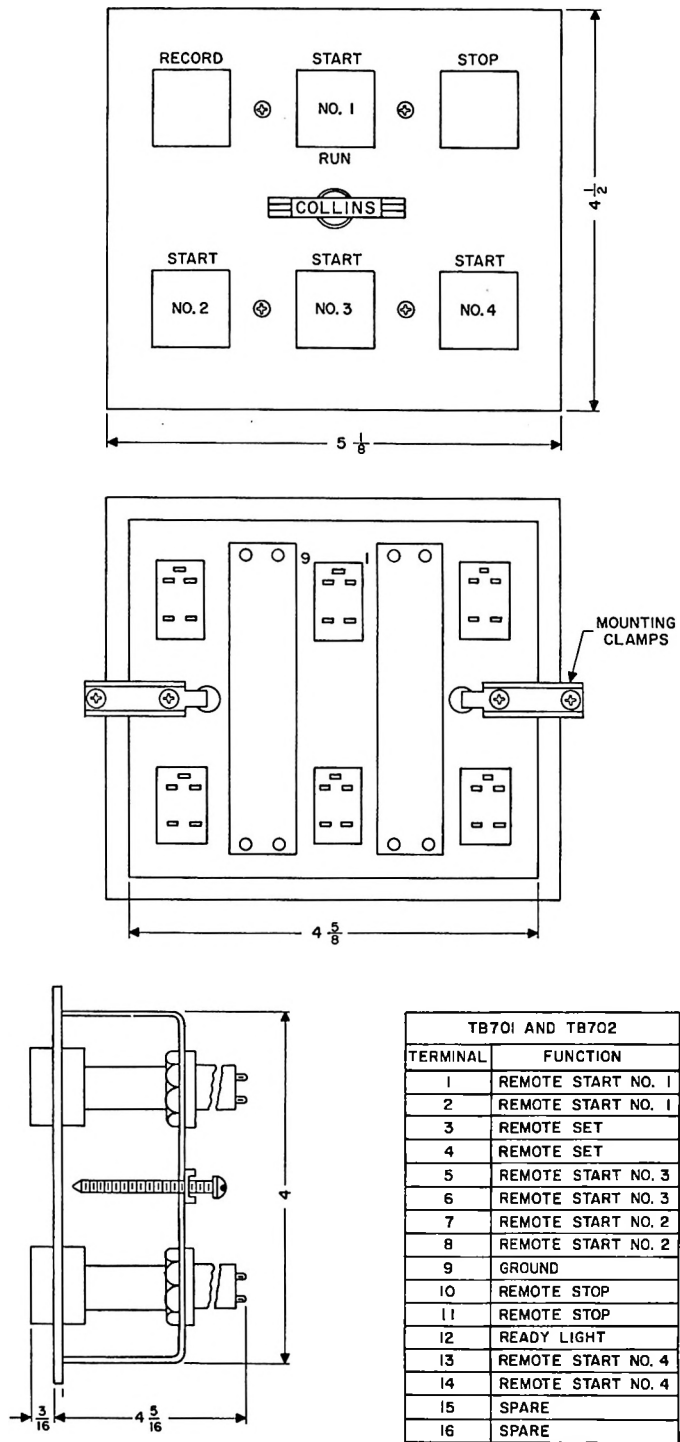


Figure 2-9. 313T-4 Remote Control Switching Unit, Outline and Mounting Dimensions

# section 3

## operation

### 3.1 Operating Controls and Indicators.

Tables 3-1 and 3-2 list the functions of the various operating controls and indicators on the 642A-2 Recorder/Playback Unit and 216C-2 Recording Amplifier. Figures 3-1 and 3-2 show the location of the controls and indicators.

### 3.2 Operating Procedures.

#### 3.2.1 RECORDING.

a. Press the POWER switches on both the 216C-2 and 642A-2. Allow a 2-minute warmup period.

b. Insert an erased tape cartridge into the right side of the slot in the 642A-2 until the READY indicator on this unit lights. This indicates that the cartridge is in the proper position.

c. Press the START switch on the 642A-2 and run several seconds of tape before starting recording. This will assure better seating of tape to the heads. Stop the tape by pressing the STOP switch on the 642A-2.

d. Press the RECORD switch on the 216C-2.

e. Adjust the MIC and LINE level controls on the 216C-2 until the VU meter indicates 0 vu at normal recording peaks. If one of the inputs is not used, set the level control for that input fully counterclockwise.

TABLE 3-1  
OPERATING CONTROLS AND INDICATORS ON  
THE 642A-2 RECORDER/PLAYBACK UNIT

CONTROL OR INDICATOR	FUNCTION
STOP/READY	Stops tape motion when pressed. Indicates that tape is ready to run when lighted.
POWER	Applies power to unit when pressed. Indicates that power is applied to unit when lighted.
START/RUN	Starts tape motion when pressed. Indicates that tape is running when lighted.

TABLE 3-2  
OPERATING CONTROLS AND INDICATORS ON  
THE 216C-2 RECORDING AMPLIFIER

CONTROL OR INDICATOR	FUNCTION
RECORD	Readies record circuits if pressed when tape is not running. Places external-cue tone on tape if pressed when tape is running. Indicates that tape is ready to record or recording when lighted.
MIC	Controls microphone input recording level.
VU meter	Indicates recording level.
LINE	Controls line input recording level.
POWER	Applies power to unit when pressed. Indicates that power is applied to unit which lighted.

f. Press the START switch on the 642A-2. Recording begins when this switch is pressed. To record an external-cue tone while recording the program material, press the RECORD switch on the 216C-2.

g. When the recording is completed, press the STOP switch on the 642A-2. If only one production is to be on the cartridge, press the START switch on the 642A-2 and allow the tape to run until it stops automatically. If more than one production is to be on the same cartridge, repeat steps d through f for each production. When the final production is completed, press the START switch on the 642A-2 and allow the tape to run until it stops automatically.

#### 3.2.2 PLAYBACK.

a. Press the POWER switch on the 642A-2. Allow a 2-minute warmup period.

b. Insert a recorded tape cartridge into the right side of the slot in the 642A-2 until the READY indicator on this unit lights. This indicates that the cartridge is in the proper position.

c. Press the START switch on the 642A-2. When this switch is pressed, the tape will start to move

past the program and cue heads, and will continue to move until either the STOP switch on the 642A-2 is pressed or until the stop-cue tone is picked up by the cue head. To ensure that the tape is properly cued after each use, it is good practice to allow the tape to stop automatically.

**CAUTION**

Do not remove the tape cartridge while the tape is moving.

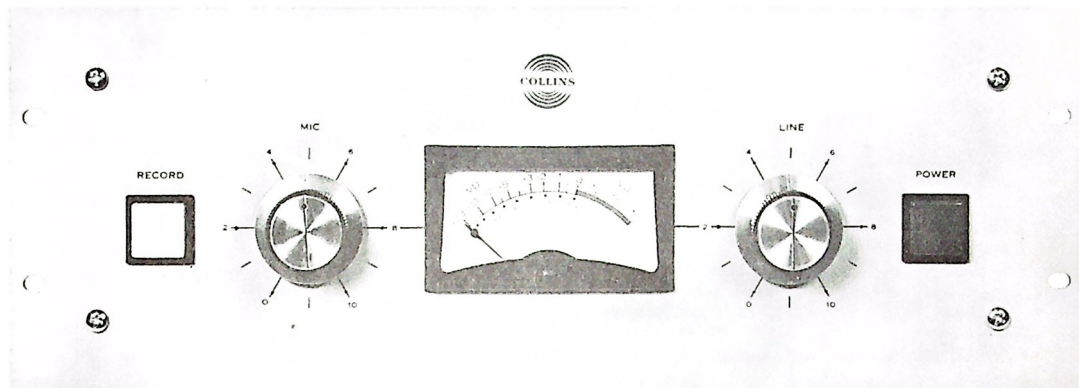


Figure 3-1. 216C-2 Recording Amplifier, Operating Controls and Indicators

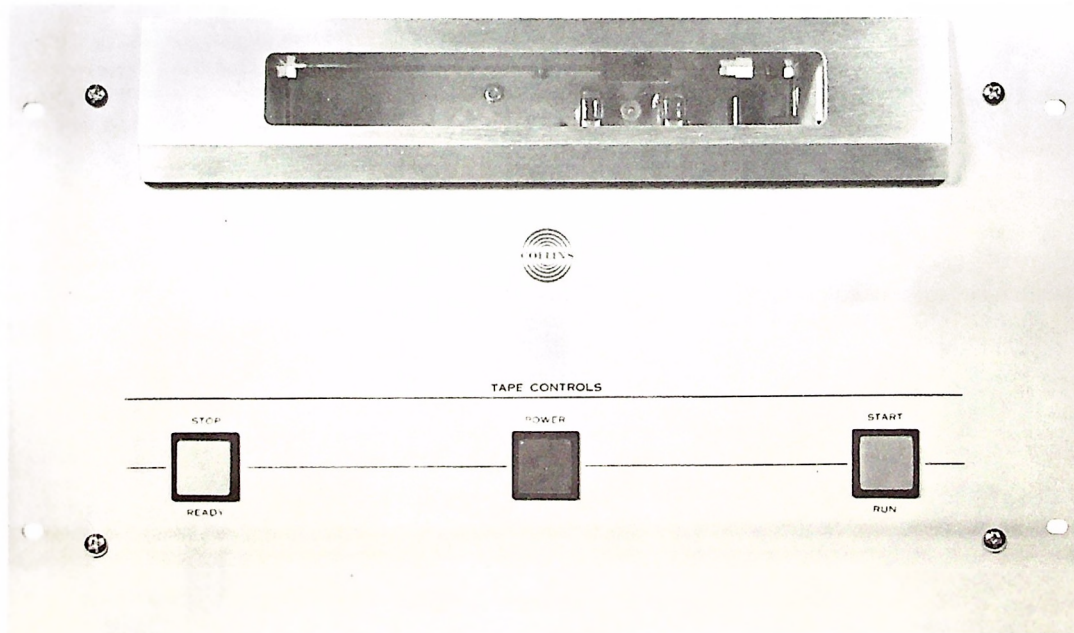


Figure 3-2. 642A-2 Recorder/Playback Unit, Operating Controls and Indicators

# section 4

## principles of operation

### 4.1 General.

Refer to figure 4-1, a block diagram of the Tape Cartridge System. Recording audio inputs are connected to the 216C-2 Recording Amplifier. The playback audio output is connected to the 642A-2 Recorder/Playback Unit. These two main units are completely interconnected by a cable that connects to jacks at the rear of the units. The remote control switching units may be connected to these two units to control them from a remote location.

Automatic cuing of tapes used with the Tape Cartridge System is accomplished by recording cue tones and program material on separate tracks of a double-track tape. Two types of cue tones are used in the Tape Cartridge System.

One, a 1000-cps tone, is used as a stop-cue tone. This tone is recorded automatically for about 1/2 second at the moment recording of the program material begins. When this tone passes the cue head during playback, a relay is energized to stop the tape in the cued position just ahead of the start of the program material.

The other tone, a 150-cps tone, is used as an external-cue tone to switch miscellaneous external equipment. This tone may be recorded at any time during the recording of program material. A typical application of this external-cue tone is automatic switching of a video slide projector during playback of recorded audio material. In installations with more than one recorder/playback unit, the external-cue tone may be used to automatically start one of the units immediately after the program material on another unit is completed.

The tape transport mechanism, located in the 642A-2 Recorder/Playback Unit, is driven by a synchronous motor that turns a flywheel and attached capstan. When the tape start circuits are energized, a rubber pressure roller presses the tape against the capstan, starting the tape moving past the recording/playback heads at a speed of 7-1/2 inches per second.

Refer to the unit instructions listed in table 1-1 for more detailed principles of operation of each of the units that make up the Tape Cartridge System.

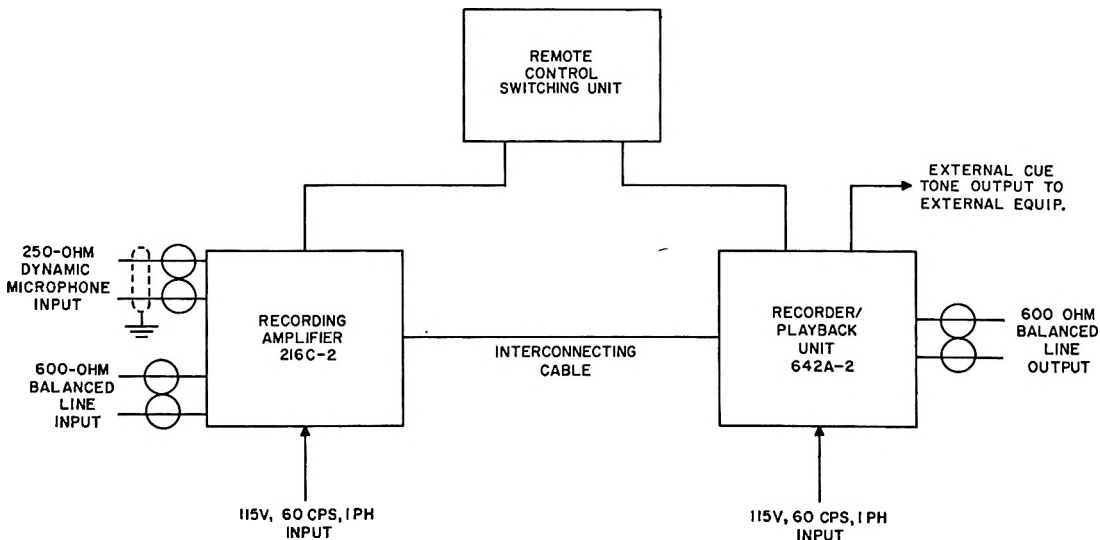


Figure 4-1. Tape Cartridge System, Block Diagram

### 5.1 System Trouble Shooting.

To isolate and remedy trouble that may occur in one of the units of the Tape Cartridge System, refer to table 5-1.

#### NOTE

Most of the symptoms listed in table 5-1 may also be caused by dirty, magnetized, or misaligned recording/playback heads or defective tape. Refer to section 5 in the 642A-2 Recorder/Playback Unit Instructions. Be sure that tape used is of good quality and in good condition.

TABLE 5-1. SYSTEM TROUBLE SHOOTING

SYMPTOM	PROBABLE CAUSE	REMEDY	
		CHECK	ADJUST
Unit will not operate - tube filaments not lighted	Fuse blown	Fuses	-
Abnormally low playback output level	Defective program amplifier	V201 V202	Program amplifier gain (642A-2)
	Low record level	V401 V402 V404	VU meter calibration (216C-2)
High playback distortion	Insufficient record bias	V403 V405	Bias output level (216C-2)
Loss of high-frequency response	Improper equalization	-	Recording amplifier (216C-2) and program amplifier (642A-2) equalization
	Excessive record bias	-	Bias output level (216C-2)
Cue inoperative or intermittent	Defective cue tone oscillator	V405	-
	Defective cue amplifier	V301 V302 V303	Cue amplifier gain (642A-2)







**unit instructions**

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**642A-2**  
**Recorder/Playback Unit**

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# table of contents

Section		Page
1	GENERAL DESCRIPTION . . . . .	1
	1.1 Purpose of Equipment . . . . .	1
	1.2 Description of Equipment . . . . .	1
	1.3 Equipment Specifications . . . . .	1
	1.3.1 Physical . . . . .	1
	1.3.2 Electrical . . . . .	1
	1.3.3 Mechanical . . . . .	2
	1.4 Tube Complement . . . . .	2
2	INSTALLATION . . . . .	3
	2.1 General . . . . .	3
3	OPERATION . . . . .	3
	3.1 General . . . . .	3
4	PRINCIPLES OF OPERATION . . . . .	3
	4.1 General . . . . .	3
	4.2 Start-Stop Circuits . . . . .	3
	4.3 Tape Transport Mechanism . . . . .	5
	4.4 Program Circuits . . . . .	5
	4.5 Cue Circuits . . . . .	5
	4.6 Remote, Auxiliary, and Cue Switching Circuits . . . . .	7
5	MAINTENANCE . . . . .	9
	5.1 Preventive Maintenance . . . . .	9
	5.1.1 Cleaning Recording/Playback Heads . . . . .	9
	5.1.2 Cleaning Pressure Roller and Capstan . . . . .	9
	5.1.3 Lubricating Motor and Bearings . . . . .	9
	5.1.4 Demagnetizing Recording/Playback Heads . . . . .	10
	5.1.5 Checking Tubes . . . . .	10
	5.1.6 Cleaning Relays . . . . .	10
	5.1.7 Checking Wiring . . . . .	10
	5.2 Adjustments . . . . .	10
	5.2.1 Test Equipment . . . . .	10
	5.2.2 Test Setup . . . . .	10
	5.2.3 Program Amplifier Equalization and Gain Adjustments . . . . .	10
	5.2.4 Cue Amplifier Gain Adjustments . . . . .	11
	5.2.5 Head Alignment . . . . .	12
	5.3 Trouble Shooting . . . . .	12
6	PARTS LIST . . . . .	13
7	ILLUSTRATIONS . . . . .	23

## list of illustrations

Figure		Page
1-1	642A-2 Recorder/Playback Unit (C754-21-P) . . . . .	1
4-1	642A-2 Recorder/Playback Unit, Block Diagram (C754-27-4) . . . . .	4
4-2	Start-Stop Circuits, Simplified Schematic Diagram (C754-18-4) . . . . .	4
4-3	Tape Transport Mechanism, Functional Diagram (C754-45-4) . . . . .	5
4-4	Program Circuits, Simplified Schematic Diagram (C754-15-3) . . . . .	6
4-5	Cue Circuits, Simplified Schematic Diagram (C754-19-4) . . . . .	6
4-6	Remote, Auxiliary, and Cue Switching Circuits, Simplified Schematic Diagram (C754-16-3) . . . . .	7
5-1	642A-2 Recorder/Playback Unit, Test Setup (C754-25-3) . . . . .	11
6-1	642A-2 Recorder/Playback Unit, Parts Identification (Top View) (C754-63-P) . . . . .	17
6-2	642A-2 Recorder/Playback Unit, Parts Identification (Bottom View) (C754-34-P) . . . . .	18
6-3	642A-2 Tape Transport Mechanism, Exploded View (C754-56-5) . . . . .	19
6-4	Program Amplifier Module, Parts Identification (C754-32-P) . . . . .	20
6-5	Cue Amplifier Module, Parts Identification (C754-64-P) (C754-59-P) . . . . .	21
7-1	642A-2 Recorder/Playback Unit, Schematic Diagram (C754-07-6) . . . . .	23
7-2	Program Amplifier Module, Schematic Diagram (C754-08-4) . . . . .	24
7-3	Cue Amplifier Module, Schematic Diagram (C754-57-5) . . . . .	25

## list of tables

Table		Page
1-1	642A-2 Tube Complement . . . . .	2
5-1	Preventive Maintenance Schedule . . . . .	9
5-2	Motor Lubricants . . . . .	10
5-3	Bearing Lubricants . . . . .	10
5-4	Program Amplifier Equalization Check . . . . .	11
5-5	642A-2 Voltage Measurements . . . . .	12

**general description**

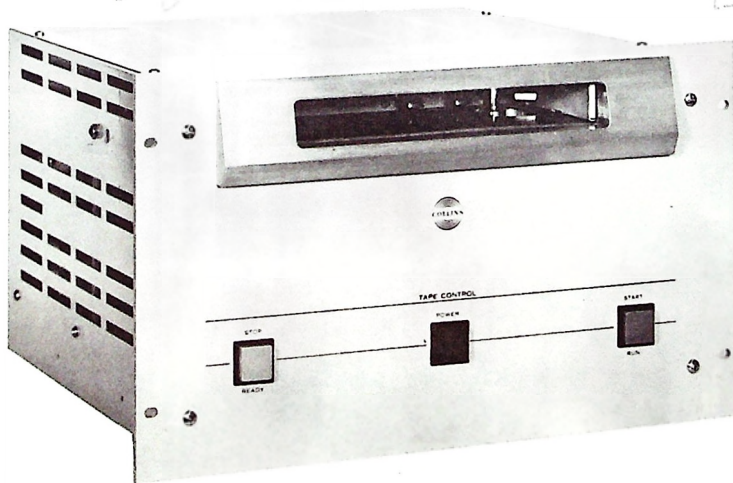
**1.1 Purpose of Equipment.**

The 642A-2 Recorder/Playback Unit contains the tape transport mechanism, magnetic recording/playback heads, program amplifier and cue amplifier modules, and most of the control circuits for the Tape Cartridge System. This unit may be used alone to provide playback facilities only, or with the 216C-2 Recording Amplifier for recording.

**1.2 Description of Equipment.**

The 642A-2 Recorder/Playback Unit, shown in figure 1-1, weighs 40 pounds, and is 8-3/4 inches high, 15 inches wide, and 13-3/4 inches deep. Extender panels are furnished with the 642A-2 to extend the width to 19 inches for rack mounting. The program and cue amplifiers in the 642A-2 are separate plug-in type modules. These modules are electrically connected to the main chassis with 12-terminal jacks, and mechanically fastened to the chassis with two hold-down screws in each module. All electrical connections to the 642A-2 are made at the rear of the unit.

*Latest mod on playback capstan head mount & positioning of heads starts with SN 1765*



**1.3 Equipment Specifications.**

**1.3.1 PHYSICAL.**

- Size . . . . . 15 inches wide, 8-3/4 inches high, 13-3/4 inches deep.
- Weight . . . . . Approximately 40 pounds.
- Mounting . . . . . 15-inch console or 19-inch rack with furnished extenders.

**1.3.2 ELECTRICAL.**

- Power source . . . . . 105 to 125 volts, 50/60 cps, 1 phase.
- Power requirements . Standby: 25 watts.  
Operate: 100 watts.
- Audio output . . . . . 600 ohms, balanced, resistive.

Figure 1-1. 642A-2 Recorder/Playback Unit

Equalization . . . . . Conforms to NAB standard playback response curve for 15-inch-per-second playback  $\pm 2$  db.

Signal-plus-noise to noise ratio . . . . . 55 db minimum, measured at 400 cps using a 3-percent total harmonic distortion tape as reference.

Harmonic distortion . . . 1 percent maximum at 400 cps.

1.3.3 MECHANICAL.

Tape speed . . . . . 7-1/2 inches per second.

Tape drive motor . . . . . Bodine type NYC12, 1/75 horsepower, synchronous.

Tape drive . . . . . Solenoid-actuated, pressure tape drive; belt-driven capstan.

Tape start and stop time . . . . . 0.15 second maximum.

Flutter and wow . . . . . 0.2 percent rms maximum.

Timing accuracy . . . . . 0.4 percent or better for series 300 and 600 cartridges.

1.4 Tube Complement.

Table 1-1 lists the types and functions of all tubes in the 642A-2 Recorder/Playback Unit.

TABLE 1-1  
642A-2 TUBE COMPLEMENT

TUBE REFERENCE DESIGNATION	TUBE TYPE	FUNCTION
V201	ECC83	Program preamplifier
V202	12AT7	Program output amplifier
V301	12AX7	Cue amplifier
V302	12AX7	Stop-cue amplifier/ external-cue amplifier
V303	12AT7	Stop-cue relay amplifier/ external-cue relay amplifier

## section 2

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### installation

#### 2.1 General.

Refer to section 2 of the system instructions for the Tape Cartridge System, Collins part number 523-0756575, for installation instructions.

## section 3

---

### operation

#### 3.1 General.

Refer to section 3 of the system instructions for the Tape Cartridge System, Collins part number 523-0756575, for operating instructions.

## section 4

---

### principles of operation

#### 4.1 General.

Figure 4-1 is a block diagram of the 642A-2 Recorder/Playback Unit. Figures 7-1 through 7-3 are schematic diagrams of the main chassis and the program and cue amplifier modules.

The principles of operation of the 642A-2 Recorder/Playback Unit are divided into five parts: (1) start-stop circuits, (2) tape transport mechanism, (3) program circuits, (4) cue circuits, and (5) remote, auxiliary, and cue switching circuits.

#### 4.2 Start-Stop Circuits.

Refer to figure 4-2, a simplified schematic diagram of start-stop circuits in the 642A-2 Recorder/Playback Unit.

When the POWER switch on the front panel is pushed, S103 is closed, applying power to the main power supply. This supply furnishes +300 volts d-c to the plates of tubes in the program and cue amplifier

modules, +12 volts d-c to the program amplifier filaments, and 6.3 volts a-c to the cue amplifier filaments.

When a tape cartridge is properly inserted in the 642A-2, microswitch S104 is closed. This switch turns on the tape-drive motor, B101, activates the tape-drive solenoid power supply, and activates a separate +30-volt d-c power supply that furnishes voltages to some of the control relays. This +30 volts d-c causes the READY indicator on the front panel to light.

When the START switch on the front panel is momentarily pushed, start relay K102 is energized. This relay (1) energizes the tape-drive solenoid to start tape motion, and (2) energizes squelch relay K103. The energizing of K103 is delayed about 0.1 second after the energizing of K102 because capacitor C105 shunts the coil of relay K103 and must charge through resistor R106. Capacitor C105 discharges through R102 when K103 becomes energized. Closed contacts 10 and 6 of K103 shunt the START switch to keep K102 and K103 energized after the START switch is released. Because of the delayed energizing of K103, the START

642A-2 Recorder/Playback Unit

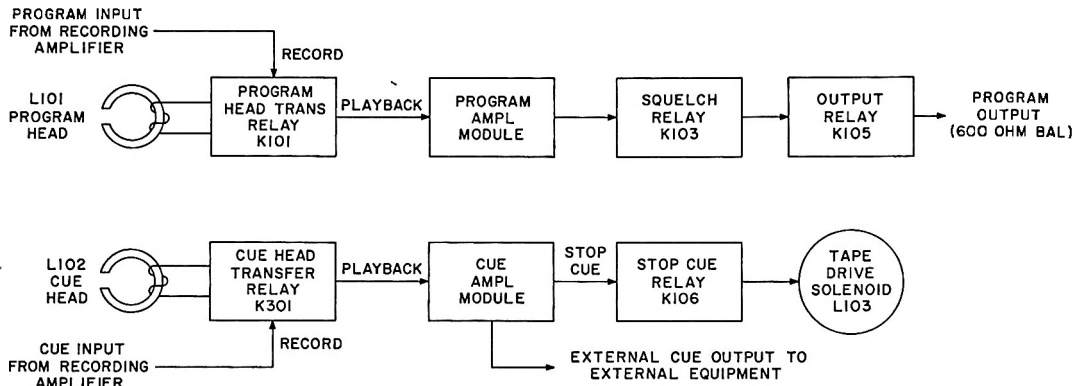


Figure 4-1. 642A-2 Recorder/Playback Unit, Block Diagram

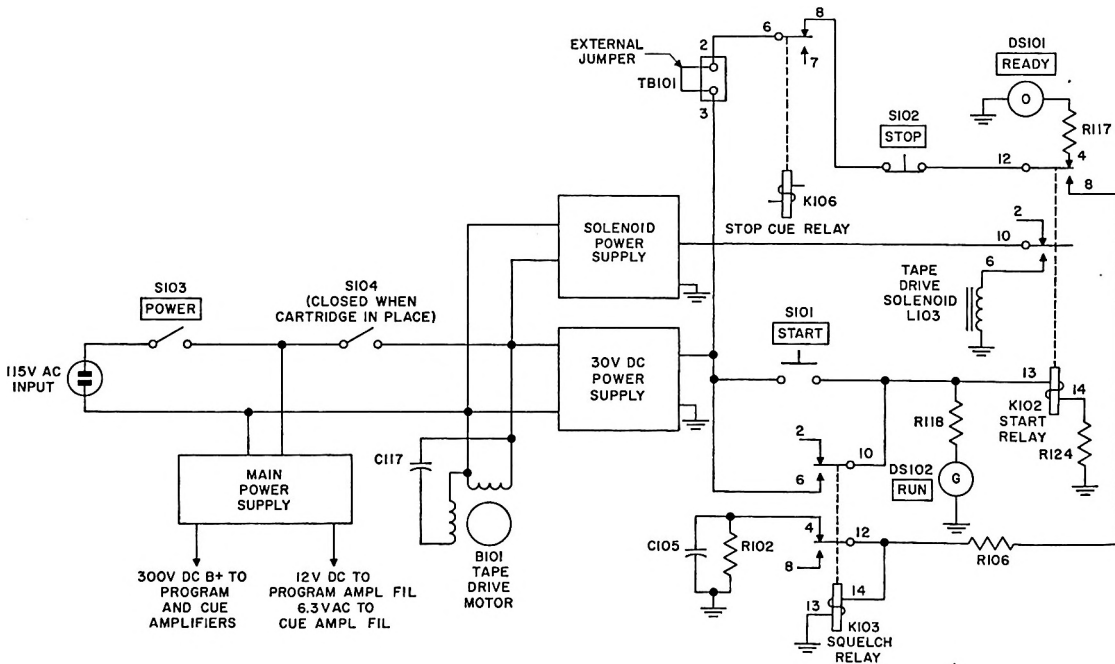


Figure 4-2. Start-Stop Circuits, Simplified Schematic Diagram



switch must be closed for at least 0.1 second in order for the start relay, K102, to remain energized.

When the STOP switch on the front panel is pushed, the +30-volt d-c to the coil of relay K103 is interrupted. This will de-energize K103 and, in turn, K102 and tape-drive solenoid L103. The stop-cue relay, K106, is also connected in the stop circuit so that if there is a stop-cue tone on the tape, K106 will be energized, stopping the tape motion in the same way as the STOP switch.

#### 4.3 Tape Transport Mechanism

The tape transport mechanism in the 642A-2 Recorder/Playback Unit is shown in figure 4-3.

When the tape cartridge is properly inserted in place, microswitch S104 is closed. This starts motor B101, a 1/75 horsepower, synchronous motor that operates directly from the 115-volt, 60-cycle line, using capacitor C117 to operate. This motor drives a flywheel through three drive belts. The capstan is connected to the flywheel.

When the START switch is pressed, tape-drive solenoid L103 is energized. This solenoid is connected, through an actuating mechanism shown in figure 4-3, to a rubber pressure roller that presses the tape against the capstan, starting the tape moving past the recording/playback heads at a speed of 7-1/2 inches per second.

#### 4.4 Program Circuits.

Refer to figure 4-4, a simplified schematic diagram of program circuits in the 642A-2 Recorder/Playback Unit.

During playback, program head transfer relay K101 is de-energized, and the program head, L101, is connected to the input of the program amplifier. The program amplifier is a separate module that connects to the 642A-2 chassis. Figure 7-2 is a schematic diagram of the program amplifier module.

The program amplifier output is fed to the program output line through squelch relay K103 and output relay K105. Squelch relay K103 is energized about 0.1 second after the tape is started and other control circuits are energized. This delay eliminates switching noise by attenuating the output with a resistive network composed of R103, R104, and R105. K103 also energizes output relay K105. This output relay switches the program output to terminals on the rear of the 642A-2. The output level is adjusted to 0 dbm by varying the gain of the program amplifier.

During recording, program head transfer relay K101 is energized by circuits in the 216C-2 Recording Amplifier. This connects the program output of the 216C-2 to the program head, L101.

#### 4.5 Cue Circuits.

Refer to figure 4-5, a simplified schematic diagram of cue circuits in the 642A-2 Recorder/Playback Unit.

During recording, the cue input from the 216C-2 Recording Amplifier may be one of two cue tones. One, the stop-cue tone, has a frequency of 1000 cps. The other, an external-cue tone, has a frequency of 150 cps. Both tones last for about 0.5 second. The stop-cue tone is recorded at the moment recording starts. The external-cue tone may be recorded at any time during the recording process.

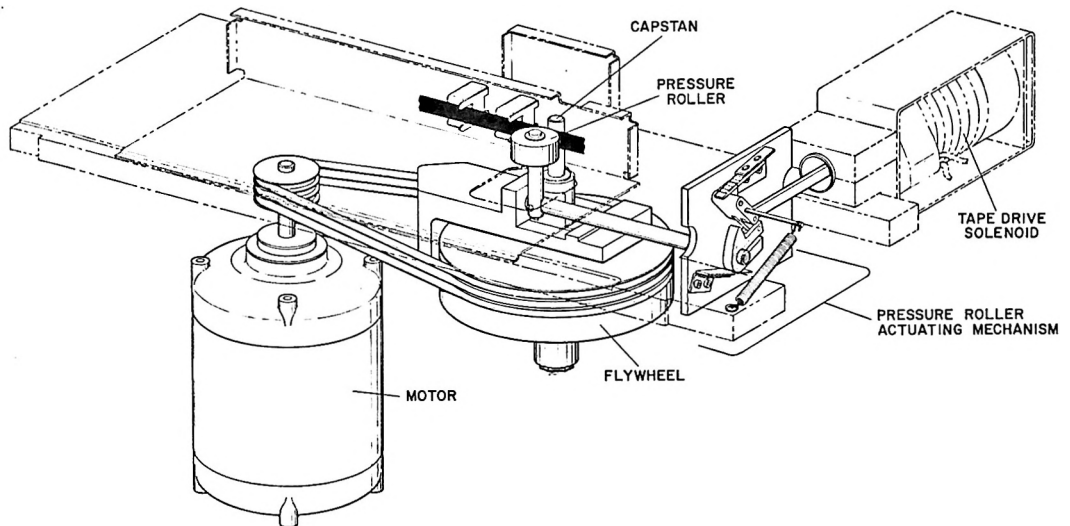


Figure 4-3. Tape Transport Mechanism, Functional Diagram

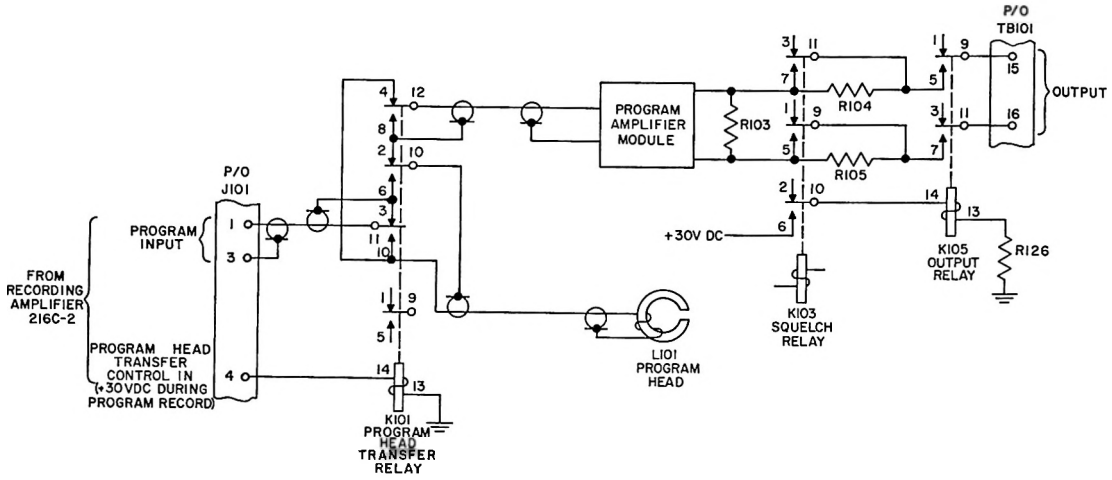


Figure 4-4. Program Circuits, Simplified Schematic Diagram

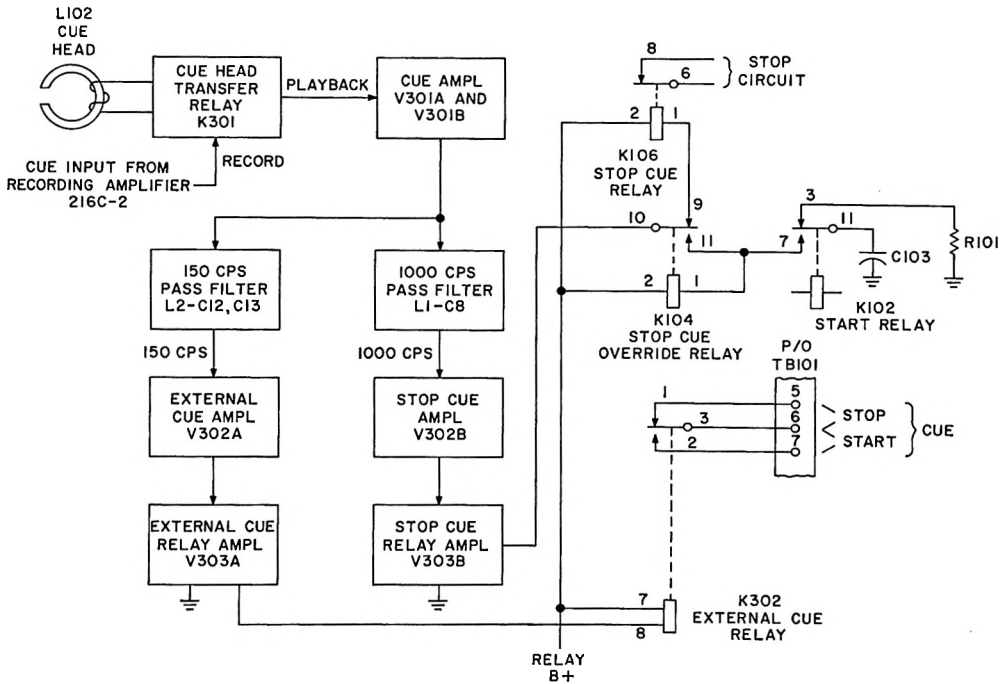


Figure 4-5. Cue Circuits, Simplified Schematic Diagram

Whenever one of the recorded cue tones passes the cue head during playback, there is an input to the cue amplifier. The cue amplifier is a separate module that connects to the 642A-2 chassis. Figure 7-3 is a schematic diagram of the cue amplifier module.

The cue-tone input to the cue amplifier module is amplified by cue amplifiers V301A and V301B and fed to the input of two audio filters. One of these filters passes the 1000-cps stop-cue tone; the other passes the 150-cps external-cue tone. The outputs of the two filters are amplified by separate amplifiers, rectified, and applied to separate relay amplifiers.

The relay amplifiers, V303A and V303B, are triode switches that are connected in series with the coils of the stop-cue and external-cue relays. If a stop-cue tone is present on the tape, the stop-cue relay, K106, will be energized and the tape will stop. If an external-cue tone is present, the external-cue relay, K302, will be energized, and the external equipment that is to be automatically cued will operate.

Since the stop-cue tone lasts for about 0.5 second and only 0.1 second is required to stop the tape, 0.4 second of the stop-cue tone will still be passing the cue head

when the tape is started. If the stop-cue relay amplifier were not disconnected from the stop-cue relay during this time, the remaining tone would cause the cue-stop relay to energize, locking the unit off. To prevent this, a stop-cue override relay, K104, is used.

When the start relay, K102, is energized, stop-cue relay K104 is energized by a current surge that charges capacitor C103, which is in series with the coil of K104. This disconnects the plate circuit of the stop-cue relay amplifier from the coil of the stop-cue relay, K106, and connects it instead to the coil of the override relay, K104, through contacts 10 and 11 of K104. The override relay will remain energized as long as there is a stop-cue tone input to the cue amplifier, and the stop-cue relay, K106, will be disabled during this time. When the stop-cue tone has passed the cue head, the override relay will be de-energized, reconnecting the stop-cue relay so that the stop-cue relay will operate when the stop-cue tone again passes the cue head.

#### 4.6 Remote, Auxiliary, and Cue Switching Circuits.

Refer to figure 4-6, a simplified schematic diagram of remote, auxiliary, and cue switching circuits in the 642A-2 Recorder/Playback Unit.

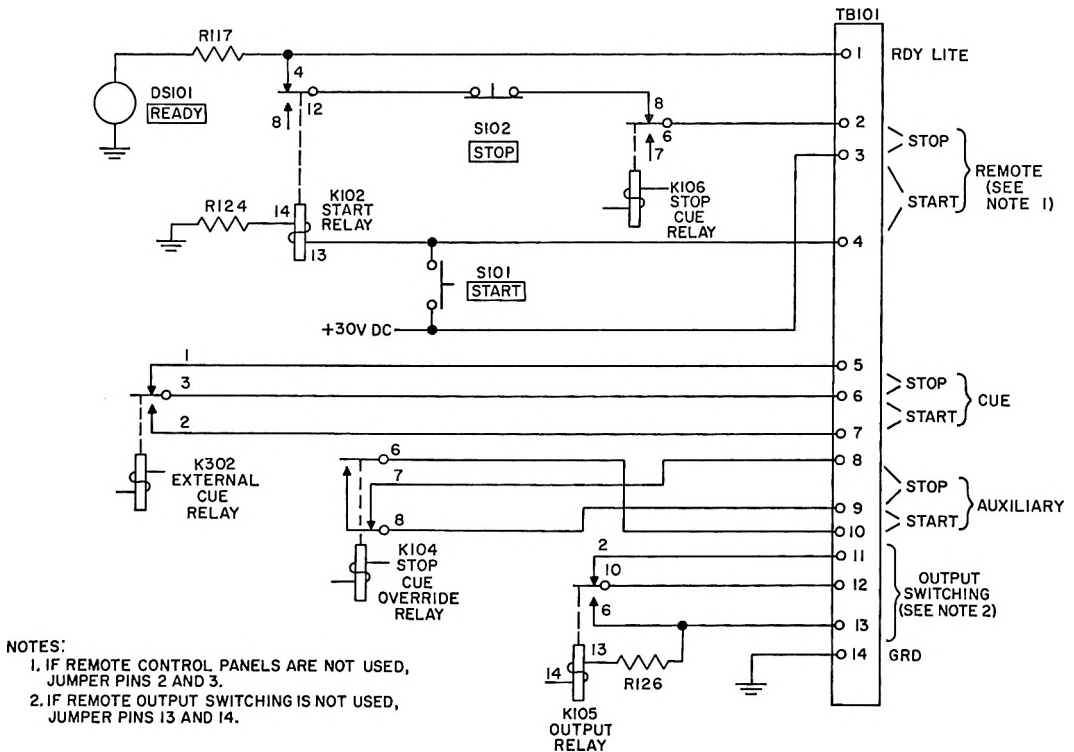


Figure 4-6. Remote, Auxiliary, and Cue Switching Circuits, Simplified Schematic Diagram

## 642A-2 Recorder/Playback Unit

Terminals 1 through 4 of TB101 are connected to the 313T-1, 313T-3, or 313T-4 Remote Control Switching Units to provide remote starting and stopping of a 642A-2.

Terminals 5 through 7 of TB101 are connected to external-cue relay contacts to provide cuing of external equipment.

Terminals 8 through 10 of TB101 are connected to the stop-cue override relay to provide starting and stopping of auxiliary equipment.

Terminals 11 through 13 of TB101 are connected to the output relay. Connections can be made to terminals 8 through 14 that allow a number of units to be connected to the same output line, but only one machine on the line at a time.

**5.1 Preventive Maintenance.**

Table 5-1 lists the preventive maintenance schedule for the 642A-2 Recorder/Playback Unit. It is essential that the maintenance operations in this table be performed at the given intervals to ensure continuing proper operation of the unit.

**5.1.1 CLEANING RECORDING/PLAYBACK HEADS.**

Remove the dust and oxide that collect on the recording/playback heads by wiping the face of each head with a lint-free cloth saturated with methyl alcohol. Be careful not to scratch the heads. The heads may be reached by wrapping the cloth around the eraser end of a pencil. After cleaning, polish the heads with a lint-free lens polishing cloth or paper to remove any remaining residue.

**CAUTION**

Do not use commercial head-cleaning solvents containing acetone or other harmful chemicals. These chemicals can permanently damage the heads, tape, and tape cartridges.

**5.1.2 CLEANING PRESSURE ROLLER AND CAPSTAN.**

Clean the pressure roller and capstan with alcohol.

**CAUTION**

Do not get alcohol into the bearings.

**5.1.3 LUBRICATING MOTOR AND BEARINGS.**

**5.1.3.1** Lubricate the tape-drive motor, B101, as follows:

- a. Remove the top cover from the 642A-2.
- b. Remove the oiler access plug from the tape deck.
- c. Put 10 drops of any of the lubricants listed in table 5-2 into each of the two oiler cups.
- d. Replace the oiler access plug.

**5.1.3.2** Lubricate the following bearings with two or three drops of any of the lubricants listed in table 5-3.

- a. Pressure-roller bearing (1).
- b. Pressure-roller cross-shaft bearings (2).
- c. Capstan/flywheel bearings (2).

**CAUTION**

Do not mix motor and bearing oils. Be careful to keep oil off the rubber pressure roller, capstan, and drive belts when lubricating the unit.

**TABLE 5-1. PREVENTIVE MAINTENANCE SCHEDULE**

INTERVAL	MAINTENANCE OPERATION	REF PARAGRAPH
Daily	Clean recording/playback heads	5.1.1
Weekly	Clean pressure roller and capstan	5.1.2
Every 2 weeks or 200 hours of operation	Lubricate motor and bearings	5.1.3
Monthly	Demagnetize recording/playback heads	5.1.4
Monthly	Check tubes	5.1.5
As required	Clean relays	5.1.6
As required	Check wiring	5.1.7
As required	Check head alignment	5.2.5

TABLE 5-2  
MOTOR LUBRICANTS

TYPE	SOURCE
Part no. 005-0759-00 L0-30 $\nearrow$	Collins Radio Company Penola, Inc.
Harmony No. 44	Gulf Oil Company

TABLE 5-3  
BEARING LUBRICANTS

TYPE	SOURCE
Part no. 553-2454-002	Collins Radio Company <i>SYNTHETIC</i>
Part no. 005-0392-00	Collins Radio Company
Aeroshell Fluid 12	Shell Oil Company
Univis P-38	Esso-Standard Oil Company
Pioneer P-10	Eclipse-Pioneer Company
Cosmolubric 270	E.F. Houghton Company
Winsor Lub L-245X	F.E. Anderson Company

#### 5.1.4 DEMAGNETIZING RECORDING/PLAYBACK HEADS.

Demagnetize the heads and capstan using a bulk tape eraser. Follow instructions for using eraser.

#### 5.1.5 CHECKING TUBES.

Check the emission of all tubes in the program and cue amplifier modules with a tube checker. Replace all low-emission tubes immediately.

#### 5.1.6 CLEANING RELAYS.

In case of relay failure, clean dirty (not pitted or burned) relay contacts with a burnishing tool. Before using tool, clean its surfaces with alcohol. Do not touch this surface with fingers before using the tool.

**CAUTION**

Do not bend contact supporting members beyond their normal operating limits while burnishing contacts.

Remove dirt and dust from contacts with a soft-bristled brush or by blowing; operate relay armature manually while blowing on contacts.

#### 5.1.7 CHECKING WIRING.

Periodically check open and laced wiring on chassis and modules. Check insulation for physical damage and charring. Examine wires for breaks and for improper dress in relation to adjacent wiring or chassis.

#### 5.2 Adjustments.

##### 5.2.1 TEST EQUIPMENT.

The following test equipment, or equivalent, is required to perform the adjustments in this section. All test equipment should be properly calibrated and in good working condition.

- a. Hewlett-Packard 200AB Audio Oscillator.
- b. Hewlett-Packard 400D Vacuum-Tube Voltmeter (2 required).
- c. Hewlett-Packard 410B Vacuum-Tube Voltmeter.
- d. Attenuator (see figure 5-1).
- e. 600-ohm, 1-watt resistor.
- f. Head alignment tape (Collins part number 097-6076-00).
- g. Cartridge alignment gauge (Collins part number 544-2632-002).

##### 5.2.2 TEST SETUP.

Connect the 642A-2 Recorder/Playback Unit and test equipment as shown in figure 5-1. Apply power to all units. Allow a 2-minute warmup period before making any tests. Remove the top cover from the 642A-2.

##### 5.2.3 PROGRAM AMPLIFIER EQUALIZATION AND GAIN ADJUSTMENTS.

- a. Connect the unbalanced audio oscillator output, through the attenuator, to the program amplifier input, J201, as shown in figure 5-1.
- b. Insert an erased tape cartridge into the 642A-2.
- c. Press the START switch on the 642A-2.
- d. Set the program amplifier input to 100 cps, 0.5 millivolt.
- e. Adjust the program amplifier GAIN control, R210, for a -7-dbm output level.
- f. Set the program amplifier input to 10,000 cps, 0.5 millivolt.
- g. Adjust the program amplifier EQUAL control, R209, for a -36-dbm output level.
- h. Repeat steps d through g, as necessary, until proper output levels are obtained at both 100 cps and 10,000 cps.
- i. Measure and record the output level (in dbm) at each of the program amplifier inputs listed in table 5-4. Limits are given in the table.
- j. Set the program amplifier input to 400 cps, 2.2 millivolts.
- k. Adjust the program amplifier GAIN control, R210, for a 0-dbm output level.
- l. Press the STOP switch on the 642A-2.

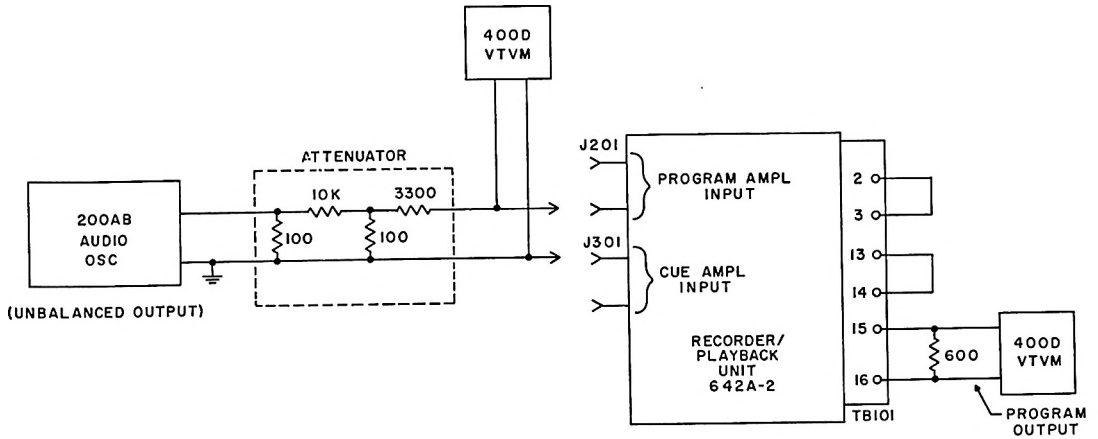


Figure 5-1. 642A-2 Recorder/Playback Unit, Test Setup

TABLE 5-4. PROGRAM AMPLIFIER EQUALIZATION CHECK

PROGRAM AMPLIFIER INPUT		OUTPUT LEVEL (dbm)	
FREQUENCY (cps)	LEVEL (millivolts)	MEASURED	LIMITS
50	0.5		-1 to -5
70	0.5		-4 to -6
100	0.5		-7
400	0.5		-17 to -19
1000	0.5		-24.5 to 26.5
4000	0.5		-33.5 to -35.5
7000	0.5		-34.5 to -36.5
10,000	0.5		-36
15,000	0.5		-34 to -38

#### 5.2.4 CUE AMPLIFIER GAIN ADJUSTMENTS.

a. Connect the unbalanced audio oscillator output, through the attenuator, to the cue amplifier input, J301, as shown in figure 5-1.

b. Insert an erased tape cartridge into the 642A-2.

c. Press the START switch on the 642A-2.

d. Set the cue amplifier STOP SEN. control, R310, fully counterclockwise.

e. Set the cue amplifier input to 1000 cps, 4 millivolts.

f. Turn the cue amplifier STOP SEN. control, R310, slowly clockwise until the tape stops.

g. Set the cue amplifier CUE SEN. control, R322, fully counterclockwise.

h. Set the cue amplifier input to 150 cps, 0.8 millivolt.

i. Connect the 410B vtvm ohmmeter between terminals 6 and 7 of TB101 on the 642A-2.

j. Turn the cue amplifier CUE SEN. control, R322, slowly clockwise until the ohmmeter abruptly indicates a short circuit between terminals 6 and 7 of TB101.

## 5.2.5 HEAD ALIGNMENT.

a. Remove the 642A-2 top cover and rear head cover shield.

b. Check cartridge alignment by inserting the cartridge alignment gauge (Collins part number 554-2632-002) into the 642A-2 in place of a tape cartridge. If adjustment is required, adjust the head mounting bracket and hexhead screw between the heads. Use a 1/4 inch open-end wrench to adjust the hexhead screw from the rear of the head mounting plate.

c. Make normal cable connections in the 642A-2. Refer to paragraph 2.2.2 of the system instructions.

d. Connect the 600-ohm output load and 400D vtm to terminals 15 and 16 of TB101 on the 642A-2 as shown in figure 5-1.

## NOTE

The two recording/playback heads are held in place by a pressure plate on the rear of the head mounting plate. To align the heads, loosen the pressure plate slightly to permit the heads to be turned, then retighten to hold the heads in place.

e. Loosen the two pressure-plate screws nearest the program head (the head on the left as viewed from the front of the unit) approximately 1/4 turn each.

f. Insert an alignment tape (Collins part number 097-6076-00) into place in the 642A-2, and start the tape.

g. Using a 3/8-inch open-end wrench, turn the 3/8-inch hexnut connected to the program head to produce a peak indication on the 400D vtm. Tighten the program pressure plate. Recheck output level to be sure it is still at the peak value. If it is not, repeat this procedure.

h. To align the cue head, follow the same procedure as in the above steps, except connect J105 (cue-head output) to J201 (program amplifier input). Be sure to reconnect cables in normal way when alignment procedure is completed.

i. Replace rear head cover shield and top cover.

## 5.3 Trouble Shooting.

Table 5-5 lists voltage values at the pins of tube in the 642A-2 Recorder/Playback Unit. These particular values were obtained from measurements on a typical operating unit. The voltages may vary slightly from unit to unit without affecting performance. All voltages listed are measured between the tube pin and ground (except where noted). Use the 410B vtm to make these measurements.

TABLE 5-5. 642A-2 VOLTAGE MEASUREMENTS

TUBE	TYPE VOLTAGE	TUBE PIN NO.								
		1	2	3	4	5	6	7	8	9
V201	D-C	+157	0	+ 1.2	+13	0	+126	0	+ 0.63	+6.4
	A-C									
V202	D-C	+215	0	+ 3.5	0	+13	+91	0	+ 1.7	+6.6
	A-C									
V301	D-C	+98	0	+ 0.9			+98	0	+0.9	
	A-C				*	*				*
V302	D-C	+145	0	+1.0			+145	0	+1.0	
	A-C				*	*				*
V303	D-C	+360	0	+14			+360	0	+14	
	A-C				*	*				*
* 6.3 volts a-c between pins 4 or 5 and 9										



Motor oil 005-0759-000

Capstan & cross shaft oil ~~553-2454-002~~ large  
(005-0392-000) small

Flywheel Bearing 309-5200-000

section **6**

parts list

ITEM	DESCRIPTION	COLLINS PART NUMBER
642A-2 RECORDER/PLAYBACK UNIT		522-2547-00
B101	SEE TAPE TRANSPORT	
C101	CAPACITOR, FIXED, CERAMIC: 10,000 uuf ±20%, 500 v d-c	913-3013-00
C102	CAPACITOR, FIXED, CERAMIC: same as C101	913-3013-00
C103	CAPACITOR, FIXED, ELECTROLYTIC: 5 uf -15% +50%, 450 v d-c; P.R. Mallory part no. TC70	183-1790-00
C104	CAPACITOR, FIXED, CERAMIC: 0.05 uf -20% +80%, 500 v d-c; Sprague Electric part no. 33C58	913-3153-00
C105	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf -10% +100%, 50 v d-c	183-1402-00
C106	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf -10% +50%, 450 v d-c; P.R. Mallory part no. TC72	183-1791-00
C107	CAPACITOR, FIXED, CERAMIC: 0.1 uf -20% +80%, 500 v d-c; Sprague Electric Co. of Wisconsin part no. 41C92A5	913-3152-00
C108	CAPACITOR, FIXED, CERAMIC: 4700 uuf ±20%, 500 v d-c	913-3012-00
C109	CAPACITOR, FIXED, CERAMIC: same as C104	913-3153-00
C110	CAPACITOR, FIXED, ELECTROLYTIC: same as C103	183-1790-00
C111	CAPACITOR, FIXED, ELECTROLYTIC: dual section. 50 uf, -10% +50%, 450 v d-c	183-1487-00
C112	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf -10% +100%, 12 v d-c; Sprague Electric part no. D33645	183-1785-00
C113	CAPACITOR, FIXED, ELECTROLYTIC: same as C112	183-1785-00
C114	CAPACITOR, FIXED, ELECTROLYTIC: 1000 uf -10% +100%, 50 v d-c	183-1403-00
C115	SEE TAPE TRANSPORT	
C116	CAPACITOR, FIXED, ELECTROLYTIC: same as C114	183-1403-00
C117	CAPACITOR, FIXED, PAPER: 3.75 uf 330 v a-c; Sangamo Electric part no. 8033-3.75-2	930-0690-00
C118	CAPACITOR, FIXED, CERAMIC: same as C101	913-3013-00
C119	CAPACITOR, FIXED, CERAMIC: 22,000 uuf ±20%, 400 v d-c; Sprague Electric Co. of Wisconsin part no. 33C79	913-3733-00
C120	SEE TAPE TRANSPORT	
C121	CAPACITOR, FIXED, CERAMIC: same as C107	913-3152-00
CR101	SEMICONDUCTOR DEVICE, DIODE: silicon; Motorola type 1N1693	353-1663-00
CR102	SEE TAPE TRANSPORT	
CR103	SEMICONDUCTOR DEVICE, DIODE: same as CR101	353-1663-00
CR104	SEMICONDUCTOR DEVICE, DIODE: same as CR101	353-1663-00
CR105	SEMICONDUCTOR DEVICE, DIODE: same as CR101	353-1663-00
CR106 thru CR109	SEMICONDUCTOR DEVICE, DIODE: same as CR102	353-1898-00
CR110	SEMICONDUCTOR DEVICE, DIODE: same as CR101	353-1663-00
CR111	SEMICONDUCTOR DEVICE, DIODE: same as CR101	353-1663-00
CR112	SEMICONDUCTOR DEVICE, DIODE: silicon; type 1N1218	353-1201-00
CR113	SEMICONDUCTOR DEVICE, DIODE: same as CR112	353-1201-00
CR114	SEMICONDUCTOR DEVICE, DIODE: same as CR112	353-1201-00
CR115	SEMICONDUCTOR DEVICE, DIODE: same as CR112	353-1201-00
CR116	SEE TAPE TRANSPORT	

ITEM	DESCRIPTION	COLLINS PART NUMBER
DS101	LAMP, INCANDESCENT: midget, flange base, 28 v d-c max; 0.40 amp, T-1-3/4 bulb; C-2F filament; Chicago Miniature Lamp Works part no. 327	262-1106-00
DS102	LAMP, INCANDESCENT: same as DS101	262-1106-00
DS103	LAMP, INCANDESCENT: miniature single contact; midget flange base; T-1-3/4 clear bulb; 14 v, 0.08 amp, C-2F filament; General Electric Co. part no. 330	262-0309-00
F101	FUSE, CARTRIDGE: glass enclosed, 2.00 amp, 250 v max; 0.07 ohm resistance	264-4070-00
F102	FUSE, CARTRIDGE: glass enclosed, 1.00 amp, 250 v max; 0.23 ohm resistance	264-4050-00
J101	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 female contacts; 3 #4 contacts, 12 #16 contacts at 5 amp; Cinch Mfg Co. part no. 47A-16627	372-1081-00
J102	JACK, TELEPHONE: miniature panel mounted; 7/16 in. OD by 7/8 in. lg; Switchcraft part no. 3501FP	360-0148-00
J103	JACK, TELEPHONE: same as J102	360-0148-00
J104	SEE TAPE TRANSPORT	
J105	SEE TAPE TRANSPORT	
J106	JACK, TELEPHONE: same as J102	360-0148-00
J107	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 female contacts, 10 amp; Howard B. Jones, Div. Cinch Mfg part no. S-312-AB	366-0025-00
J108	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J107	366-0025-00
K101	RELAY, ARMATURE: 4C; low level or up to 2 amp at 28 v resistive; 24 v d-c coil voltage, 650 ohms ±10% coil resistance; continuous duty cycle; Potter and Brumfield part no. KHP17D13	970-2257-00
K102	RELAY, ARMATURE: same as K101	970-2257-00
K103	RELAY, ARMATURE: same as K101	970-2257-00
K104	RELAY, ARMATURE: 2C, 1D; 2 amp at 115 v a-c resistive; 8.7 ma d-c max operating current; continuous duty cycle; Automatic Electric Mfg part no. 110-4459	970-2174-00
K105	RELAY, ARMATURE: same as K101	970-2257-00
K106	RELAY, ARMATURE: 2C; 2 amp at 115 v a-c resistive; 7.2 ma d-c max operating current; continuous duty cycle; Potter and Brumfield part no. KR2932	970-2189-00
L101	SEE TAPE TRANSPORT	
L102	SEE TAPE TRANSPORT	
L103	SEE TAPE TRANSPORT	
L104	COIL, RADIO FREQUENCY: 22 uh ±10%, 1330 ma d-c; 0.31 ohm d-c resistance; Jeffers Electronics part no. 10404-20	240-0186-00
L105	COIL, RADIO FREQUENCY: same as L104	240-0186-00
R101	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1 w	745-3422-00
R102	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%, 1/2 w	745-1377-00
R103	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/2 w	745-1394-00
R104	RESISTOR, FIXED, COMPOSITION: 10 megohms ±10%, 1/2 w	745-1520-00
R105	RESISTOR, FIXED, COMPOSITION: same as R104	745-1520-00
R106	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%, 2 w	745-5610-00
R107	RESISTOR, FIXED, COMPOSITION: 82,000 ohms ±10%, 1 w	745-3433-00
R108	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%, 2 w	745-5708-00
R109	RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±10%, 2 w	745-5698-00
R110	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1 w	745-3394-00

Head cover & shield 548-8136-003

Pressure Roller 235-0001-000

" " Spring 548-8132-002

642A-2 Recorder/Playback Unit

ITEM	DESCRIPTION	COLLINS PART NUMBER
R111	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%, 2 w	745-5684-00
R112	RESISTOR, FIXED, COMPOSITION: same as R111	745-5684-00
R113	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 2 w	745-5666-00
R114	RESISTOR, FIXED, COMPOSITION: 0.15 megohm ±10%, 2 w	745-5743-00
R115	RESISTOR, FIXED, COMPOSITION: same as R114	745-5743-00
R116	SEE TAPE TRANSPORT	
R117	RESISTOR, FIXED, COMPOSITION: 270 ohms ±10%, 1/2 w	745-1328-00
R118	RESISTOR, FIXED, COMPOSITION: same as R117	745-1328-00
R119	RESISTOR, FIXED, COMPOSITION: same as R114	745-5743-00
R120	SEE TAPE TRANSPORT	
R121	SEE TAPE TRANSPORT	
R122	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1 w	745-3342-00
R123	RESISTOR, FIXED, COMPOSITION: 120,000 ohms ±10%, 1 w	745-3440-00
R124	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/2 w	745-1324-00
R125	NOT USED	
R126	RESISTOR, FIXED, COMPOSITION: same as R124	745-1324-00
S101	SWITCH, PUSH, ILLUMINATED: spst, 2 circuit momentary	266-6161-00
S102	SWITCH, PUSH, ILLUMINATED: spst, 2 circuit momentary	266-6160-00
S103	SWITCH, PUSH, ILLUMINATED: spst, 120 v a-c, 3 amp noninductive, 1 amp inductive	266-6140-00
S104	SEE TAPE TRANSPORT	
T101	TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: pri 115 v, sec #1, 600 v rms ±5%, 0.085 amp ct; sec #2, 6.3 v rms ±5%, 2.7 amp, ct; 50/60 cps; metal encased; Ballastran part no. BC-3174	662-0028-00
T102	TRANSFORMER, POWER, STEP-DOWN: pri 115 v; sec 24 v d-c ±5%, at 2 amp; 50/60 cps; continuous duty cycle; metal encased; Chicago Sld. Transformer part no. 30938	662-0029-00
TB101	TERMINAL BOARD: phenolic; barrier type, 16 terminals; 7/8 in. w by 6-3/8 in. lg	367-0024-00
TB102	TERMINAL BOARD: phenolic; 3 terminals; 7/8 in. w by 1-1/8 in. lg; Kulka Electric Mfg. part no. 600-3	367-0119-00
TB103	TERMINAL BOARD: phenolic w/5 brass solder-lug terminals; 11/16 in. w by 1-7/8 in. lg; Cinch Mfg Co. part no. 1542-A	306-0550-00
TB104	TERMINAL BOARD: same as TB103	306-0550-00
TB105	TERMINAL BOARD: Bakelite, 4 terminals, 1 grounded 3 insulated; 21/32 in. w by 1-1/2 in. lg; Cinch Mfg Co. part no. 1534-A	306-2240-00
TB106	TERMINAL BOARD: phenolic, 4 brass solder-lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.; Cinch Mfg Corp. part no. 1532-A	306-9032-00
TB107	TERMINAL BOARD: same as TB105	306-2240-00
TB108	TERMINAL BOARD: phenolic; 3 brass solder-lug terminals; 7/32 in. w by 1-1/8 in. lg; Cinch Mfg part no. 1520-A	306-9033-00
TB109	TERMINAL BOARD: same as TB103	306-0550-00
TB110	TERMINAL BOARD: same as TB103	306-0550-00
TB111	SEE TAPE TRANSPORT	
TB112	SEE TAPE TRANSPORT	
TB113	NOT USED	
TB114	SEE TAPE TRANSPORT	
TB115	TERMINAL BOARD: 2 brass solder lugs, cadmium plated; 1/16 in. by 3/8 in. by 3/4 in.	306-0006-00
XF101	FUSEHOLDER: extractor post type w/test probe hole in knob for w/1-1/4 x 1/4 fuses; 15 amp; 250 v; Bussman Fuse, Div. McGraw-Edison Co. part no. HKP-HJIT	285-1019-00
XF102	FUSEHOLDER: same as XF101	285-1019-00
642A-2 TAPE TRANSPORT		549-5081-00
B101	MOTOR, ALTERNATING CURRENT: 115 v, 60 cps; 1800 rpm; cw rotation; continuous duty cycle; Bodine Electric Co. part no. 2270XNYC-12 MOD	230-0430-00 762-8937-001 230-0574-010 730-0768-020

ITEM	DESCRIPTION	COLLINS PART NUMBER
C115	CAPACITOR, FIXED, PAPER: 0.47 uf ±20%, 400 v d-c; Sprague Electric part no. 160P47404	031-8849-00
C120	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf ±20%, 250 v d-c; Sprague Electric Co. part no. S14999	183-0998-00
CR102	SEMICONDUCTOR DEVICE, DIODE: silicon; General Electric type IN1696	353-1898-00
CR116	SEMICONDUCTOR DEVICE, DIODE: silicon; General Electric type IN1095	353-1547-00
H101	WASHER, FLAT: mylar; 0.250 in. ID, 0.583 in. OD, 0.010 in. thk	548-9566-003
H102	WASHER, FLAT: stainless steel; 0.127 in. ID, 0.250 in. OD, 0.033 in. thk	502-1515-002
H103	WASHER, FLAT: CRES; 0.317 in. ID, 0.490 in. OD, 0.015 in. thk	500-1130-003
H104	WASHER, FLAT: CRES; passivate finish; 0.319 in. ID, 0.500 in. OD, 0.0050 in. thk	549-5072-002
H105	WASHER, FLAT: rd; stainless steel, passivate finish; 0.275 in. dia, 0.003 in. thk	541-1204-003
H106	WASHER, FLAT: acetate; 0.312 in. ID, 0.625 in. OD, 0.015 in. thk	548-9564-003
H107	SETSCREW: CRES; 1/2-20 thd; 0.500 in. dia by 1 in. lg overall; p/o MP113	549-5015-002
H108	STUD, CONTINUOUS THREAD: stainless steel, plain finish; 6-32NC-2 thd, 2-1/2 in. lg	312-0087-00
H109	SETSCREW: CRES; plain finish, multiple spline, cup point; 6 flutes; 8-36 UNF-3A thd 1/4 in. lg	328-0022-00
H110	NUT, PLAIN, HEXAGON: brass, nickel plated; 1/2 - 20UNF-2B thd, 0.125 in. h by 0.5625 in. hex	334-0260-00
H111	NUT, SELF-LOCKING, HEXAGON: aluminum, anodized finish; w/nylon insert; 10/32 UNF-3B thd; 0.239 in. h, 0.375 in. w across flats; Elastic Stop Nut Corp. of America part no. 68NM-02	333-0388-00
H112	SCREW, MACHINE: stainless steel, plain finish; 6-32 UNG-2 thd; 0.250 in. w across flats, 0.750 in. lg	325-0087-00
HI113	NUT, SELF-LOCKING, HEXAGON: dural, anodized; w/nylon insert; 6-32NC-2 thd; 0.172 in. h, 0.312 in. w across flats; Elastic Stop Nut Corp. of America part no. 68NM-62	333-0368-00
J104	JACK, TELEPHONE: steel, miniature panel mtg; Switchcraft, Inc. part no. 3501FF	360-0148-00
J105	JACK, TELEPHONE: same as J104	360-0148-00
L101	HEAD, SOUND RECORDER-REPRODUCER: half track 0.250 in. tape; 2000 ohms impedance; 12 db record level; 0.040 ma audio current; 62 kc bias frequency; 7,500 ips tape speed; 0.30 henry inductance; 0.343 in. by 0.625 in. by 0.742 in. overall, excl bushing and shaft; Michigan Magnetics, Inc. part no. 3FM20-104	235-0413-00
L102	HEAD, SOUND RECORDER-REPRODUCER: half track 0.250 in. tape; 2000 ohms impedance; 62 kc bias frequency; 12 db record level; 0.040 ma audio current; 0.8 ma to 1 ma bias current; 7,500 ips tape spec; 0.30 henry inductance; 0.343 in. by 0.625 in. by 0.742 in. overall, incl bushing and shaft; Michigan Magnetics, Inc. part no. 3FM20-115	235-0012-00
L103	SOLENOID, ELECTRICAL: 1-1/4 in. stroke; 500 ohms resistance; -20°C to +50°C temp range; continuous duty cycle; 500 v rms; SR Engineering and Mfg part no. 2500	411-0039-00
MP101	PULLEY, GROOVED: brass; 1.078 in. dia by 0.884 in. lg overall dim.	549-5044-003
MP102	GUIDE, TAPE: CRES; 0.408 in. by 0.582 in. by 0.812 in. overall dim.	548-8130-002
MP103	SPRING ASSEMBLY, LOWER: 0.374 in. by 0.841 in. by 1.655 in. overall	549-5033-003
MP104	SPRING ASSEMBLY, UPPER: 0.499 in. by 0.944 in. by 1.718 in. overall	549-5050-003
MP105	BELT, ROUND: neoprene synthetic rubber 'O' ring type, 5.234 in. ID	200-1882-00
MP108	BELT, ROUND: same as MP105	200-1882-00
MP107	BELT, ROUND: same as MP105	200-1882-00
MP108	SHAFT, SHOULDERED: CRES; passivated finish; 0.250 in. dia by 1.264 in. lg overall dim.	549-5013-002
MP109	SHAFT, STRAIGHT: CRES; passivated finish; 0.312 in. dia by 3.375 in. lg overall dim.	549-5012-002
MP110	DRIVE LINK ASSEMBLY: CRES; incl 1 switch arm adapter, 1 cam, 2 connecting links and hardware	549-5083-003
MP111	BUTTON, PLUG: brass, nickel plated; 0.078 in. thk cap, 0.359 in. o/a h, 0.906 in. OD of prongs, 1.062 in. OD of head; 12 prongs; United-Carr Fastener Corp. part no. 48156	308-3000-00

Spacers for prog head 500-1065-003  
 New single pole head 235-0413-002  
 Capstan plastic washer 548-9564-003

ITEM	DESCRIPTION	COLLINS PART NUMBER
MP112	SPRING, HELICAL EXTENSION: CRES; passivated finish; 43 coils; 0.250 in. dia by 2.998 in. lg overall dim.	549-50C3-002
MP113	FLYWHEEL-DECK ASSEMBLY: 4-1/2 in. h by 5-7/8 in. d by 13 in. lg	554-2604-004
MP114	ADAPTER, SWITCH ACTUATOR: CRES; cadmium plated 0.740 in. by 0.800 in. by 2.450 in. overall dim.	548-8134-002
MP115	ROLLER, PINCH: compresses tape against tape drive capstan, 0.795 in. dia by 0.375 in. lg overall	235-0001-00
MP116	PLATE AND BRACKET ASSEMBLY, MOUNTING: 0.513 in. by 4.375 in. by 5.250 in. o/a dim.	549-5043-003
MP117	SPACER, SLEEVE: aluminum, chromate dip; 0.203 in. ID, 0.625 OD, 0.812 in. lg	549-5021-002
MP118	PIN, THREADED: CRES; 10-32 thd; 0.250 in. w across flats by 1.166 in. lg overall	549-5005-002
MP119	SPACER, SLEEVE: aluminum, chromate dip; 0.049 in. thk wall, 0.250 in. OD, 0.750 in. lg; no. 6 screw size	541-6037-002
MP120	BUSHING, SLEEVE: plastic; 0.220 in. dia by 0.167 in. lg overall	549-5010-002
MP121	CLIP, SPRING TENSION: copper; 0.375 in. by 1 in. by 3 in. approx overall	548-8132-002
MP122	MOUNT, RESILIENT: rubber and brass; 1 in. dia by 0.500 in. lg overall; Lord Mfg Co. part no. J-2927-1-4	200-0963-00
MP123	RING, RETAINING: steel, type "E", 0.145 in. ID, 0.335 in. OD, 0.025 in. thk; Walde Kohinoor part no. 5133-18-MD	340-0090-00
MP124	RING, RETAINING: steel, type "E", 0.073 in. ID, 0.187 in. OD, 0.015 in. thk; Walde Kohinoor part no. 5133-9-MD	340-0086-00
MP125	RING, RETAINING: steel, type "E", 0.094 in. ID, 0.230 in. OD, 0.015 in. thk; Walde Kohinoor part no. 5133-12-MD	340-0087-00
MP126	RING, RETAINING: steel, type "E", 0.207 in. ID, 0.527 in. OD, 0.025 in. thk; Walde Kohinoor part no. 5133-25-MD	340-0091-00
MP127	CLAMP, SOLENOID: aluminum, 1/218 in. by 1.500 in. by 1.625 in. overall	549-5069-003
MP128	KEY, WOODRUFF: stainless steel; 0.0635 in. by 0.109 in. by 0.250 in.	015-0347-00
MP129	BUSHING, CLAMP: steel; 0.750 in. dia by 0.190 in. lg overall	548-8129-002
MP130	BRACKET, SHIELD: steel; 1.125 in. by 1.750 in. by 3.250 in. overall	549-5058-004
MP131	BALL, BEARING: steel; 3/16 in. dia; New Departure Div. of General Motors Corp. part no. 3/16 in. A1BW BALL: (p/o MP113)	309-5200-00
MP132	WASHER, NONMETALLIC: felt; 3/16 in. ID, 7/16 in. OD, (p/o MP113)	549-5065-002
MP133	PLATE, SHIELD: steel; 1.187 in. by 4 in. by 8.500 in. overall	549-5060-004
R116	RESISTOR, FIXED, COMPOSITION: 47 ohms $\pm 10\%$ , 2 w	745-5596-00
R120	RESISTOR, FIXED, WIREWOUND: 16 ohms $\pm 15\%$ , 11 w	746-6044-00
R121	RESISTOR, FIXED, COMPOSITION: 1000 ohms, $\pm 10\%$ , 2 w	745-5652-00
S104	SWITCH, SENSITIVE: spst; normally open, 10 amp at 125 or 250 v a-c; solder-lug terminal; Micro Switch Div. of First Industrial Corp. part no. V3-32	286-7029-00
TB111	TERMINAL BOARD: phenolic, 4 brass solder-lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in., Cinch Mfg Corp. part no. 1532-A	306-9032-00
TB112	TERMINAL BOARD: same as TB111	306-9032-00
TB114	TERMINAL BOARD: 2 brass solder-lug terminals; 1/16 in. by 3/8 in. by 3/4 in.	306-0006-00
642A-2 PROGRAM AMPLIFIER MODULE		548-8091-00
C201	CAPACITOR, FIXED, MICA: 51 uuf $\pm 10\%$ , 500 vdcw; Electro Motive part no. DM15E510K01	912-2796-00
C202	CAPACITOR, FIXED, ELECTROLYTIC: 250 uuf $-10\%$ $+100\%$ , 6 vdcw; Sprague Electric part no. 30D138A1	183-1185-00
C203	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 15 uuf $-10\%$ $+40\%$ , 450 vdcw	183-1491-00
C204	CAPACITOR, FIXED, PAPER: 0.047 uuf $\pm 10\%$ , 400 vdcw; Sprague Electric part no. 180P47394	931-0295-00
C205	NOT USED	
C206	CAPACITOR, FIXED, CERAMIC: 0.1 uuf $\pm 10\%$ , 400 vdcw; Sprague Electric part no. 160P10494	931-0299-00
C207	CAPACITOR, FIXED, PAPER: same as C204	931-0295-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C208	CAPACITOR, FIXED, PAPER: same as C204	931-0295-00
C209	CAPACITOR, FIXED, ELECTROLYTIC: 8 uuf $-10\%$ $+50\%$ , 450 vdcw; P. R. Mallory part no. TC71	183-1051-00
C210	CAPACITOR, FIXED, MICA: 270 uuf $\pm 5\%$ , 500 vdcw; Electro Motive part no. DM15F271J01	912-2846-00
H201	WASHER, FLAT: CRES, 0.062 in. thk by 0.192 in. ID by 3/8 in. OD	500-1122-003
H202	SCREW, CAPTIVE, NO. 3: steel, undercut and grooved, 0.240 in. dia by 3.093 in. lg	548-2169-003
J201	JACK, TELEPHONE: steel, miniature, panel mounted; Switchcraft part no. 3501EP	360-0148-00
P201	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts, 10 amp; Howard B. Jones, Div. Cinch Mfg. part no. P-312-AB	365-2120-00
R201	RESISTOR, FIXED, COMPOSITION: 0.39 megohm $\pm 10\%$ , 1/2 w	745-1461-00
R202	RESISTOR, FIXED, COMPOSITION: 1500 ohms $\pm 10\%$ , 1 w	745-3359-00
R203	RESISTOR, FIXED, COMPOSITION: 56,000 ohms $\pm 10\%$ , 1/2 w	745-1426-00
R205	RESISTOR, FIXED, COMPOSITION: 1.0 megohm $\pm 10\%$ , 1/2 w	745-1478-00
R206	RESISTOR, FIXED, COMPOSITION: 560 ohms $\pm 10\%$ , 1/2 w	745-1342-00
R207	RESISTOR, FIXED, COMPOSITION: 0.15 megohm, 1/2 w	745-1443-00
R208	RESISTOR, FIXED, COMPOSITION: 22,000 ohms $\pm 10\%$ , 1/2 w	745-1408-00
R209	RESISTOR, VARIABLE: COMPOSITION: 1000 ohms $\pm 20\%$ , 1/4 w	376-4727-00
R210	RESISTOR, VARIABLE: COMPOSITION: 100,000 ohms $\pm 30\%$ , 1/4 w	376-4733-00
R211	RESISTOR, FIXED, COMPOSITION: 2200 ohms $\pm 10\%$ , 1/2 w	745-1366-00
R212	RESISTOR, FIXED, COMPOSITION: 0.33 megohm $\pm 10\%$ , 1/2 w	745-1457-00
R213	RESISTOR, FIXED, COMPOSITION: same as R205	745-1478-00
R214	RESISTOR, FIXED, COMPOSITION: 1200 ohms $\pm 10\%$ , 1/2 w	745-1356-00
R215	RESISTOR, FIXED, COMPOSITION: 39,000 $\pm 10\%$ , 1 w	745-3419-00
R216	RESISTOR, FIXED, COMPOSITION: 0.10 megohm $\pm 10\%$ , 1/2 w	745-1436-00
R217	RESISTOR, FIXED, COMPOSITION: 0.47 megohm $\pm 10\%$ , 1/2 w	745-1464-00
T201	TRANSFORMER, AUDIO FREQUENCY: pri 15,000 ohms; sec. CT, 600 ohms, 250 ohms, 50 ohms; continuous duty cycle; Microton part no. M4135	667-0008-00
TB201	TERMINAL BOARD: phenolic, brass solder-lug terminals, 1/16 in. w by 1-7/8 in. lg; Cinch Mfg. part no. 1542-A	306-9033-00
TB202	TERMINAL BOARD ASSEMBLY: incl 1 board, 4 capacitors, 13 resistors	549-4528-004
V201	ELECTRON TUBE: twin triode; Ampere type ECC83/12AX7	255-0386-00
V202	ELECTRON TUBE: twin triode; General Electric type 12AT7	255-0205-00
XV201	SOCKET, ELECTRON TUBE: 9 contact, top mounting, miniature; 1 amp current rating; phenolic insulation	220-1103-00
XV202	SOCKET, ELECTRON TUBE: same as XV201	220-1103-00
642A-2 CUE AMPLIFIER MODULE		554-5535-00
C301	CAPACITOR, FIXED, CERAMIC: 0.01 uuf $-20\%$ $+80\%$ , 100 v d-c; Erie Resistor Corp. part no. 855502 X5G0 103P	913-3680-00
C302	CAPACITOR, FIXED, ELECTROLYTIC: 50 uuf $-10\%$ $+100\%$ , 15 v d-c; Sprague Electric Co. part no. D32359	183-1157-00
C303	CAPACITOR, FIXED, PAPER: 0.1 uuf $\pm 10\%$ , 400 v d-c; Sprague Electric Co. part no. 160P10494	931-0299-00
C304	CAPACITOR, FIXED, PAPER: 0.0047 uuf $\pm 10\%$ , 400 v d-c; Sprague Electric Co. part no. 180P47204	931-0285-00
C305	CAPACITOR, FIXED, ELECTROLYTIC: 2 uuf $-10\%$ $+100\%$ , 50 v d-c; Sprague Electric part no. D33212	183-1183-00
C306	CAPACITOR, FIXED, PAPER: 0.01 uuf $\pm 10\%$ , 600 v d-c; Sprague Electric Co. part no. 160P10396	931-0289-00
C307	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 15 uuf $\pm 10\%$ $+40\%$ both sections, $-10\%$ $+40\%$	183-1491-00
C308	CAPACITOR, FIXED, MICA: 2700 uuf $\pm 5\%$ , 500 v d-c; MIL type CM06F27203	912-3034-00
C309	CAPACITOR, FIXED, ELECTROLYTIC: 20 uuf $-10\%$ $+100\%$ , 25 v d-c; Sprague Electric Co. part no. D29791	183-1165-00

## 642A-2 Recorder/Playback Unit

ITEM	DESCRIPTION	COLLINS PART NUMBER
C310	CAPACITOR, FIXED, PAPER: 0.047 uf $\pm 10\%$ , 400 v d-c; Sprague Electric Co. part no. 180P47394	931-0295-00
C311	CAPACITOR, FIXED, CERAMIC: same as C301	913-3680-00
C312	CAPACITOR, FIXED, PAPER: same as C310	931-0295-00
C313	CAPACITOR, FIXED, PAPER: same as C303	931-0299-00
C314	CAPACITOR, FIXED, CERAMIC: 0.02 uf $-20\%$ $+80\%$ , 100 v d-c; Erie Resistor Corp. part no. 815501X5G0203P	913-3678-00
C315	CAPACITOR, FIXED, CERAMIC: same as C314	913-3678-00
C316	NOT USED	
C317	CAPACITOR, FIXED, PAPER: same as C303	931-0299-00
C318	CAPACITOR, FIXED, CERAMIC: same as C301	913-3680-00
CR301	SEMICONDUCTOR DEVICE, DIODE: silicon; JEDEC type 1N1693	353-1663-00
CR302	SEMICONDUCTOR DEVICE, DIODE: silicon; hermetically sealed; JEDEC type 1N704	353-2864-00
CR303	SEMICONDUCTOR DEVICE, DIODE: same as CR302	353-2864-00
CR304	SEMICONDUCTOR DEVICE, DIODE: silicon; JEDEC type 1N626	353-2857-00
CR305	SEMICONDUCTOR DEVICE, DIODE: same as CR304	353-2857-00
CR306	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed; JEDEC type 1N718	353-2734-00
CR307	SEMICONDUCTOR DEVICE, DIODE: same as CR304	353-2857-00
CR308	SEMICONDUCTOR DEVICE, DIODE: same as CR304	353-2857-00
H301	SCREW, CAPTIVE: stainless steel, passivate finish; red head; 0.240 in. by 0.468 in. by 3.530 in.	548-2169-003
H302	WASHER, FLAT: steel; round; 0.192 in. ID, 0.375 in. OD, 0.062 in. thk	500-1122-003
J301	JACK, TELEPHONE: steel, miniature, panel mtd; Switchcraft, Inc. part no. 3501FP	360-0148-00
J302	JACK, TELEPHONE: same as J301	360-0148-00
K301	RELAY, ARMATURE: 4C; low level or up to 2 amp at 28 v, resistive; 24 v d-c nom coil voltage, 650 ohms $\pm 10\%$ at $+25^{\circ}\text{C}$ coil resistance; continuous duty cycle; Potter & Brumfield part no. KHP 17D13	970-2257-00
K302	RELAY, ARMATURE: 2C; 2 amp at 115 v a-c resistive; 7.2 ma d-c max operating current; continuous duty cycle; Potter & Brumfield, Inc. part no. KR2932	970-2169-00
L301	REACTOR: 7 henrys min at 10 v rms, 0.003 amp, 230 ohms d-c resistance	668-0048-00
L302	REACTOR: same as L301	668-0048-00
MP301	COVER, CHASSIS: rolled steel cadmium plated; 2.688 in. by 3 in. by 6 in.	756-3701-002
P301	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts, 10 amp	365-0040-00
R301	RESISTOR, FIXED, COMPOSITION: 10,000 ohms $\pm 10\%$ , 1/2 w; MIL type RC20GF103K	745-1394-00
R302	RESISTOR, FIXED, COMPOSITION: 2200 ohms $\pm 10\%$ , 1/2 w; MIL type RC20GF222K	745-1366-00
R303	RESISTOR, FIXED, COMPOSITION: 0.33 megohm $\pm 10\%$ , 1/2 w; MIL type RC20GF334K	745-1457-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R304	RESISTOR, FIXED, COMPOSITION: 1.0 megohm $\pm 10\%$ , 1/2 w; MIL type RC20GF105K	745-1478-00
R305	RESISTOR, FIXED, COMPOSITION: same as R302	745-1366-00
R306	RESISTOR, FIXED, COMPOSITION: same as R303	745-1457-00
R307	RESISTOR, FIXED, COMPOSITION: 66,000 ohms $\pm 10\%$ , 1 w; MIL type RC32GF683K	745-3429-00
R308	RESISTOR, FIXED, COMPOSITION: same as R304	745-1478-00
R309	NOT USED	
R310	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms $\pm 20\%$ , 1/4 w; Chicago Telephone Supply Co. part no. LL6074	376-4733-00
R411	NOT USED	
R312	RESISTOR, FIXED, COMPOSITION: 470 ohms $\pm 10\%$ , 1/2 w; MIL type RC20GF471K	745-1338-00
R313	RESISTOR, FIXED, COMPOSITION: 0.12 megohm $\pm 10\%$ , 1/2 w; MIL type RC20GF124K	745-1440-00
R314	RESISTOR, FIXED, COMPOSITION: same as R304	745-1478-00
R315	RESISTOR, FIXED, COMPOSITION: 0.47 megohm $\pm 10\%$ , 1/2 w; MIL type RC20GF474K	745-1464-00
R316	RESISTOR, FIXED, COMPOSITION: 0.39 megohm $\pm 10\%$ , 1/2 w; MIL type RC20GF394K	745-1461-00
R317	RESISTOR, FIXED, COMPOSITION: 4700 ohms $\pm 10\%$ , 1 w; MIL type RC32GF472K	745-3380-00
R318	RESISTOR, FIXED, COMPOSITION: 220 ohms $\pm 10\%$ , 1/2 w; MIL type RC20GF221K	745-1324-00
R319	RESISTOR, FIXED, COMPOSITION: 0.18 megohm $\pm 10\%$ , 1/2 w; MIL type RC20GF184K	745-1447-00
R320	NOT USED	
R321	NOT USED	
R322	RESISTOR, VARIABLE, COMPOSITION: 1,000,000 ohms $\pm 20\%$ , 1/4 w	376-4736-00
R323	NOT USED	
R324	RESISTOR, FIXED, COMPOSITION: same as R313	745-1440-00
R325	RESISTOR, FIXED, COMPOSITION: same as R304	745-1478-00
R326	RESISTOR, FIXED, COMPOSITION: same as R304	745-1478-00
R327	NOT USED	
R328	RESISTOR, FIXED, COMPOSITION: 18,000 ohms $\pm 10\%$ , 1 w; MIL type RC32GF183K	745-3405-00
TB301	AMPLIFIER SUBASSEMBLY: plastic; 1/16 in. by 2-1/4 in. by 5-57/64 in. o/a board dim, includes 32 terminals	756-3708-004
TB302	TERMINAL BOARD: phenolic insulation, w/4 solder lug terminals; 11/16 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1532-A	306-9032-00
V301	ELECTRON TUBE: twin triode, Amperex Electronics Co. part no. ECC83/12AX7	255-0386-00
V302	ELECTRON TUBE: same as V301	255-0386-00
V303	ELECTRON TUBE: twin triode type; Radio Corp. of America part no. 12AY7	255-0205-00
XV301	SOCKET, ELECTRON TUBE: 9 pin oval socket, molded construction, phenolic body; MIL type TS103P01	220-1103-00
XV302	SOCKET, ELECTRON TUBE: same as XV301	220-1103-00
XV303	SOCKET, ELECTRON TUBE: same as XV301	220-1103-00

New pads 50 - \$7.50 099-2546-000  
 old " 235-0011-000  
 1700 ft tape 097-5852-000  
 Align tape 097-6076-000

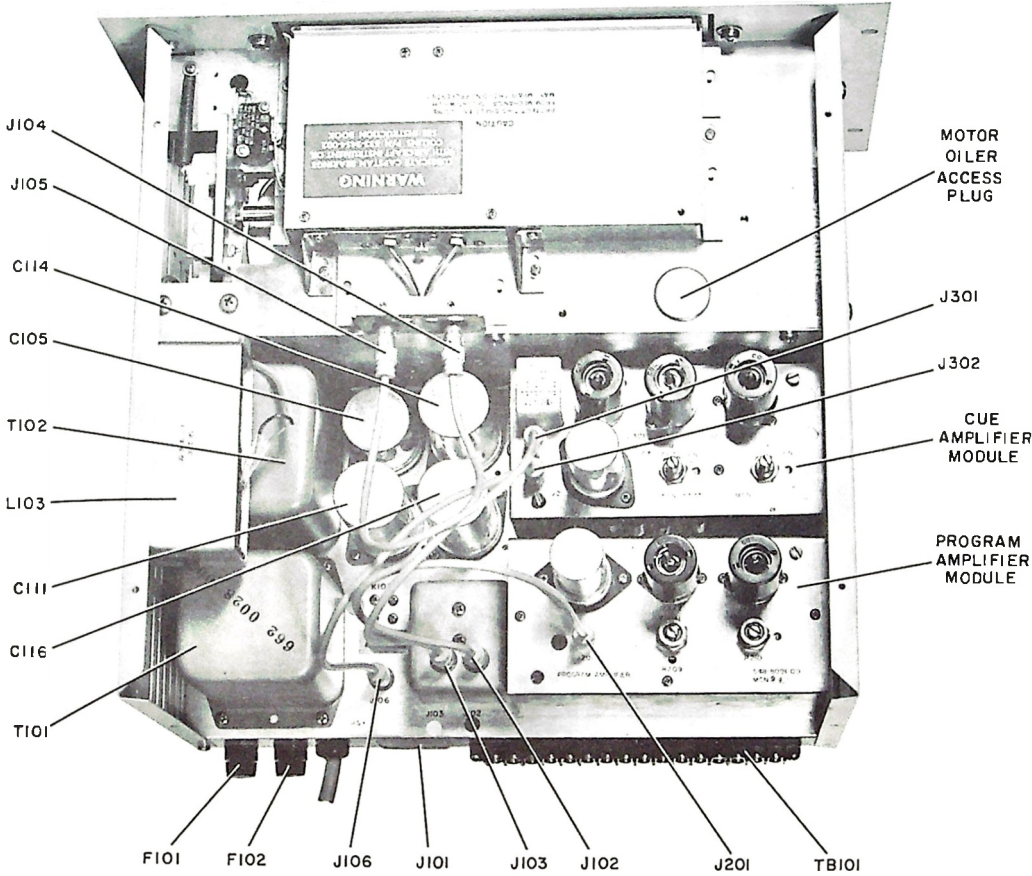


Figure 6-1. 642A-2 Recorder/Playback Unit, Parts Identification (Top View)

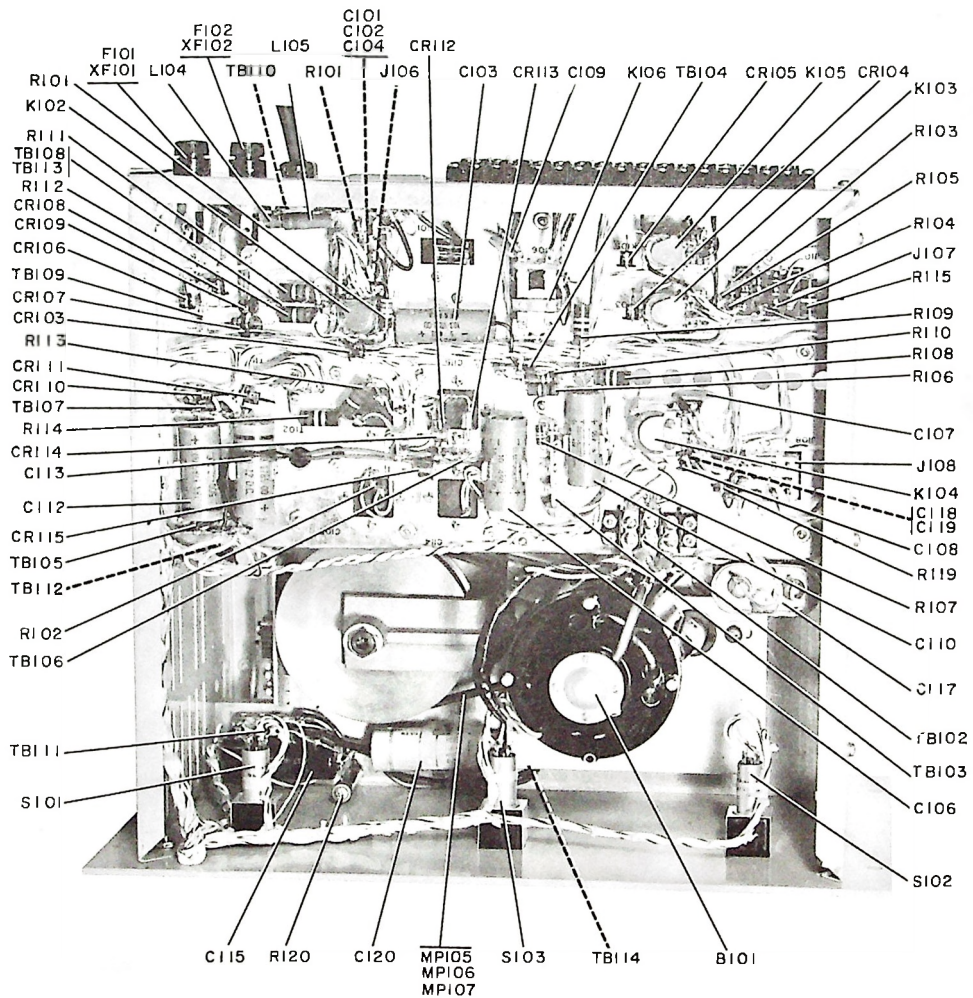


Figure 6-2. 642A-2 Recorder/Playback Unit, Parts Identification (Bottom View)

64-A-119A

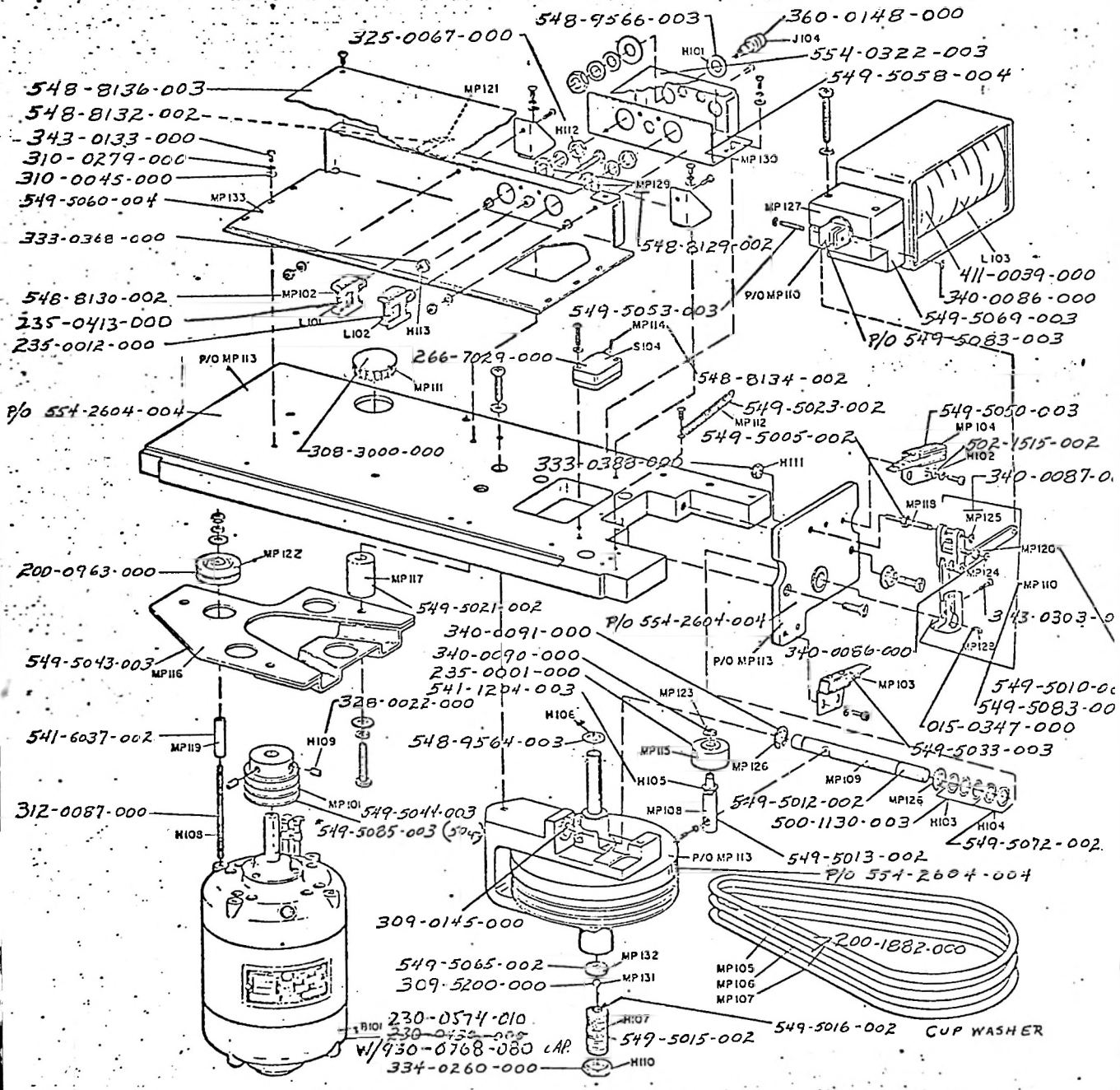


Figure 6-3. Tape Transport Assembly, Exploded View

CAPSTAN OIL { 005-0392-000 - 1/2 oz  
 MOTOR OIL - 005-0759-000

Program  
235-0413-00

Hardware (cont.)  
343-0285-00 4.40 bolts  
313-0015-00 " nuts  
310-0076-00 " washers

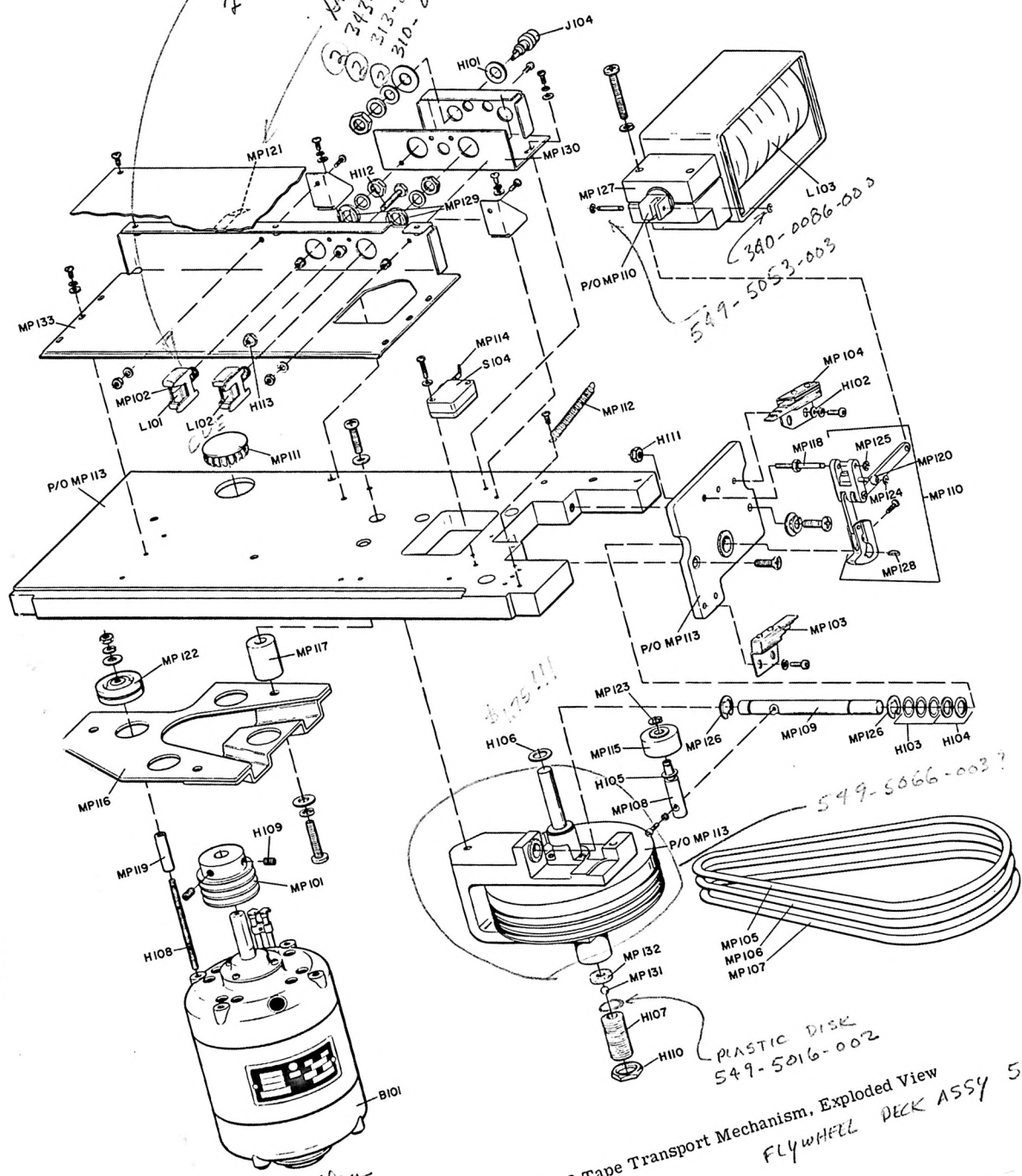


Figure 6-3. 642A-2 Tape Transport Mechanism, Exploded View  
554-2604-004  
19



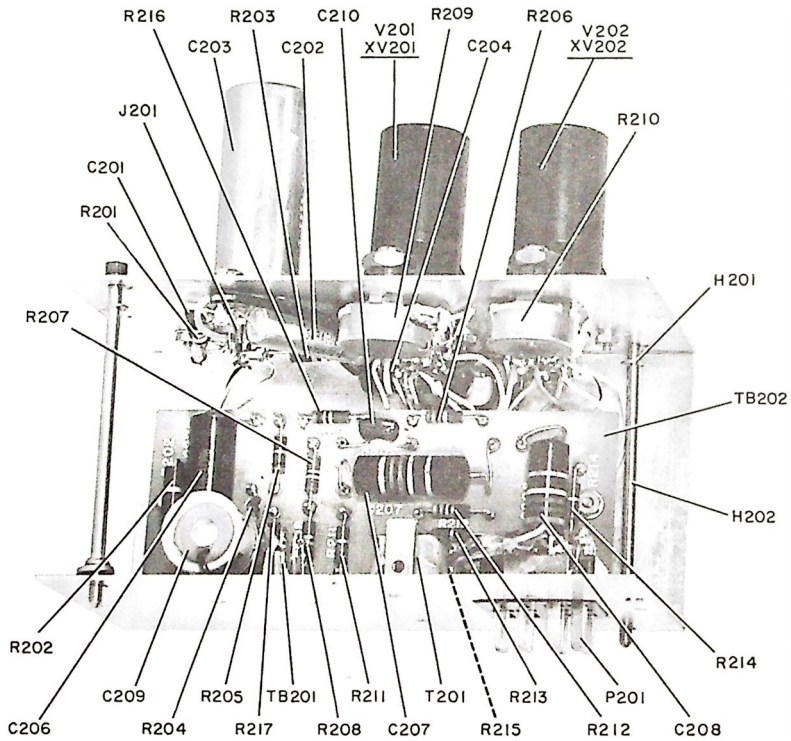


Figure 6-4. Program Amplifier Module, Parts Identification

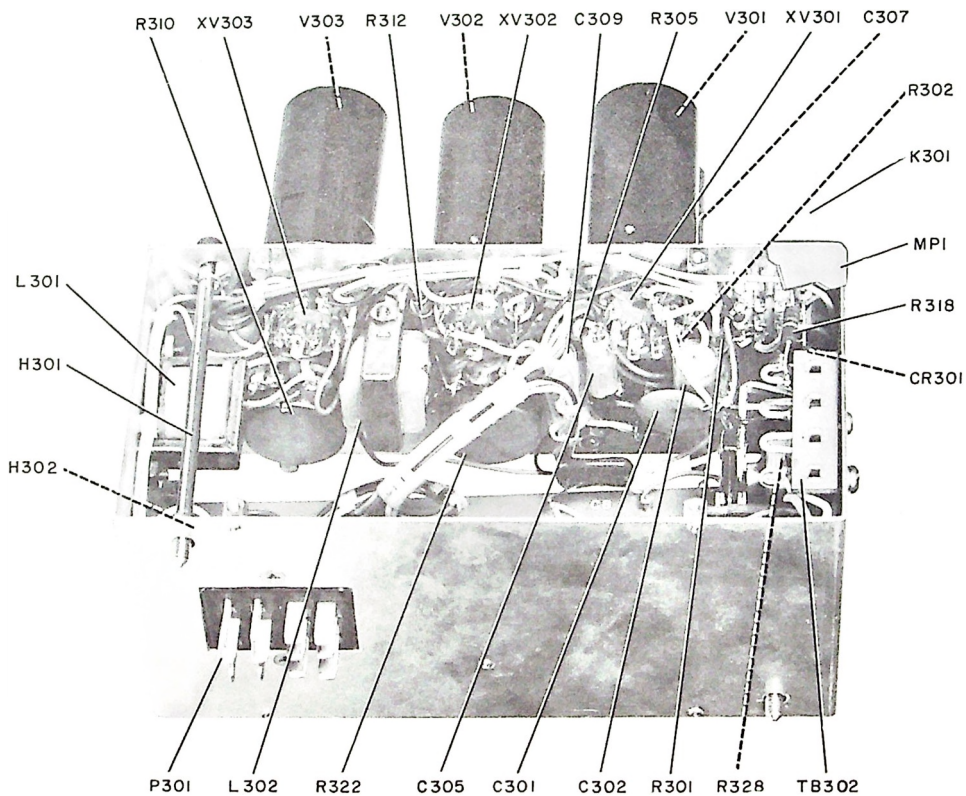


Figure 6-5. Cue Amplifier Module, Parts Identification (Sheet 1 of 2)

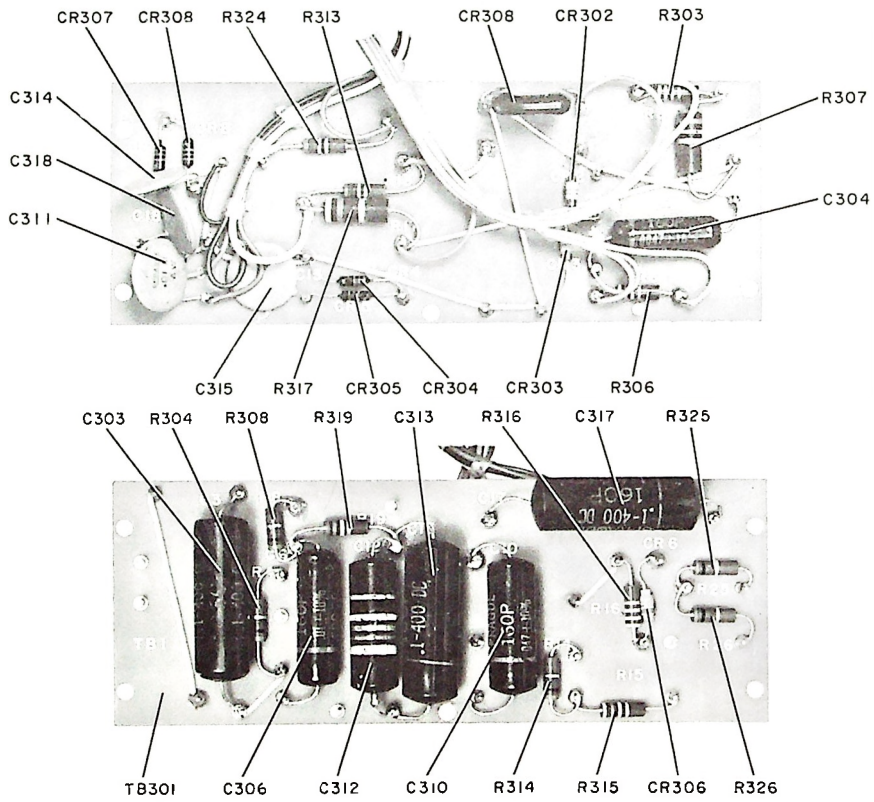


Figure 6-5. Cue Amplifier Module, Parts Identification (Sheet 2 of 2)

*jumper if not used.*

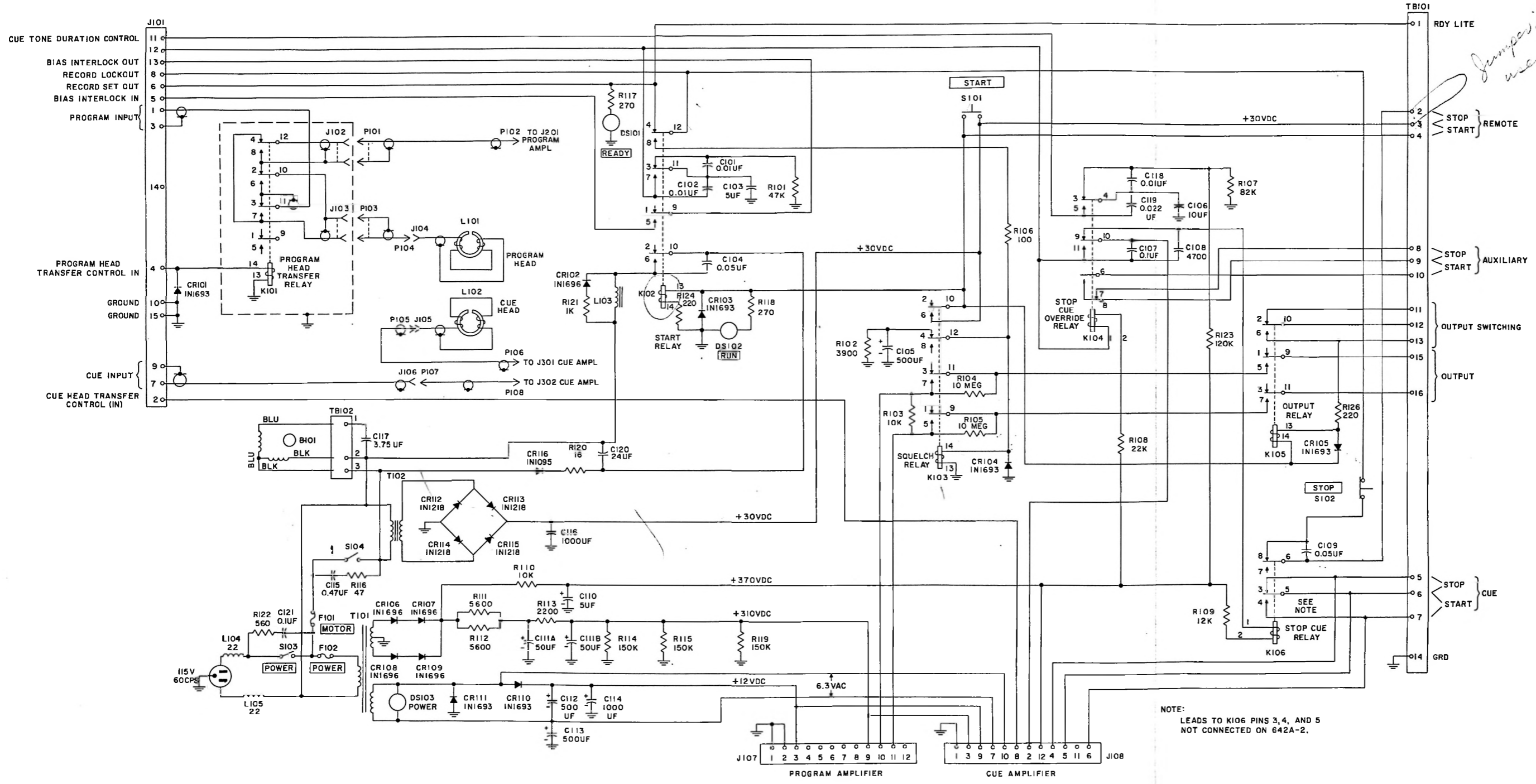


Figure 7-1. 642A-2 Recorder/Playback Unit, Schematic Diagram

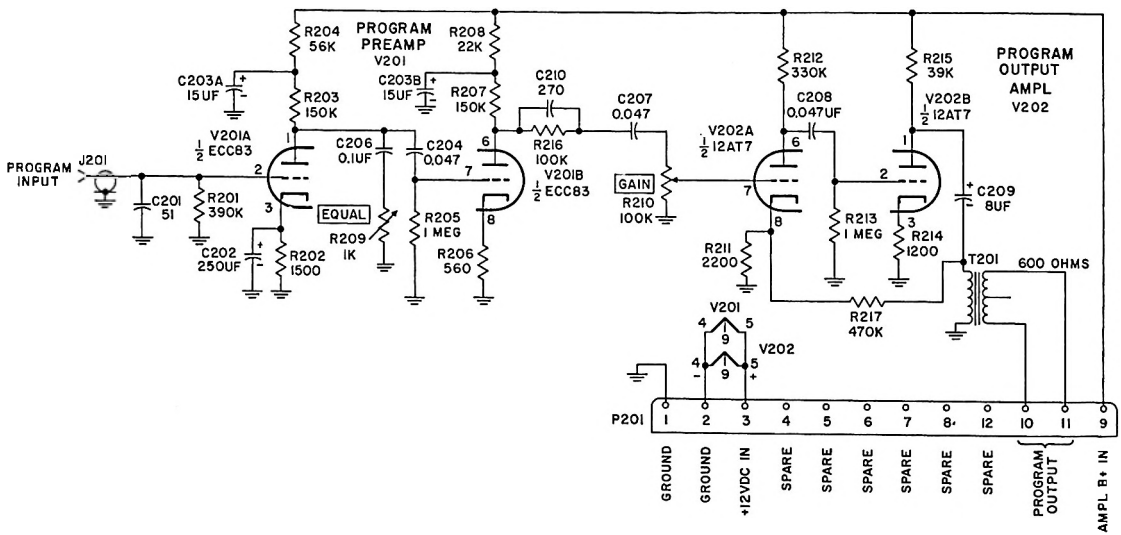


Figure 7-2. Program Amplifier Module, Schematic Diagram

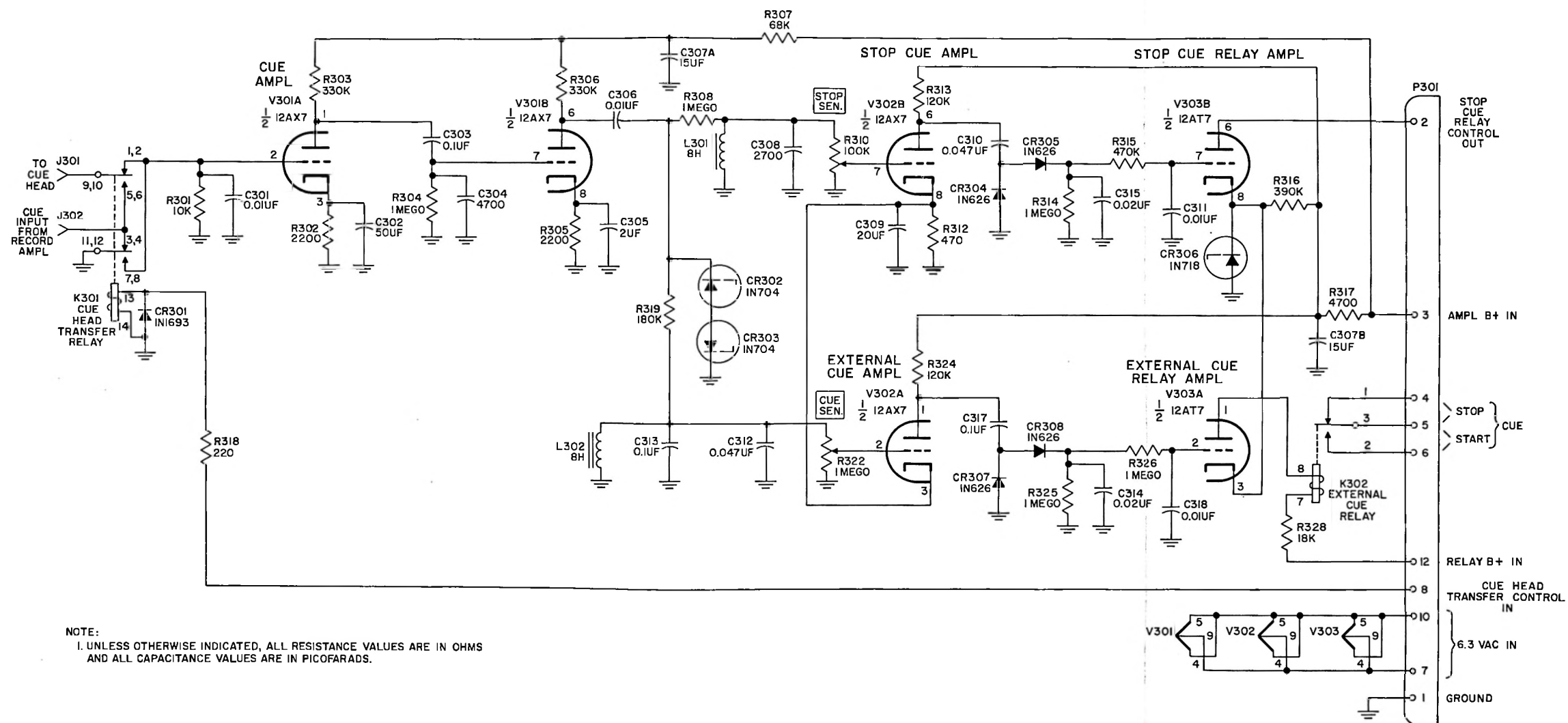


Figure 7-3. Cue Amplifier Module, Schematic Diagram





**unit instructions**

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**216C-2**  
**Recording Amplifier**

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# table of contents

Section		Page
1	GENERAL DESCRIPTION . . . . .	1
1.1	Purpose of Equipment . . . . .	1
1.2	Description of Equipment . . . . .	1
1.3	Equipment Specifications . . . . .	1
1.3.1	Physical . . . . .	1
1.3.2	Electrical . . . . .	1
1.4	Tube Complement . . . . .	2
2	INSTALLATION . . . . .	3
2.1	General . . . . .	3
3	OPERATION . . . . .	3
3.1	General . . . . .	3
4	PRINCIPLES OF OPERATION . . . . .	3
4.1	General . . . . .	3
4.2	Control Circuits . . . . .	3
5	MAINTENANCE . . . . .	7
5.1	Preventive Maintenance . . . . .	7
5.1.1	Tubes . . . . .	7
5.1.2	Wiring . . . . .	7
5.2	Adjustments . . . . .	7
5.2.1	Test Equipment . . . . .	7
5.2.2	Test Setup . . . . .	7
5.2.3	Equalization and Meter Calibration Adjustments . . . . .	7
5.2.4	Bias Output Level Adjustment . . . . .	8
5.2.5	Microphone Amplifier Gain Check . . . . .	8
5.2.6	Line Amplifier Gain Check . . . . .	8
5.3	Trouble Shooting . . . . .	9
6	PARTS LIST . . . . .	10
7	ILLUSTRATIONS . . . . .	17

## list of illustrations

Figure		Page
1-1	216C-2 Recording Amplifier (C754-23-P) . . . . .	1
4-1	216C-2 Recording Amplifier, Block Diagram (C754-26-4) . . . . .	4
4-2	Control Circuits, Simplified Schematic Diagram (C754-36-5) . . . . .	5
5-1	216C-2 Test Setup (C754-24-4) . . . . .	7
6-1	216C-2 Recording Amplifier, Parts Identification (Top View) (C754-62-P) . . . . .	13
6-2	216C-2 Recording Amplifier, Parts Identification (Bottom View) (C754-65-P) (C754-66-P) . . . . .	14
7-1	216C-2 Recording Amplifier, Schematic Diagram (C754-58-5) . . . . .	17

## list of tables

Table		Page
1-1	216C-2 Tube Complement . . . . .	2
5-1	Recording Amplifier Equalization Check . . . . .	8
5-2	216C-2 Voltage Measurements . . . . .	9

general description

1.1 Purpose of Equipment.

The 216C-2 Recording Amplifier, shown in figure 1-1, is used with the 642A-2 Recorder/Playback Unit to provide facilities for recording pre-erased tape cartridges. This unit contains preamplifiers for 600-ohm line and 250-ohm microphone inputs, input level controls, and an output amplifier. The two inputs may be mixed if desired.

1.2 Description of Equipment.

The 216C-2 weighs 15 pounds, and is 5-1/4 in. high, 15 in. wide, and 13-3/4 in. deep. Extender panels are furnished with the 216C-2 to extend the width to 19 in. for rack mounting. A VU meter on the front panel indicates the recording level. Two input level controls, one for the microphone input and one for the line input, are also located on the front panel. All electrical connections to the 216C-2 are made at the rear of the unit.

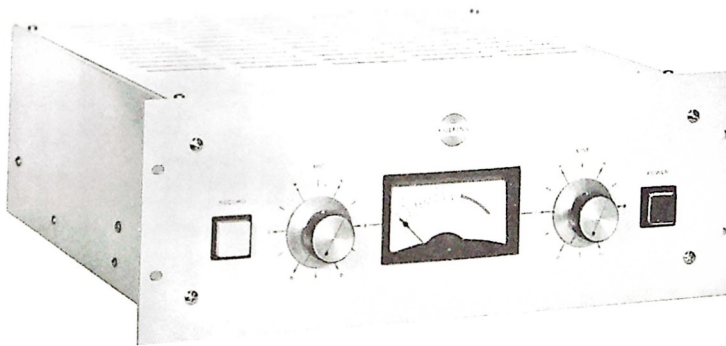


Figure 1-1. 216C-2 Recording Amplifier

1.3 Equipment Specifications.

1.3.1 PHYSICAL.

- Size . . . . . 15 inches wide, 5-1/4 inches high, 13-3/4 inches deep.
- Weight . . . . . Approximately 15 pounds.
- Mounting . . . . . 15-inch console or 19-inch rack with furnished extenders.

1.3.2 ELECTRICAL.

- Power source . . . . . 105 to 125 volts, 50/60 cps, 1 phase.
- Power requirements . . . . . 35 watts.
- Audio inputs . . . . . Line: 600 ohms, balanced, -15 dbm to +10 dbm.  
Microphone: 250 ohms, balanced, -65 dbm to -35 dbm.

216C-2 Interconnecting Cable - 706-3686-00 (PLUGS 372-4079-00) 1  
216C-1 - 548-8119-00 (COVER 549-4529-002)

216C-2 Recording Amplifier

- Signal-plus-noise to noise ratio . . . . . 50 db minimum with a line input of 400 cps, -15 dbm, or a microphone input of 400 cps, -65 dbm.
- Harmonic distortion . . . . . 1 percent maximum at 400 cps with a line input level of -5 dbm and output level of 110 millivolts into a 3300-ohm load.

1.4 Tube Complement.

Table 1-1 lists the type and functions of all tubes in the 216C-2 Recording Amplifier.

TABLE 1-1. 216C-2 TUBE COMPLEMENT

TUBE REFERENCE DESIGNATION	TUBE TYPE	FUNCTION
V401	12AU7	Line input amplifier/mixer amplifier
V402	12AX7	Program output amplifier/meter amplifier
V403	12BH7	Program bias amplifier/cue bias amplifier
V404	12AX7	Microphone input preamplifier
V405	7247	Bias oscillator/cue-tone oscillator

## section 2

### installation

#### 2.1 General.

Refer to section 2 of the system instructions for the Tape Cartridge System, Collins part number 523-0756575, for installation instructions.

## section 3

### operation

#### 3.1 General.

Refer to section 3 of the system instructions for the Tape Cartridge System, Collins part number 523-0756575, for operating instructions.

## section 4

### principles of operation

#### 4.1 General.

Figure 4-1 is a block diagram of the 216C-2 Recording Amplifier. Figure 7-1 is a schematic diagram of the 216C-2.

The line and microphone program inputs to the 216C-2 are amplified by input preamplifiers, a mixer amplifier, and an output amplifier. Part of the mixer amplifier output is applied, through a meter amplifier, to the front-panel VU meter to monitor recording levels.

The cue-tone output from the 216C-2 is either 1000 cps or 150 cps, depending on whether a stop-cue or external-cue is being recorded.

The 64-kc bias oscillator output is applied to both the program and cue outputs from the 216C-2 to the 642A-2 Recorder/Playback Unit.

#### 4.2 Control Circuits.

Refer to figure 4-2, a simplified schematic diagram of control circuits in the 216C-2 Recording Amplifier.

When a tape cartridge is inserted into the 642A-2, +30 volts d-c is applied to the 216C-2 via the record set line. This energizes the record set relay, K404, and applies +30 volts d-c to one side of the RECORD switch in the 216C-2.

When the RECORD switch, S402, is pressed, the +30 volts d-c is applied to the coil of the program record relay, K402, energizing it. The RECORD switch is a momentary switch, but K402 remains energized by +30 volts d-c that reaches the coil through closed contacts 5 and 9 of K402 and the record lock line from the 642A-2. This +30 volts d-c is also fed back to the 642A-2 on the program head transfer relay control line to energize K101, connecting the recording amplifier program output to the program head.

When the 642A-2 START switch is pressed, the tape starts to move. Start relay K102 in the 642A-2 energizes, removing +30 volts d-c from the record set line and de-energizing the record set relay, K404. At the same time, stop-cue override relay K102 energizes. This, in turn, causes cue record relay K401 to energize for about 0.5 second when capacitor C106 in the 642A-2 discharges through the cue-tone duration control line.

The cue record relay, K401, causes the stop-cue tone to be recorded because it (1) activates the cue-tone oscillator by removing a ground from the oscillator grid, and (2) energizes the cue head transfer relay, K301, by applying +30 volts d-c to the relay coil via the cue head transfer relay control line.

When the tape is running, pressing the RECORD switch will cause the cue record relay, K401, and the external-cue record relay, K403, to be energized for about 0.5

second. This will cause the external-cue tone to be recorded in a manner similar to the stop-cue tone. K403 switches components in the RC phase-shift network of the cue-tone oscillator to change the oscillator frequency from 1000 cps to 150 cps. The duration of the external-cue tone is limited to about 0.5 second as capacitor C445 discharges through the coil of K401. Contacts 10 and 6 of K403 shunt the RECORD switch to keep K403 energized as long as cue record relay K401 is energized.

If the 64-kc bias output of the recording amplifier were recorded while the tape accelerates when it starts, there would be an audible click when the tape is played back. To eliminate this, the bias amplifiers in the 216C-2 are normally biased off. When the tape is started, the bias interlock line is grounded and a time-delay circuit in the 216C-2 is activated to delay the application of bias until the tape reaches full speed.

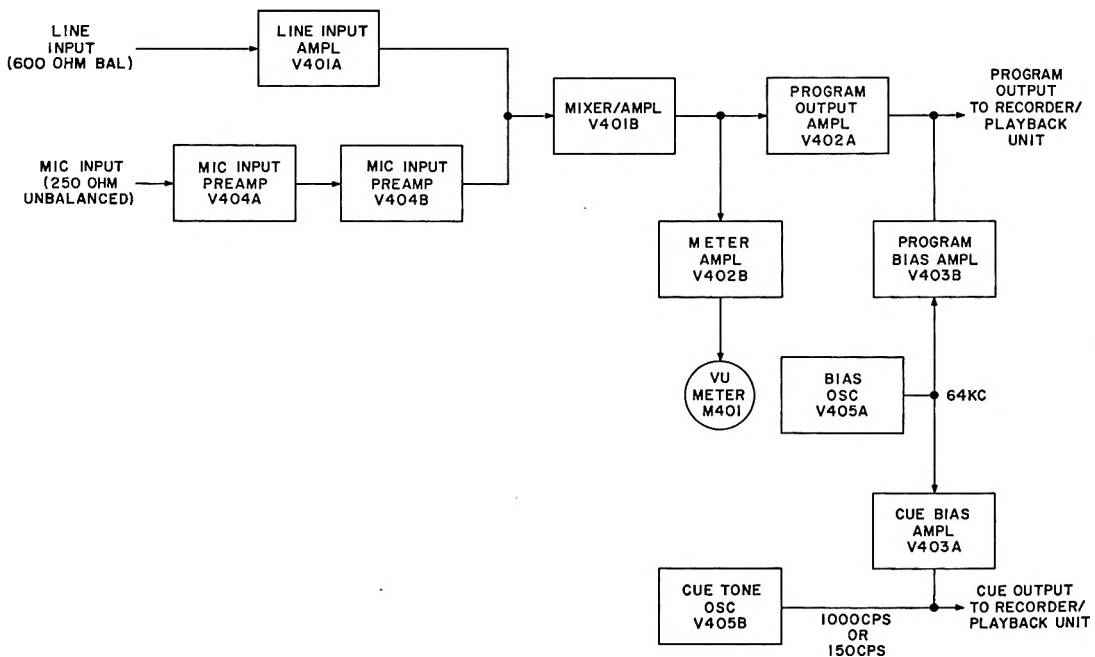


Figure 4-1. 216C-2 Recording Amplifier, Block Diagram

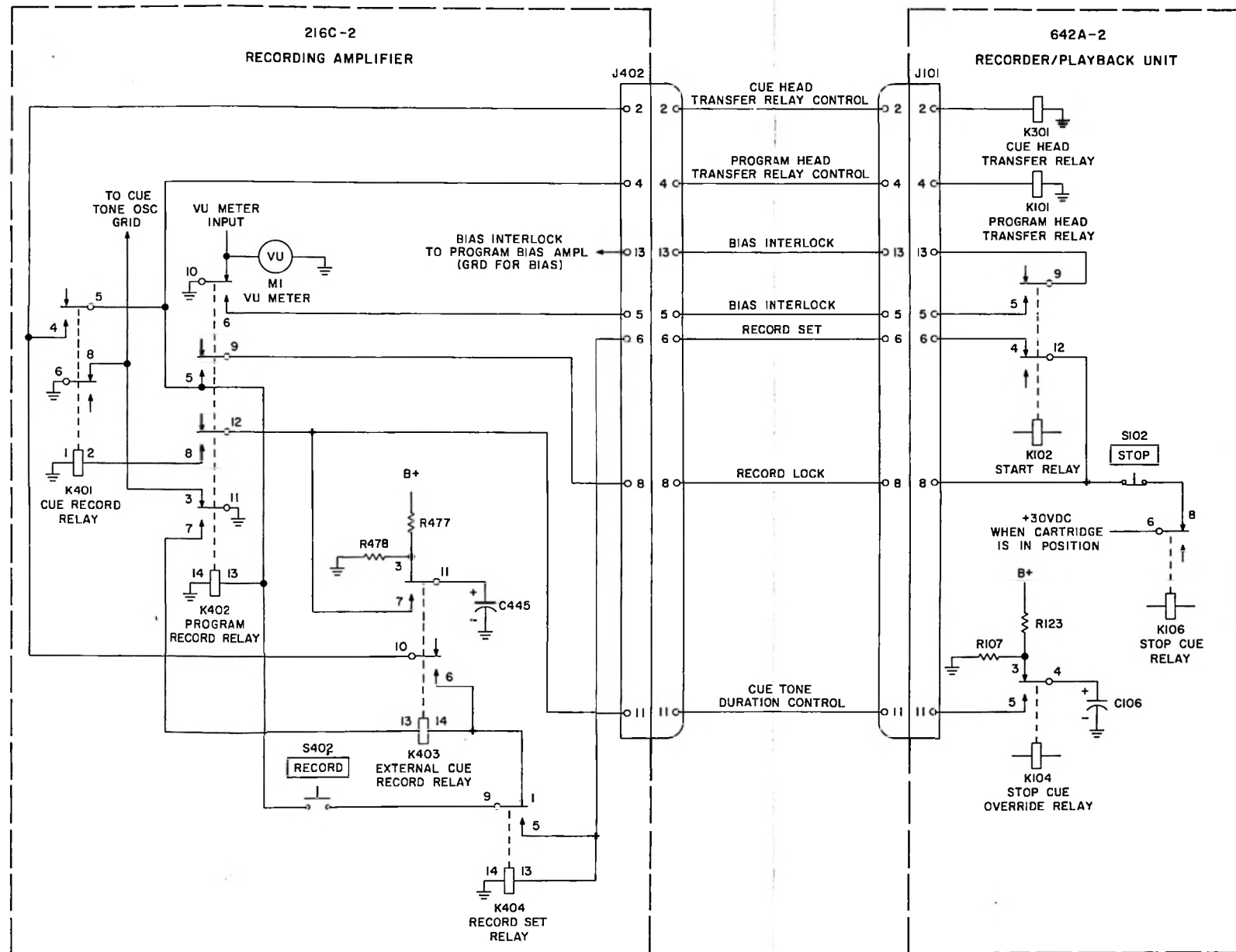


Figure 4-2. Control Circuits, Simplified Schematic Diagram

# section 5

## maintenance

### 5.1 Preventive Maintenance.

#### 5.1.1 TUBES.

Periodically check the emission of all tubes in the recording amplifier with a tube checker. Replace all low-emission tubes immediately.

#### 5.1.2 WIRING.

Periodically check all open and laced wiring on the chassis. Check insulation for physical damage and charring. Examine wires for breaks and for improper dress in relation to adjacent wiring or chassis.

### 5.2 Adjustments.

#### 5.2.1 TEST EQUIPMENT.

The following test equipment, or equivalent, is required to perform the adjustments in this section. All test equipment should be properly calibrated and in good working condition.

- a. Hewlett-Packard 200AB Audio Oscillator.
- b. Hewlett-Packard 400D Vacuum-Tube Voltmeters (two required).
- c. Attenuator (see figure 5-1).
- d. 3300-ohm, 1/2-watt resistors (two required).
- e. 600-ohm, 1-watt resistor.

#### 5.2.2 TEST SETUP.

Connect the 216C-2 Recording Amplifier, 642A-2 Recorder/Playback Unit, and test equipment as shown in figure 5-1. Apply power to all units. Allow a 2-minute warmup period before making any tests. Remove the top covers from the 216C-2 and 642A-2.

#### 5.2.3 EQUALIZATION AND METER CALIBRATION ADJUSTMENTS.

- a. Connect the balanced audio oscillator output to the LINE INPUT terminals on TB401, as shown in figure 5-1.
- b. Connect the HP-400D vtm to the program output, as shown in figure 5-1.
- c. Remove tube V405.

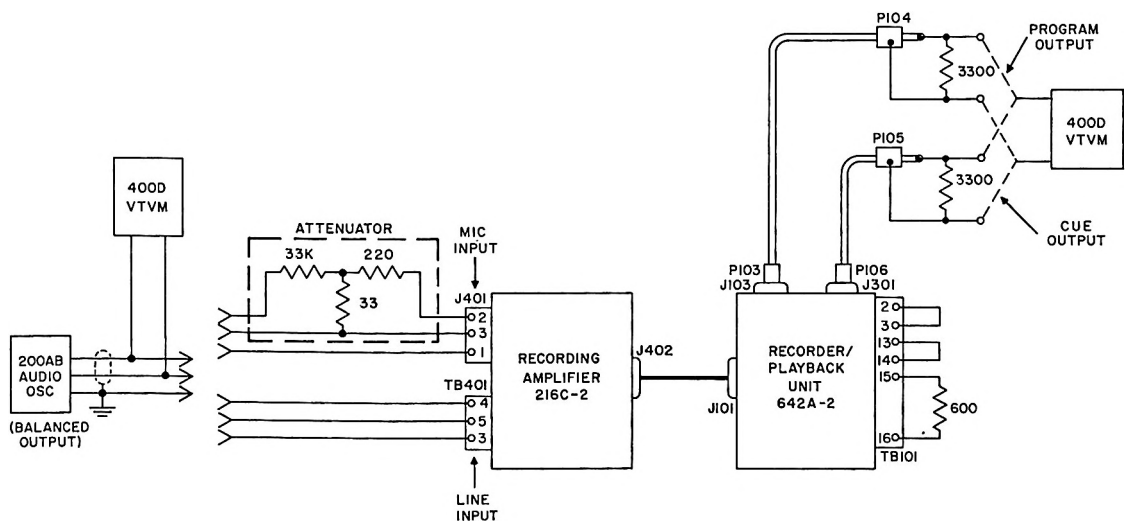


Figure 5-1. 216C-2 Test Setup



- d. Set the MIC level control on the 216C-2 front panel fully counterclockwise.
- e. Insert an erased tape cartridge into the 642A-2.
- f. Press the RECORD switch on the 216C-2.
- g. Press the START switch on the 642A-2.
- h. Set the line input to 400 cps, -5 dbm.
- i. Adjust the LINE level control on the 216C-2 front panel for a -17-dbv program output level (0 dbv = 0.776 volt rms).
- j. Adjust the METER CAL. control, R421, until the VU meter on the 216C-2 front panel indicates 0 vu.
- k. Set the line input to 12,000 cps, -5 dbm.
- l. Adjust the RECORD EQUAL. control, C407, for a -3-dbv program output level.
- m. Measure and record the program output level (in dbv) at each of the line inputs listed in table 5-1. Limits are given in the table.
- n. Press the STOP switch on the 642A-2.
- o. Replace tube V405.

5.2.4 BIAS OUTPUT LEVEL ADJUSTMENT.

- a. Connect the 400D vtm to the program output, as shown in figure 5-1.
- b. Set the MIC and LINE level controls on the 216C-2 front panel fully counterclockwise.
- c. Insert an erased tape in the 642A-2.
- d. Press the RECORD switch on the 216C-2.
- e. Press the START switch on the 642A-2.
- f. Adjust the BIAS ADJ control, R433, for a 13-volt rms program output level.
- g. Connect the 400D vtm to the cue output. The cue output level should be from 12 to 14 volts rms.
- h. Press the STOP switch on the 642A-2.

5.2.5 MICROPHONE AMPLIFIER GAIN CHECK.

- a. Connect the balanced audio oscillator output, through the attenuator, to the microphone input at J401, as shown in figure 5-1.

- b. Connect the 400D vtm to the program output, as shown in figure 5-1.
- c. Set the MIC level control on the 216C-2 front panel fully clockwise.
- d. Set the LINE level control on the 216C-2 front panel fully counterclockwise.
- e. Insert an erased tape cartridge into the 642A-2.
- f. Press the RECORD switch on the 216C-2.
- g. Press the START switch on the 642A-2.
- h. Tune the audio oscillator to 1000 cps. Adjust the oscillator output level until the VU meter on the 216C-2 front panel indicates 0 vu.
- i. Measure the microphone input voltage at the terminals of the J401. This voltage should be less than 0.56 millivolt. If it is not, replace V404, V401, and V402 and repeat this check.
- j. Press the STOP switch on the 642A-2.

5.2.6 LINE AMPLIFIER GAIN CHECK.

- a. Connect the balanced audio oscillator output to the LINE INPUT terminals on TB401, as shown in figure 5-1.
- b. Connect the 400D vtm to the program output, as shown in figure 5-1.
- c. Set the MIC level control on the 216C-2 front panel fully counterclockwise.
- d. Set the LINE level control on the 216C-2 front panel fully clockwise.
- e. Insert an erased tape into the 642A-2.
- f. Press the RECORD switch on the 216C-2.
- g. Press the START switch on the 642A-2.
- h. Tune the audio oscillator to 1000 cps. Adjust the oscillator output level until the VU meter on the 216C-2 front panel indicates 0 vu.
- i. Measure the line input voltage at the terminals of TB401. This voltage should be less than -15 dbm. If it is not, replace V401 and V402, and repeat this check.
- j. Press the STOP switch on the 642A-2.

TABLE 5-1. RECORDING AMPLIFIER EQUALIZATION CHECK

LINE INPUT		PROGRAM OUTPUT LEVEL (dbv)	
FREQUENCY (cps)	LEVEL (dbm)	MEASURED	LIMITS
50	-5		-16.5 to -17.5
400	-5		-17
1000	-5		-16 to -18
5000	-5		-11.5 to -13.5
12,000	-5		-3

## 5.3 Trouble Shooting.

Table 5-2 lists voltage values at the pins of tubes in the 216C-2 Recording Amplifier. These particular values were obtained from measurements on a typical

operating unit. The voltages may vary slightly from unit to unit without affecting performance. All voltages listed are measured between the tube pin and ground. Use the 410B vtvm to make these measurements.

TABLE 5-2. 216C-2 VOLTAGE MEASUREMENTS

TUBE	TYPE VOLTAGE	TUBE PIN NO.								
		1	2	3	4	5	6	7	8	9
V401	D-C	+118	0	+5.5			+95	0	+4	
	A-C				3.2	3.2				3.2
V402	D-C	+100	0	+0.85			+97	0	+1.1	
	A-C				3.2	3.2				3.2
V403	D-C	*+330 **+180	*-68 **0	*0 **+6.3			*+330 **+180	*-68 **0	*0 **+6.3	
	A-C	*0 **28	*9.4 **8.2	*0 **4.5	3.2	3.2	*0 **28	*9.4 **8.2	*0 **4.5	3.2
V404	D-C	+160	0	+1.2			+190	0	+1.6	
	A-C				3.2	3.2				3.2
V405	D-C	+200	0	+21			+177	0	+1.4	
	A-C	62		13	3.2	3.2	*0 ***12	*0 ***0.6	*0 ***1.1	3.2
*Standby **Record ***Cue Record										

# section 6

## parts list

ITEM	DESCRIPTION	COLLINS PART NUMBER
216C-2 RECORDING AMPLIFIER		522-3486-00
C401	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 20 uf -10% +40%, 450 v d-c	183-1485-00
C402	CAPACITOR, FIXED, PAPER: 0.047 uf ±10%, 400 v d-c; Sprague Electric Co. part no. 160P47394	931-0295-00
C403	CAPACITOR, FIXED, MICA: 68 uuf ±5%, 500 v d-c; MIL type CM05E680J03	912-2804-00
C404	CAPACITOR, FIXED, CERAMIC: 10,000 uuf ±20% 500 v d-c	913-3013-00
C405	CAPACITOR, FIXED, PAPER: 0.1 uf ±10%, 400 v d-c; Sprague Electric Co. part no. 160P10494	931-0268-00
C406	CAPACITOR, FIXED, ELECTROLYTIC: 30 uf -10% +100%, 15 v d-c; Sprague Electric Co. part no. D33930	183-1166-00
C407	CAPACITOR, VARIABLE, CERAMIC: -20 uuf min to 125 uuf max, 500 v d-c; Centralab part no. 823AN	917-1004-00
C408	NOT USED	
C409	CAPACITOR, FIXED, PAPER: 0.47 uf ±20%, 400 v d-c; Sprague Electric Co. part no. 160P47404	931-6840-00
C410	CAPACITOR, FIXED, MICA: 330 uuf ±10%, 500 v d-c; MIL type CM05D331K03	912-2853-00
C411	CAPACITOR, FIXED, PAPER: same as C405	931-0299-00
C412	CAPACITOR, FIXED, MICA: 470 uuf ±5%, 500 v d-c; MIL type CM06F471J03	912-2974-00
C413	CAPACITOR, FIXED, CERAMIC: 0.1 uf -20% +80%, 500 v d-c; Sprague Electric Co. of Wisconsin part no. 41C92	913-3152-00
C414	CAPACITOR, FIXED, CERAMIC: same as C413	913-3152-00
C415	CAPACITOR, FIXED, MICA: 1800 uuf ±2%, 500 v d-c; MIL type CM06F182G03	912-3018-00
C416	CAPACITOR, FIXED, MICA: 6800 uuf ±2%, 500 vdcw; MIL type CM07F682G03	912-2722-00
C417	CAPACITOR, FIXED, PAPER: 0.5 uf -10% +20%, 200 v d-c; Sangamo Electric Co. Capacitor Division part no. 330205	931-0169-00
C418	CAPACITOR, FIXED, ELECTROLYTIC: same as C401	183-1485-00
C419	CAPACITOR, FIXED, CERAMIC: same as C413	913-3152-00
C420	CAPACITOR, FIXED, ELECTROLYTIC: same as C406	183-1166-00
C421	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf -10% +100%, 150 v d-c; Sprague Electric Co. part no. D36582	183-1789-00
C422	CAPACITOR, FIXED, ELECTROLYTIC: same as C401	183-1485-00
C423	CAPACITOR, FIXED, PAPER: same as C420	931-0295-00
C424	CAPACITOR, FIXED, MICA: same as C403	912-2804-00
C425	CAPACITOR, FIXED, PAPER: same as C402	931-0295-00
C426	CAPACITOR, FIXED, CERAMIC: same as C404	913-3013-00
C427	NOT USED	
C428	NOT USED	
C429	NOT USED	
C430	CAPACITOR, FIXED, CERAMIC: same as C413	913-3152-00
C431	CAPACITOR, FIXED, ELECTROLYTIC: 8 uf -10% +100%, 25 v d-c; Sprague Electric Co. part no. D31582	183-1167-00
C432	CAPACITOR, FIXED, MICA: same as C412	912-2974-00
C433	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 50 uf, 450 v d-c both sections, -10% -50%	183-1487-00
C434	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf -10% -100%, 50 v d-c; Sprague Electric Co. part no. D33642	183-1402-00
C435	CAPACITOR, FIXED, CERAMIC: same as C404	913-3013-00
C436	CAPACITOR, FIXED, CERAMIC: same as C404	913-3013-00
C437	CAPACITOR, FIXED, CERAMIC: same as C413	913-3152-00
C438	CAPACITOR, FIXED, PAPER: 0.01 uf ±10%, 600 v d-c; Sprague Electric Co. part no. 160P10396	931-0269-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C439	CAPACITOR, FIXED, PAPER: 0.0015 uf ±10%, 1000 v d-c; Sprague Electric Co. part no. 160P152910	931-0279-00
C440	CAPACITOR, FIXED, PAPER: same as C439	931-0279-00
C441	CAPACITOR, FIXED, PAPER: same as C402	931-0295-00
C442	CAPACITOR, FIXED, PAPER: same as C438	931-0289-00
C443	CAPACITOR, FIXED, PAPER: same as C438	931-0289-00
C444	CAPACITOR, FIXED, CERAMIC: same as C404	913-3013-00
C445	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf -10% +100%, 450 v d-c; Sprague Electric Co. part no. D36250	183-1791-00
CR401	SEMICONDUCTOR DEVICE, DIODE: germanium; JEDEC type IN60	353-2010-00
CR402	SEMICONDUCTOR DEVICE, DIODE: germanium; hermetically sealed; JEDEC type IN188	353-0160-00
CR403	RECTIFIER: silicon; axial lead mounted; JEDEC type IN1693	353-1663-00
CR404	SEMICONDUCTOR DEVICE, DIODE: silicon; JEDEC type IN1696	353-1898-00
CR405	SEMICONDUCTOR DEVICE, DIODE: same as CR404	353-1898-00
CR406	SEMICONDUCTOR DEVICE, DIODE: same as CR404	353-1898-00
CR407	SEMICONDUCTOR DEVICE, DIODE: same as CR404	353-1898-00
CR408	RECTIFIER: same as CR403	353-1663-00
CR409	RECTIFIER: same as CR403	353-1663-00
CR410	RECTIFIER: same as CR403	353-1663-00
CR411	RECTIFIER: same as CR403	353-1663-00
DS401	LAMP, INCANDESCENT: miniature single contact midget flange base for use with T-1-3/4 clear bulb; 14 v, 0.08 amp; General Electric Co. part no. 330	262-0309-00
DS402	LAMP, INCANDESCENT: midget, flange base, 28 v d-c max; 0.40 amp, T-1-3/4 bulb, C-2F filament; AN, type AN3140	262-1106-00
F401	FUSE, CARTRIDGE: glass case; 1 amp, 250 v d-c; 1/4 in. dia by 1-1/4 in. lg; MIL type F02A250VIAS	264-4050-00
H1	SPACER, SLEEVE: aluminum; 0.037 in. thk wall 0.218 in. OD, 0.187 in. lg	541-6002-002
H2	JUMPER, BARRIER: brass, cadmium plated; 0.015 in. by 0.250 in. by 0.650 in.; Kulka Electric Mfg. Co. Inc. part no. 600-J	367-0854-00
H3	BUTTON, CABLE: plastic; 4-40 NC-2B internal thd; 0.312 in. hex by 0.250 in. lg o/a	541-5178-002
H4	BUTTON, CABLE: nylon plastic; 4-40 NC-2B internal thd; 0.375 in. hex by 0.312 in. lg o/a	541-5179-002
H5	BUTTON, CABLE: nylon plastic; 4-40 NC-2B internal thd; 0.437 in. hex by 0.375 in. lg o/a	541-5180-002
J401	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 female contacts 15 amp; Camcon Electric Co. part no. XLR-3-13	370-2019-00
J402	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 female contacts, 3 contacts at 15 amp; 12 contacts 5 amps; 500 vrms; Cinch Mfr Corp. part no. 47A-16627	372-1081-00
K401	RELAY, ARMATURE: 2 c contact arrangement; 2 amp at 115 v a-c resistive; 5000 ohms coil resistance, continuous duty cycle; Potter and Brunfield, Inc. part no. KR2932	970-2169-00
K402	RELAY, ARMATURE: 4 c contact arrangement; low level or up to 2 amp at 28 v resistive; 24 v d-c coil voltage; 650 ohms coil resistance; continuous duty cycle; Potter and Brunfield, Inc. part no. KHP17D13	970-2257-00
K403	RELAY, ARMATURE: same as K402	970-2257-00
K404	RELAY, ARMATURE: same as K402	970-2257-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
L401	COIL, RADIO FREQUENCY: 22 $\pm$ 10%, 0.31 ohms d-c max resistance; 1330 ma; powdered iron coil form; Jeffers Electronics part no. 10404-20	240-0186-00
L402	COIL, RADIO FREQUENCY: same as L401	240-0186-00
L403	COIL, RADIO FREQUENCY: universal wound; 3 or 4 pi, 5 mh, #40 AWG wire; carbonyl form; Delevan Electronics Corp. part no. BP218	240-0312-00
M401	AMMETER, dc microammeter for u/as a vu meter; 0.200 microamp, 750 ohms approx; -1 to -20 ccw; +1 to +3 cw; black and red markings, white dial background; Assembly Products, Inc. part no. 36-4750-0000	458-0593-00
MP1	PANEL, FRONT: aluminum, gray finish; 0.187 in. thk; 5.218 in. by 15 in.	549-4990-003
MP2	COVER, AMPLIFIER, BOTTOM: steel, gray enamel finish; 0.0359 in. thk, 12-15, 32 in. by 13 in.	549-4984-003
MP3	COVER, AMPLIFIER, TOP: steel, gray enamel finish; 0.0359 in. thk, 12-15, 32 in. by 13 in.	549-4985-003
MP4	PANEL, SIDE, LEFT: steel, gray enamel finish; 0.500 in. by 4.781 in. by 12.500 in.	549-4989-003
MP5	PANEL, SIDE, RIGHT: steel, gray enamel finish; 0.500 in. by 4.781 in. by 12.500 in.	549-4988-003
MP6	PLATE, COVER: steel, cadmium plated; 1-1/16 by 1-1/4 in.	548-8147-002
MP7	BRACKET, RELAY: stainless steel, passivate finish 0.594 in. by 0.750 in. by 0.9687 in.	553-7268-003
MP8	BRACKET, RELAY: same as MP7	553-7268-003
MP9	BRACKET, RELAY: same as MP7	553-7268-003
MP10	COVER ASSEMBLY: w/right angle cable entry for 15 contact socket connectors; 7/16 in. cable opening 1-1/16 in. by 1-3/8 in. by 2-1/8 in.	549-4529-002
MP11	COVER, ASSEMBLY: same as MP10	549-4529-002
O1	KNOB: black phenolic shell, aluminum skirt, 1.562 in. dia and black plastic setscrew knob w/metal insert; 1.5625 in. dia, 0.765 in. w o/a	549-1023-003
O2	KNOB: same as O1	549-1023-003
P401	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 round male contacts, 1 connector mating end; 3 contacts 15 amp, 12 contacts 5 amp; Cinch Mfg. Corp. part no. 472-21-02-092	372-1079-00
P402	CONNECTOR, RECEPTACLE, ELECTRICAL: same as P1	372-1079-00
P403	ADAPTER, CONNECTOR: 2 mating ends, 3 contacts ea end, plastic dielectric, a-c plug 110 v; Pass & Seymour Ind. part no. 1919	368-0110-00
R401	NOT USED	
R402	NOT USED	
R403	NOT USED	
R404	NOT USED	
R405	RESISTOR, FIXED, COMPOSITION: 0.56 meg-ohms $\pm$ 10%, 1/2 w; MIL type RC20GF564K	745-1468-00
R406	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms $\pm$ 30% 1/4 w; Chicago Telephone Supply Co. part no. LL5883	376-2480-00
R407	RESISTOR, FIXED, COMPOSITION: 22,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF223K	745-1408-00
R408	RESISTOR, FIXED, COMPOSITION: 82,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF823K	745-1433-00
R409	RESISTOR, FIXED, COMPOSITION: 0.33 megohm $\pm$ 10%, 1/2 w; MIL type RC20GF334K	745-1457-00
R410	RESISTOR, FIXED, COMPOSITION: 2200 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF222K	745-1366-00
R411	RESISTOR, FIXED, COMPOSITION: 10,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF103K	745-1394-00
R412	RESISTOR, FIXED, COMPOSITION: 5600 ohms, $\pm$ 10%, 2 w; MIL type RC20GF562K	745-1384-00
R413	RESISTOR, FIXED, COMPOSITION: 82,000 ohms $\pm$ 10%, 1 w; MIL type RC32GF823K	745-3433-00
R414	RESISTOR, FIXED, COMPOSITION: 3300 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF332K	745-1373-00
R415	RESISTOR, FIXED, COMPOSITION: 0.10 megohm $\pm$ 10%, 1/2 w; MIL type RC20GF104K	745-1436-00
R416	RESISTOR, FIXED, COMPOSITION: 0.10 megohms $\pm$ 10%, 1/2 w; MIL type RC20GF105K	745-1478-00
R417	RESISTOR, FIXED, COMPOSITION: 47,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF473K	745-1422-00
R418	RESISTOR, FIXED, COMPOSITION: same R415	745-1436-00
R419	RESISTOR, FIXED, COMPOSITION: 56,000 ohms $\pm$ 10%, 2 w; MIL type RC42GF563K	745-5728-00
R420	RESISTOR, FIXED, COMPOSITION: 330 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF331K	745-1331-00
R421	RESISTOR, VARIABLE, COMPOSITION: 250,000 ohms $\pm$ 30%, 1/4 w; Chicago Telephone Supply Co. part no. LL6064	376-4734-00
R422	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R423	RESISTOR, FIXED, COMPOSITION: same as R411	745-1394-00
R424	RESISTOR, FIXED, COMPOSITION: 220 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF221K	745-1324-00
R425	RESISTOR, FIXED, COMPOSITION: same as R408	745-1433-00
R426	NOT USED	
R427	RESISTOR, FIXED, COMPOSITION: 56,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF563K	745-1426-00
R428	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R429	RESISTOR, FIXED, COMPOSITION: 1200 ohms $\pm$ 10%, 1 w; MIL type RC32GF122K	745-3356-00
R430	RESISTOR, FIXED, COMPOSITION: 560 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF561K	745-1342-00
R431	RESISTOR, FIXED, COMPOSITION: 33,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF333K	745-1415-00
R432	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R433	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms $\pm$ 30% 1/4 w; Chicago Telephone Supply Co. part no. LL6063	376-4730-00
R434	RESISTOR, FIXED, COMPOSITION: 10,000 ohms $\pm$ 10%, 2 w; MIL type RC42GF103K	745-5694-00
R435	RESISTOR, FIXED, COMPOSITION: same as R431	745-1415-00
R436	RESISTOR, FIXED, COMPOSITION: same as R407	745-1457-00
R437	RESISTOR, FIXED, COMPOSITION: same as R419	745-1422-00
R438	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R439	RESISTOR, FIXED, COMPOSITION: 1200 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF122K	745-1356-00
R440	RESISTOR, VARIABLE, COMPOSITION: same as R406	376-2480-00
R441	RESISTOR, FIXED, COMPOSITION: same as R417	745-1422-00
R442	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R443	RESISTOR, FIXED, COMPOSITION: same as R410	745-1366-00
R444	RESISTOR, FIXED, COMPOSITION: same as R409	745-1457-00
R445	RESISTOR, FIXED, COMPOSITION: 4700 ohms $\pm$ 10%, 1/2 w, type RC20GF472K	745-1380-00
R446	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R447	NOT USED	
R448	RESISTOR, FIXED, COMPOSITION: same as R407	745-1408-00
R449	RESISTOR, FIXED, COMPOSITION: 220,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF224K	745-1450-00
R450	RESISTOR, FIXED, COMPOSITION: 1500 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF152K	745-1359-00
R451	RESISTOR, FIXED, COMPOSITION: 0.47 megohm $\pm$ 10%, 1/2 w; MIL type RC20GF474K	745-1464-00
R452	RESISTOR, FIXED, COMPOSITION: same as R424	745-1324-00
R453	RESISTOR, FIXED, COMPOSITION: same as R453	745-5694-00
R454	RESISTOR, FIXED, COMPOSITION: same as R430	745-1342-00
R455	RESISTOR, FIXED, COMPOSITION: 120,000 ohms $\pm$ 10%, 2 w; MIL type RC42GF124K	745-5740-00
R456	RESISTOR, FIXED, COMPOSITION: 10,000 ohms $\pm$ 10%, 1 w; MIL type RC32GF103K	745-3394-00
R457	RESISTOR, FIXED, COMPOSITION: 1800 ohms $\pm$ 10%, 2 w; MIL type RC42GF182K	745-5663-00
R458	RESISTOR, FIXED, COMPOSITION: same as R457	745-5663-00
R459	RESISTOR, FIXED, COMPOSITION: same as R456	745-3394-00
R460	RESISTOR, FIXED, COMPOSITION: 120 ohms $\pm$ 10%, 1 w; MIL type RC32GF121K	745-3314-00
R461	RESISTOR, FIXED, COMPOSITION: 0.15 megohms $\pm$ 10%, 2 w; MIL type RC42GF154K	745-5743-00
R462	RESISTOR, FIXED, COMPOSITION: same as R461	745-5743-00
R463	RESISTOR, FIXED, COMPOSITION: same as R424	745-1324-00
R464	RESISTOR, FIXED, COMPOSITION: 270 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF271K	745-1328-00
R465	RESISTOR, FIXED, COMPOSITION: same as R457	745-5663-00
R466	RESISTOR, FIXED, COMPOSITION: same as R430	745-1342-00
R467	RESISTOR, FIXED, COMPOSITION: same as R455	745-5740-00
R468	NOT USED	
R469	RESISTOR, FIXED, COMPOSITION: 560 ohms $\pm$ 10%, 1 w; MIL type RC32GF561K	745-3342-00
R470	RESISTOR, FIXED, COMPOSITION: 1000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF102K	745-1352-00
R471	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R472	RESISTOR, FIXED, COMPOSITION: same as R415	745-1436-00
R473	RESISTOR, FIXED, COMPOSITION: 12,000 ohms $\pm$ 10%, 1/2 w; MIL type RC20GF123K	745-1398-00
R474	RESISTOR, FIXED, COMPOSITION: 0.12 megohm $\pm$ 10%, 1/2 w; MIL type RC20GF124K	745-1440-00
R475	RESISTOR, FIXED, COMPOSITION: same as R474	745-1440-00
R476	RESISTOR, FIXED, COMPOSITION: same as R407	745-1408-00
R477	RESISTOR, FIXED, COMPOSITION: same as R455	745-5740-00
R478	RESISTOR, FIXED, COMPOSITION: same as R413	745-3433-00
S401	SWITCH PUSH, ILLUMINATED, spst, 120 vac, 3 amp noninductive, 1 amp inductive; Pandar Co. part no. 56-1118L41R	266-6149-00

## 216C-2 Recording Amplifier

ITEM	DESCRIPTION	COLLINS PART NUMBER
S402	SWITCH, PUSH: spst (2 circuit) momentary; yellow lens; black adapter; Pendar Co., Inc. part no. 56-1018L41Y	266-6159-00
T401	TRANSFORMER, AUDIO FREQUENCY: pri 600 ohms, 50 ohms, 250 ohms ct, sec. 85,000 ohms; 30 to 15,000 cps; continuous duty cycle; Triad Transformer Corp. part no. A-8J	667-0006-00
T402	NOT USED	
T403	TRANSFORMER, AUDIO FREQUENCY: same as T401	667-0006-00
T404	TRANSFORMER, POWER, STEP-UP AND STEP-DOWN: primary 115 vrms, secondary 6.3 vrms, CT, 2.7 amp, 600 vrms, secondary 6.3 vrms, CT, 2.7 amp, 600 vrms, CT, 0.065 amp; 50/60 cps; continuous duty cycle; American Magnetics Corp. part no. AM-2157	662-0050-00
TB1	TERMINAL BOARD: phenolic w/3 solder-lug terminals 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB2	TERMINAL BOARD: phenolic; 1/16 in. by 3/8 in. by 1-1/2 in.; 4 brass solder lug terminals; Cinch Mfg. Corp. part no. 1532-A	306-9032-00
TB3	TERMINAL BOARD: same as TB1	306-9033-00
TB4	TERMINAL BOARD: phenolic, w/5 solder-lug terminals; 1-7/8 in. lg by 11/16 in. w; Cinch Mfg. Corp. part no. 1542-A	306-0550-00
TB5	TERMINAL BOARD: same as TB4	306-0550-00
TB6	TERMINAL BOARD: same as TB4	306-0550-00
TB7	TERMINAL BOARD: phenolic w/4 wiring lugs, 1 mounting lug; 3/8 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1009	367-1059-00
TB8	NOT USED	
TB9	TERMINAL BOARD: same as TB1	306-9033-00
TB10	TERMINAL BOARD: same as TB4	306-0550-00
TB11	TERMINAL BOARD: same as TB4	306-0550-00
TB12	TERMINAL BOARD: same as TB4	306-0550-00
TB13	TERMINAL BOARD: same as TB4	306-0550-00
TB14	NOT USED	
TB15	TERMINAL BOARD: same as TB4	306-0550-00
TB16	TERMINAL BOARD: same as TB2	306-9032-00
TB17	TERMINAL BOARD: same as TB7	367-1059-00
TB18	TERMINAL BOARD: same as TB1	306-9033-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
TB19	NOT USED	
TB20	TERMINAL BOARD: same as TB4	306-0550-00
TB21	TERMINAL BOARD: same as TB4	306-0550-00
TB22	TERMINAL BOARD: same as TB1	306-9033-00
TB23	TERMINAL BOARD: same as TB2	306-9032-00
TB24	TERMINAL BOARD: same as TB4	306-0550-00
TB401	TERMINAL BOARD: phenolic; barrier type w/lug for back connection, 5 terminals; Howard E. Jones part no. 353-18-05-001	367-0013-00
V401	ELECTRON TUBE: twin triode; Radio Corp. of America part no. 12AU7	255-0199-00
V402	ELECTRON TUBE: twin triode type; Radio Corp. of America part no. 12AT7	255-0205-00
V403	ELECTRON TUBE: twin triode; Tun Sol Electric, Inc. part no. 12BH7	255-0302-00
V404	ELECTRON TUBE: low noise twin triode; Amperex Electronics Co. Division of North American Phillips Co. part no. ECC83/12AX7	255-0386-00
V405	ELECTRON TUBE: double triode; General Electric Co. part no. 7247	255-0368-00
W1	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 3 conductors #18 AWG; 125 vrms working voltage; 0.325 in. dia by 6 ft 0.843 in. lg o/a; one end terminated w/plug connector; Belden Mfg. Co. part no. KH3491	426-1464-00
W2	CABLE, RADIO FREQUENCY: coaxial; 1500 vrms working voltage, 50 ohms impedance, 7 strands #34 AWG copper covered steel wire inner conductor; single braid #38 AWG tinned copper wire outer conductor; Communication Electronic Nomenclature Subpanel part no. RG-174/U	425-1005-00
XF401	FUSEHOLDER: extractor post type; 250 v, 15 amp; accommodates one 0.250 in. dia by 1.250 in. lg cartridge fuse w/ferule terminals; 0.687 in. dia by 2.140 in. lg o/a dim.; Bussman Fuse part no. HKP-HJR-ZZ	265-1019-00
XV401	SOCKET, ELECTRON TUBE: type E naval contact configuration, plastic; MIL type TS103P01	220-1103-00
XV402	SOCKET, ELECTRON TUBE: same as XV401	220-1103-00
XV403	SOCKET, ELECTRON TUBE: same as XV401	220-1103-00
XV404	SOCKET, ELECTRON TUBE: same as XV401	220-1103-00
XV405	SOCKET, ELECTRON TUBE: same as XV401	220-1103-00

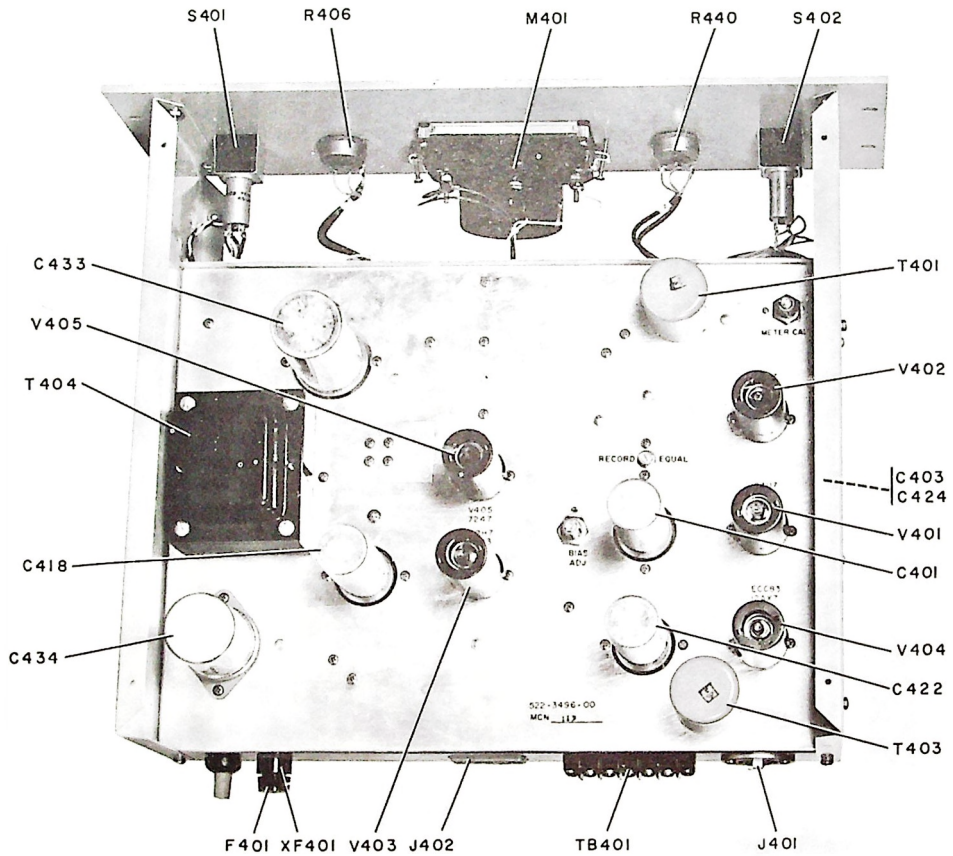


Figure 6-1. 216C-2 Recording Amplifier, Parts Identification (Top View)

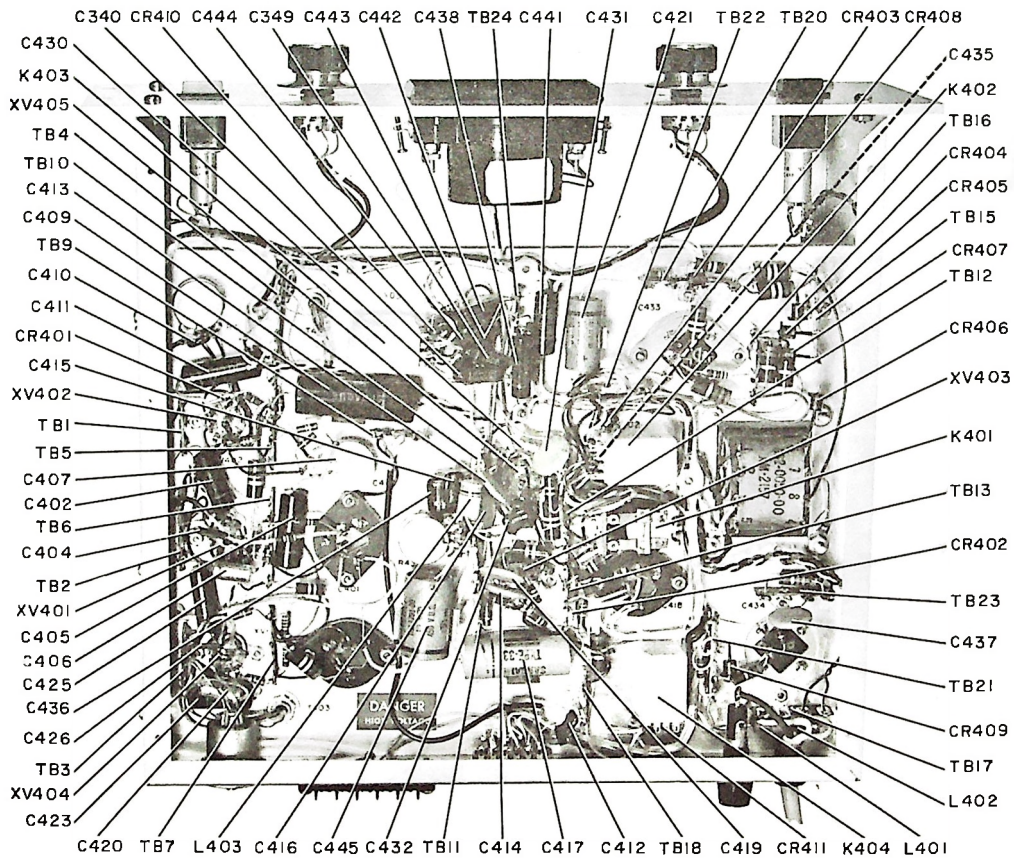


Figure 6-2. 216C-2 Recording Amplifier, Parts Identification (Bottom View) (Sheet 1 of 2)

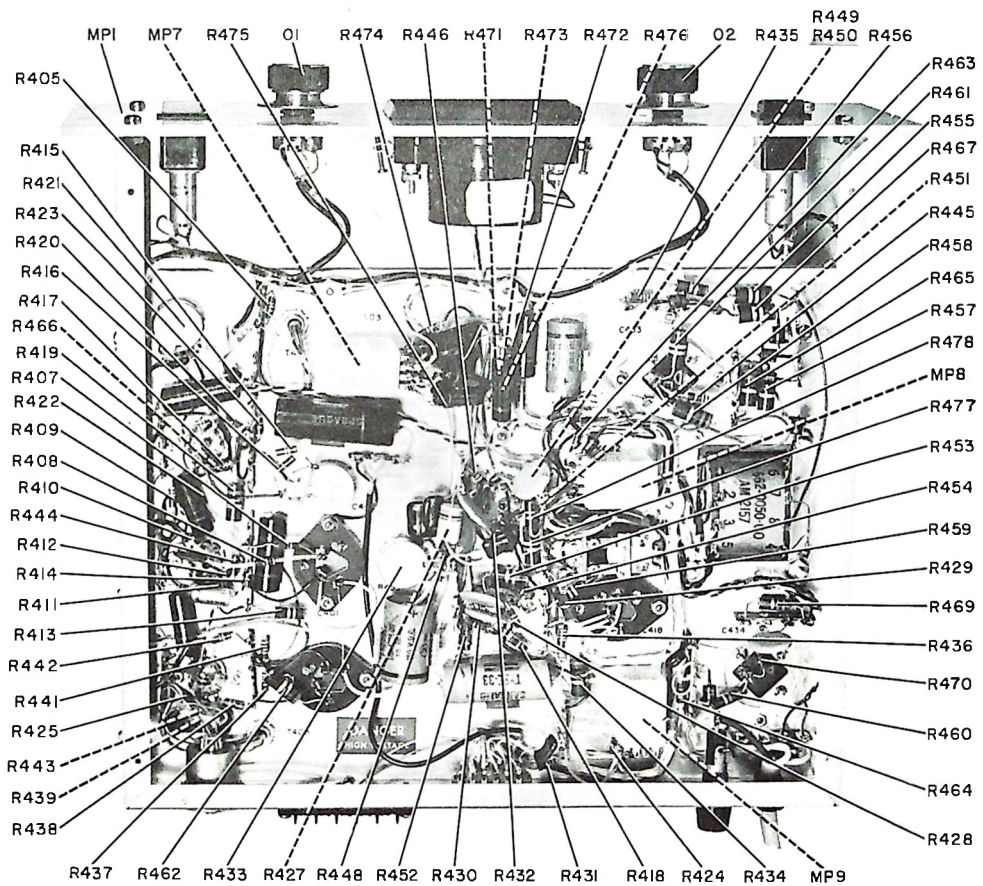
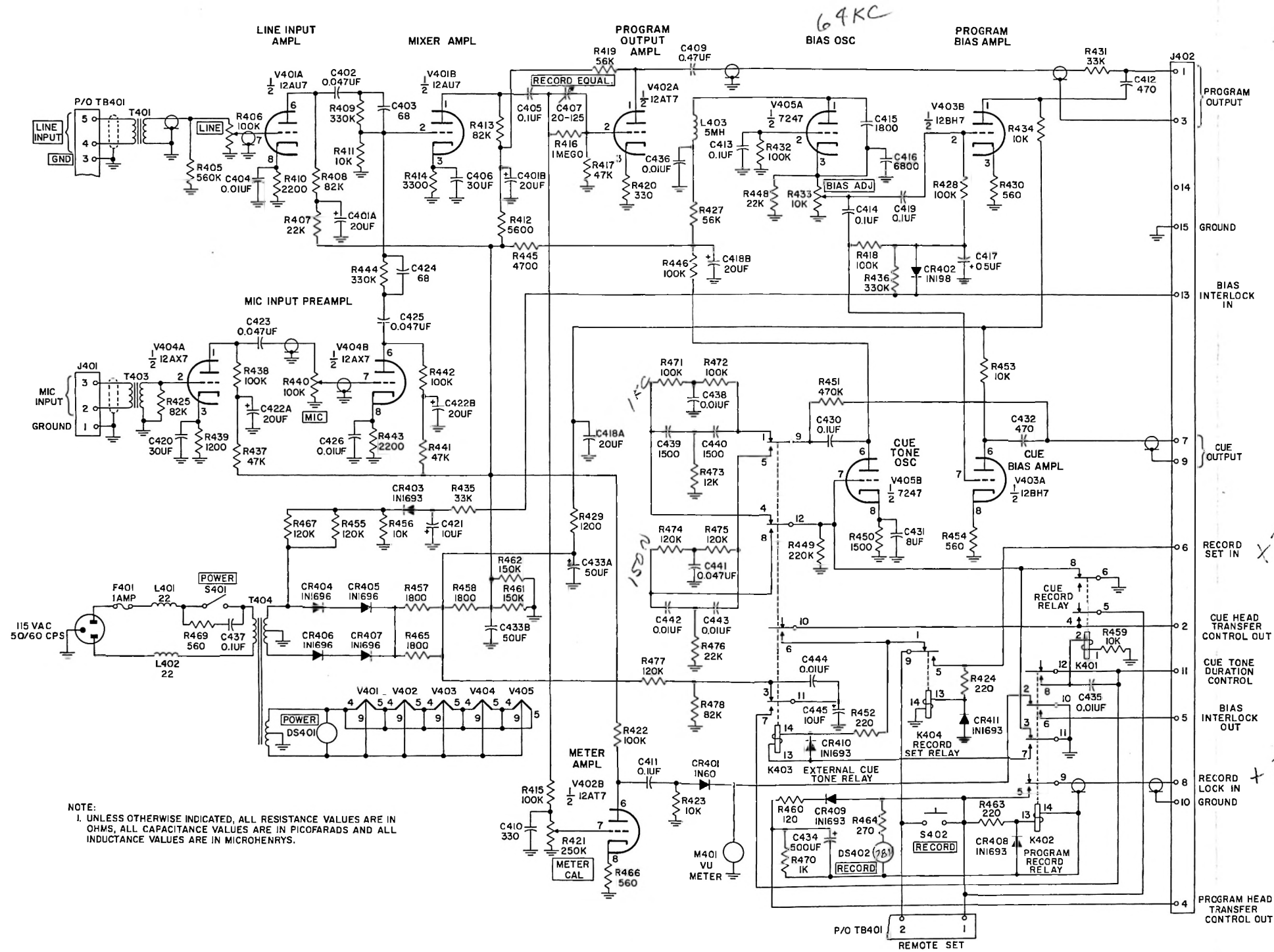


Figure 6-2. 216C-2 Recording Amplifier, Parts Identification (Bottom View) (Sheet 2 of 2)



section **7**  
illustrations



NOTE:  
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.

Figure 7-1. 216C-2 Recording Amplifier, Schematic Diagram





# Magnetic Tape Cartridges

unit instructions

Cedar Rapids Division | Collins Radio Company, Cedar Rapids, Iowa

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Printed in U.S.A.

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## 1.1 GENERAL DESCRIPTION.

The magnetic tape cartridges (see figure 1) used with Collins Tape Cartridge System eliminate tape spilling, breaking, and accidental erasing. The cartridges consist of an endless loop of lubricated tape on a free-turning reel. Figure 2 shows the cartridge parts.

The reel used in the cartridges is the same as a standard reel with the top side removed. On a cartridge reel, however, the beginning of the tape is near the hub of the reel and the end of the tape on the outside as shown in figure 3. To make the tape loop continuous, the beginning and end of the tape are merely spliced together, as shown in figure 4.

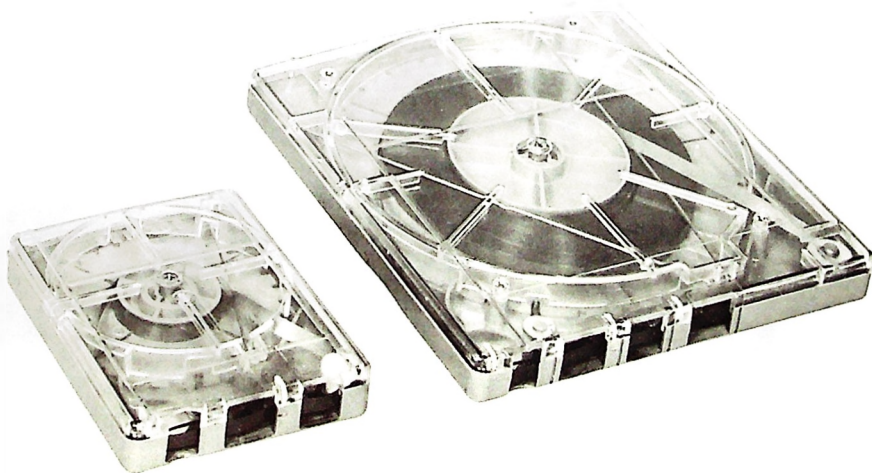


Figure 1. Magnetic Tape Cartridges

C754-28-P

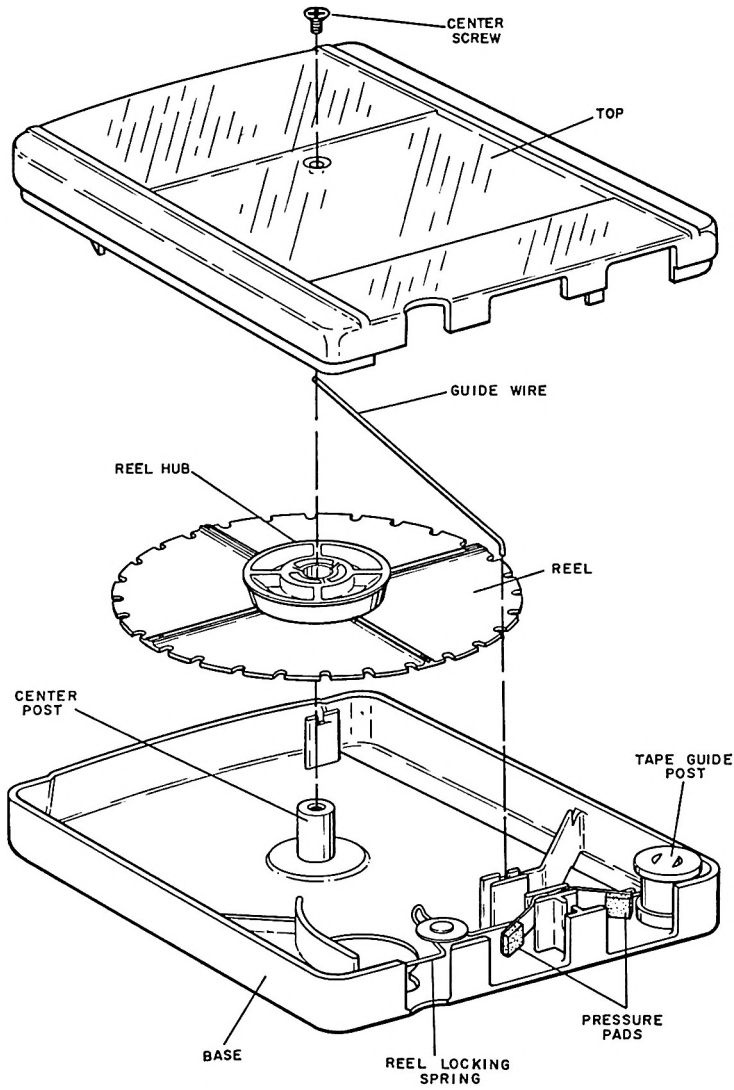


Figure 2. Magnetic Tape Cartridge, Exploded View

C754-51-3

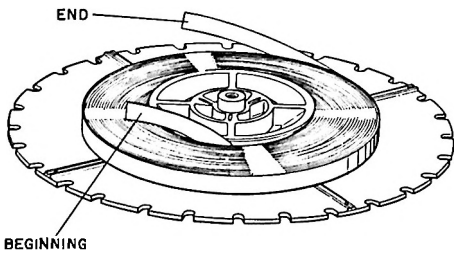


Figure 3. Tape on Cartridge Reel (Unspliced)

C754-54-3

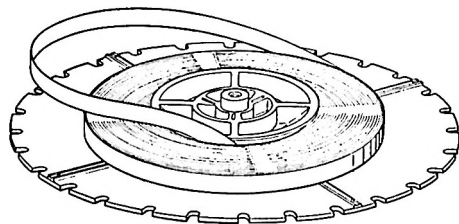


Figure 4. Tape on Cartridge Reel (Spliced)

C754-49-3

If the reel is placed on a spindle and tape is pulled from the beginning (inside) of the reel, it will rewind on the outside of the reel. Since the outside diameter is greater than at the hub, the tape will rewind faster than it is unwinding, and the free tape loop will get smaller. If the tape were not allowed to slip upon itself, the free loop would eventually become so small that the tape would bind and stop. For this reason, tape used in cartridges must be lubricated with a special compound so that it can slip upon itself. Then, each turn of tape on the reel moves when tape is pulled from the inside of the reel, allowing tape to be pulled from the inside as fast as it is being wound on the outside.

In the cartridge, the tape loops out from the center of the reel, travels around a guide post, across the heads, around another guide, and is wound back on the outside of the supply reel.

Preloaded cartridges are available with 17 different lengths of tape, ranging in running time from 40 seconds to 31 minutes. Table 1 lists the cartridges that are available from Collins Radio Company. Blank cartridges are also available. Paragraph 2.2 contains instructions for loading the blank cartridges.

TABLE 1. TAPE CARTRIDGES AND ASSOCIATED EQUIPMENT

CARTRIDGE TYPE	TAPE PLAYING TIME	COLLINS PART NUMBER
Series 300	40 sec	097-5205-00
Series 300	70 sec	097-5206-00
Series 300	90 sec	099-0191-00
Series 300	100 sec	099-0192-00
Series 300	2-1/2 min	099-0193-00
Series 300	3 min	099-0194-00
Series 300	3-1/2 min	097-5207-00
Series 300	5 min	099-0195-00
Series 300	5-1/2 min	097-5208-00
Series 300	7-1/2 min	099-0196-00
Series 300	10 min	099-0197-00
Series 300	10-1/2 min	097-5209-00
Series 600	11 min	099-0198-00
Series 600	13-1/3 min	099-0199-00
Series 600	15 min	099-0200-00
Series 600	16 min	097-5210-00
Series 1200	31 min	097-5211-00
Series 300 (blank)	--	097-5528-00
Series 600 (blank)	--	097-5914-00
Series 1200 (blank)	--	097-5915-00
Head Alignment Tape	70 sec	097-6076-00
Magneraser Model 200C Tape Eraser	--	097-5172-00

**2.1 NEW CARTRIDGES.**

Visually inspect new tape cartridges for loose mounting screws, pressure pads, and for any shipping damage. Check to be sure that the tape is in its proper operating path. After this inspection, run through the tape several times to ensure smooth pull-out of tape from the inside of the reel.

**2.2 LOADING PROCEDURE FOR BLANK CARTRIDGES.**

To load blank or prerecorded tape onto a cartridge reel, using a standard reel-to-reel recorder, perform the following steps.

**CAUTION**

Be sure that the tape being loaded has been especially lubricated for use in tape cartridges. Use Collins part number 097-5852-00 (Minnesota Mining MM151) or equivalent.

- a. If the tape being loaded has been prerecorded, cut the tape approximately one foot beyond the end of the recorded material.
- b. Remove the supply reel from the recorder. Then remove the take-up reel, with the recorded tape,

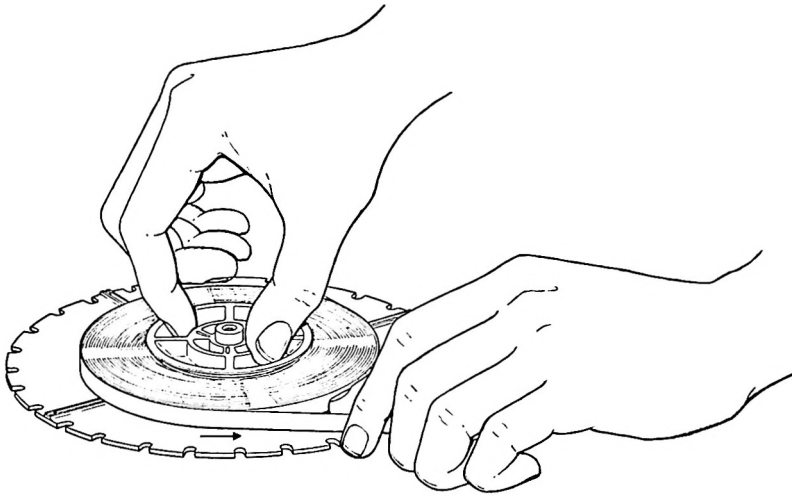


Figure 5. Preparing to Splice Tape (No. 1)

C754-53-3

from the take-up spindle. Without turning this reel over, place it on the supply spindle.

c. Place an empty reel on the recorder take-up spindle and rewind the recorded tape fast forward in the normal manner. Note that after this has been done, the recorded information now faces away from the recording head.

d. Place an empty cartridge reel on the recorder supply spindle. Wind a few turns of tape around the reel hub, and by means of fast rewind, wind the recorded tape on the cartridge reel. Keep as little back-tension as possible on the supply reel during this rewinding.

Whenever loading tape on a cartridge reel, keep in mind the following points: (1) The cartridge reel

must revolve clockwise during loading of recorded information. (2) The tape must be loaded with the recorded information facing outward. (3) The start of the program material must be at the hub of the cartridge reel when starting to load. (4) Tape should be fed to the cartridge reel during loading with as little back-tension as possible on the supply reel.

### 2.3 SPLICING TAPE ON A CARTRIDGE REEL.

a. Place the loaded reel on a flat surface. While holding the hub of the reel firmly with the right hand, pull about 18 inches of tape from the outside of the reel as shown in figure 5. The tape should be loose enough on the reel to slip off without having to turn the reel.

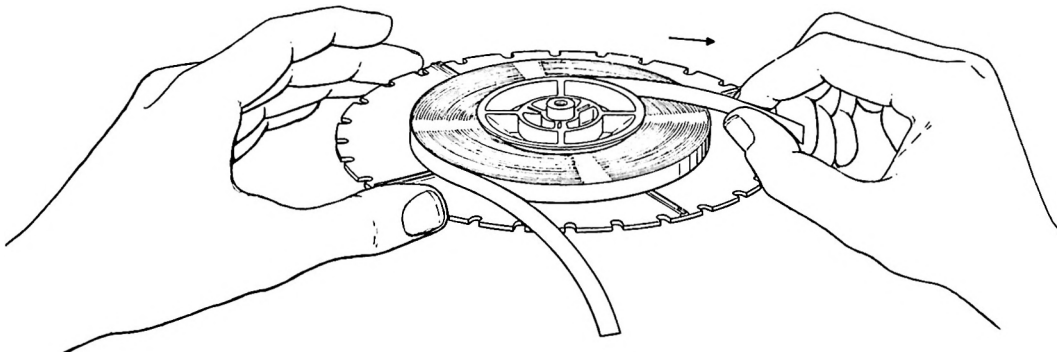


Figure 6. Preparing to Splice Tape (No. 2)

C754-50-3

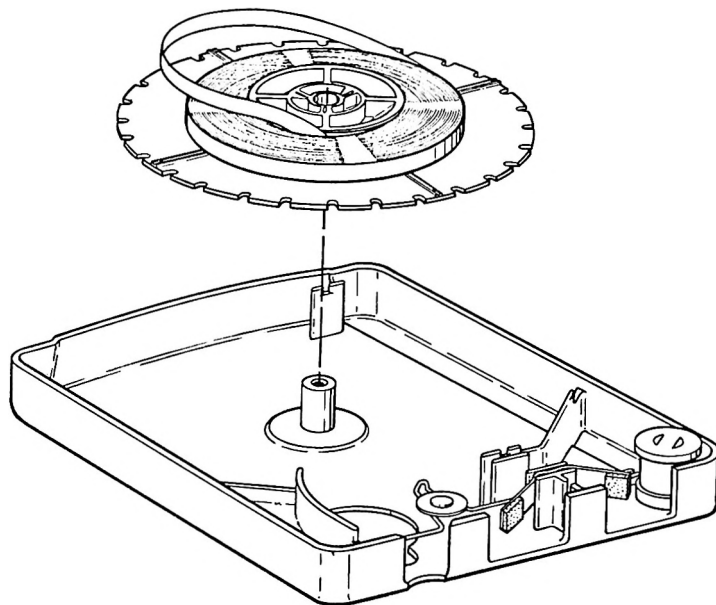


Figure 7. Placing Reel into Cartridge

C754-47-3

b. Remove about 9 inches of tape from the inside of the reel by pulling gently on the free end of the tape near the reel hub as in figure 6. Do this carefully to avoid spilling tape from the reel.

c. After making sure that there are no twists in either the beginning or end of the tape, place the two ends of the tape on a splicer and splice the tape in a normal manner (oxide to oxide). Use mylar-base splicing tape.

## 2.4 LOADING THE CARTRIDGE REEL INTO CARTRIDGE.

a. After the tape has been spliced, place the reel in the cartridge with the head openings facing front. See figure 7.

b. With the left hand, release the reel locking spring over the opening in the bottom left of the cartridge as in figure 8. This will allow the reel to turn. Then, with the right hand, pull the tape from the inside of the reel until the slack in the free tape loop has been taken up.

c. Refer to figure 9. Place the tape around the corner guide post, through the front guide slots, and around the left guides as shown in the figure. To check for correct slack, pull the slack tape out of one of the head openings. The loop should extend between one and two inches for best performance.

d. Turn the cartridge so that the rear of the cartridge is facing front. Pass the straight guide wire under the tape coming from the hub, and insert the front and rear ends of the guide in the holes or slots provided at the front and rear of the cartridge.

Refer to figure 9. On the Series 1200 (large size) cartridges, place the guide wire with the "V" on the right side of the tape reel with the shorter end of the guide facing the front of the cartridge. The "V" guide wire should rest near, but not touching, the reel hub, and the "V" portion of the wire should rest lightly on the tape. This is necessary to keep the tape down against the hub. The "V" guide wire is not used with Series 600 and Series 300 cartridges.

e. After the guide wire or wires are in place, put the top on the cartridge and tighten in place with the center screw. While doing this, check to be sure that the reel does not bind on any part of the cartridge, and that the tape or reel motion is not hindered in any way by the guide wires. The reel must be able to turn freely and the tape travel must not be impeded in order for the cartridge to function properly. **THIS IS IMPORTANT.**

f. After the cartridge is assembled, place it in 642A-2 Recorder/Playback Unit and run through the tape several times to properly position the slack tape.

## 3.1 GENERAL MAINTENANCE.

Tape cartridges must be maintained and used properly to ensure proper operation. Handle the cartridges carefully to avoid misadjustment that may cause a malfunction. If a cartridge is dropped, audition it once to ensure that it is still operating properly.

Some problems that appear to be caused by faulty tape cartridges may often be caused by misalignment of

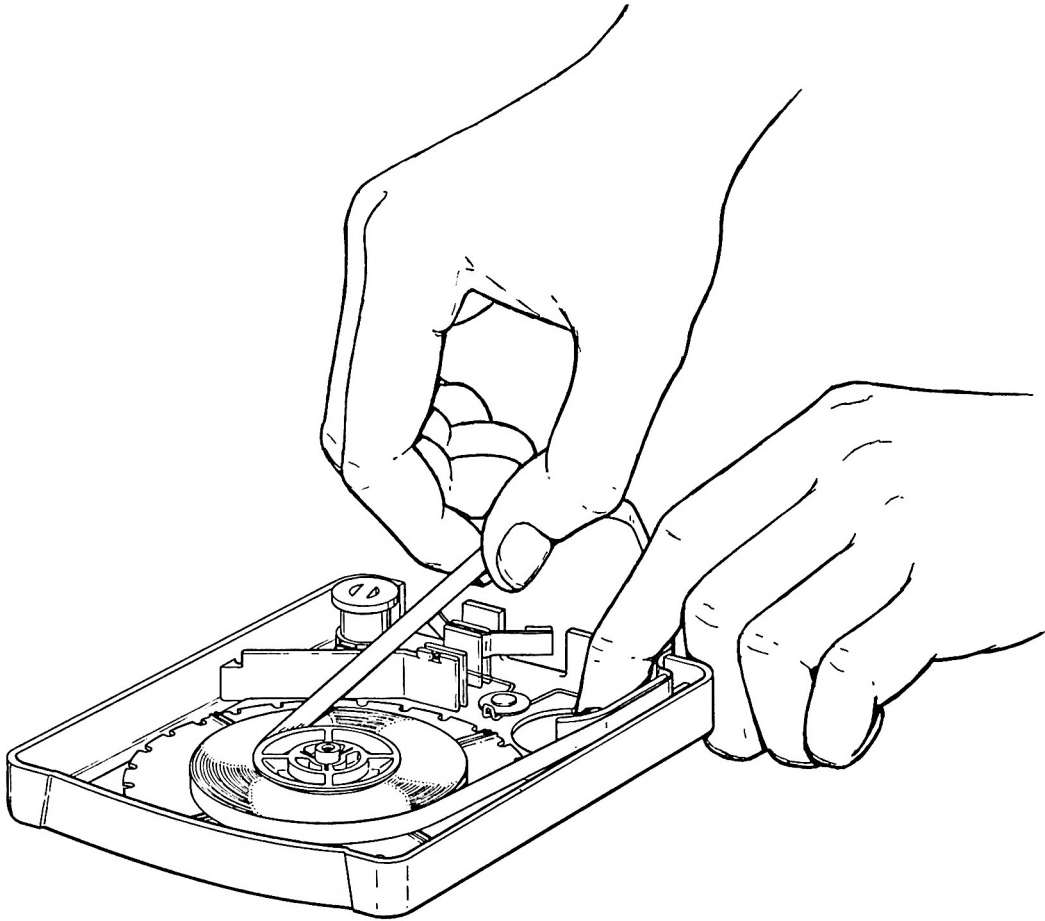


Figure 8. Adjusting Tape in Cartridge

C754-52-3



the tape mechanism. An improperly adjusted or worn pressure roller, misaligned or dirty heads, or improperly adjusted head bracket assembly, cartridge stop, or cartridge guide can cause recording and playback difficulty.

The guide wire (or wires) should not touch the tape or reel hub. If they do, tape tightening will result. The guide wire should be bent in a slight upward arc and slightly toward the hub, but not touching the hub.

The pressure pads in the cartridges should be bent until they are 1/8 inch from the edge of the cartridge case. If, after repeated cartridge use, the pads become loose in the cartridge, replace them on the spring with a drop of household cement. If the pads become so worn that the tape tension weakens, replace them with new pads, Collins part number 235-0011-00.

Periodically check the tape guide post. It should be fully seated and cemented into the cartridge so that the tape cannot ride up and down during operation.

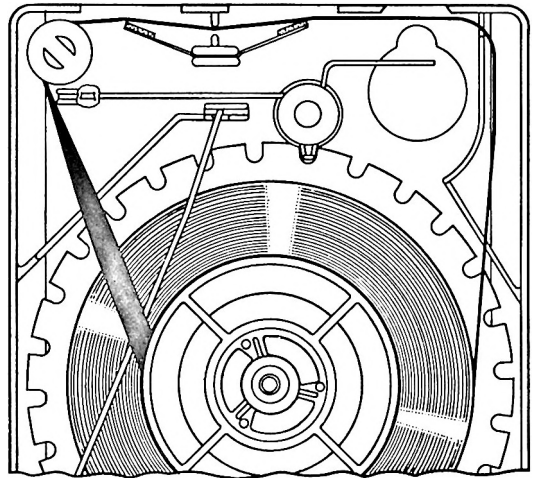
Each six months, remove the reel from the cartridge and place a thin film of Lubriplate or a similar grease on the center post.

Periodically check the freedom of the reel locking spring. If this locking spring is not operating properly, the reel will not turn and the tape that is being pulled from the inside of the reel will be spilled from the cartridge.

### 3.2 CORRECTING TIGHT TAPE.

Tape tightening will occur whenever the tape in the cartridge cannot slip upon itself freely. It may be caused by lack of tape lubrication or binding of the tape on one or more of the cartridge parts. When tightening occurs, the reel will not be able to turn and the tape will be torn or damaged.

After a cartridge has been in use for some time, the graphite lubricant on the tape may gradually wear away, causing the tape to tighten. Tape damage due to tightening because of improper lubrication may be prevented by periodic visual checks of the tape. When the tape appears dull on both sides, it is properly lubricated. If the tape becomes very shiny,



C754-48-3

Figure 9. Tape and Guide Wire in Place in Cartridge

the graphite lubricant is wearing off. When this happens, the material on the tape in the cartridge should be rerecorded on lubricated tape. Refer to paragraph 2.2.

### 3.3 CORRECTING LOOSE TAPE.

If the tape in the cartridge becomes so loose that it loops out of the drive capstan opening or is visibly loose on the reel, tighten it immediately as follows. Remove the top cover and wire guide. Unsplice the tape. Hold the reel to prevent its turning and pull tape from the outside of the reel until the slack has been reduced to normal. Then, turning the reel by hand, wind up all of the excess tape. Resplice the tape and reassemble the cartridge.

### 3.4 STORING TAPE CARTRIDGES.

Store the tape cartridges in their normal playing position when they are not being used. Avoid heat and strong magnetic fields during storage.



# 313T-1/3/4 Remote Control Switching Units



unit instructions

Cedar Rapids Division | Collins Radio Company, Cedar Rapids, Iowa

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Printed in U.S.A.

TD-529  
523-0755297-002418  
2nd Edition, 1 March 1964

## 1.1 PURPOSE OF EQUIPMENT.

Remote Control Switching Units 313T-1, 313T-3, and 313T-4 (see figure 1) furnish remote control of functions controlled by the START, STOP, and RECORD switches on Recorder/Playback Unit 642A-( ) and Recording Amplifier 216C-( ).

Unit 313T-1 can start and stop one 642A-1 and one 216C-2. Unit 313T-3 can start three 642A-2's. Unit 313T-4 can start and stop one 642A-2 and one 216C-2, and can start three other 642A-2's.

Figures 3, 4, and 5 are schematic diagrams of the units.

## 1.2 PHYSICAL DESCRIPTION.

Figures 2-9, 2-10, and 2-11 in the system instruction book, SP-178, give outline and mounting dimensions for Remote Control Switching Units 313T-1, 313T-3, and 313T-4 respectively. Figure 2 shows parts placement for the three units.

## 2.1 INSTALLATION PROCEDURES.

Refer to section II of the system instruction book, SP-178, for installation procedures.

## PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
REMOTE CONTROL SWITCHING UNIT 313T-1		522-2550-00
DS501	LAMP, INCANDESCENT: midget flange base, 28 v dc max; 0.40 amp; T-1-3/4 bulb; C-2F filament	262-1106-00
DS502	LAMP, INCANDESCENT: same as DS501	262-1106-00
DS503	LAMP, INCANDESCENT: same as DS501	262-1106-00
S501	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; orange lens	266-6071-00
S502	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; green lens	266-6069-00
S503	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; yellow lens	266-6070-00
TB501	TERMINAL BOARD: phenolic; barrier type w/ lug for back connection; 4 terminals	367-0012-00
TB502	TERMINAL BOARD: same as TB501	367-0012-00
REMOTE CONTROL SWITCHING UNIT 313T-3		522-2551-00
S601	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; green lens	266-6069-00
S602	SWITCH, PUSH: same as S601	266-6069-00
S603	SWITCH, PUSH: same as S601	266-6069-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
TB601	TERMINAL BOARD: phenolic; barrier type w/ lug for back connection; 4 terminals	367-0012-00
TB602	TERMINAL BOARD: same as TB601	367-0012-00
REMOTE CONTROL SWITCHING UNIT 313T-4		522-2552-00
DS701	LAMP, INCANDESCENT: midget flange base, 28 v dc max; 0.40 amp; T-1-3/4 bulb; C-2F filament	262-1106-00
DS702	LAMP, INCANDESCENT: same as DS701	262-1106-00
DS703	LAMP, INCANDESCENT: same as DS701	262-1106-00
S701	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; orange lens	266-6071-00
S702	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; green lens	266-6069-00
S703	SWITCH, PUSH: lighted pushbutton; spdt; momentary; 28 v dc, 0.5 amp resistive; yellow lens	266-6070-00
S704	SWITCH, PUSH: same as S702	266-6069-00
S705	SWITCH, PUSH: same as S702	266-6069-00
S706	SWITCH, PUSH: same as S702	266-6069-00
TB701	TERMINAL BOARD: phenolic; barrier type w/ lug for back connection; 4 terminals	367-0016-00
TB702	TERMINAL BOARD: same as TB701	367-0016-00

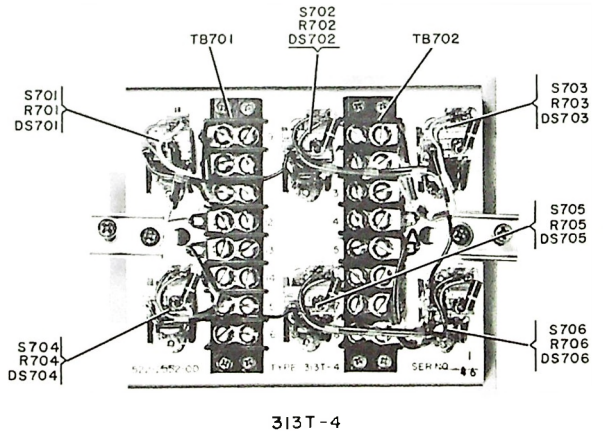
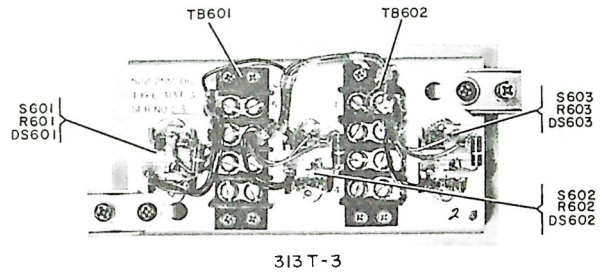
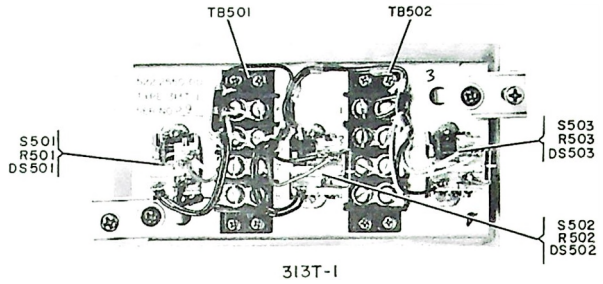
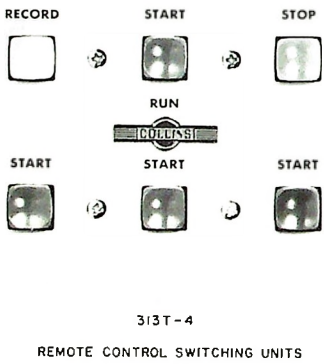
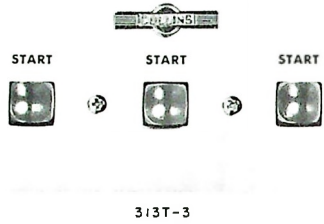
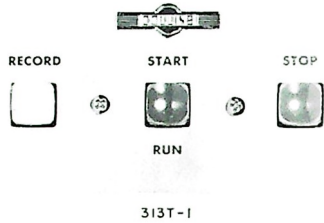


Figure 1. Remote Control Switching Units 313T-1/3/4 C754-40-P

Figure 2. Remote Control Switching Units 313T-1/3/4, Rear Views C754-41-P

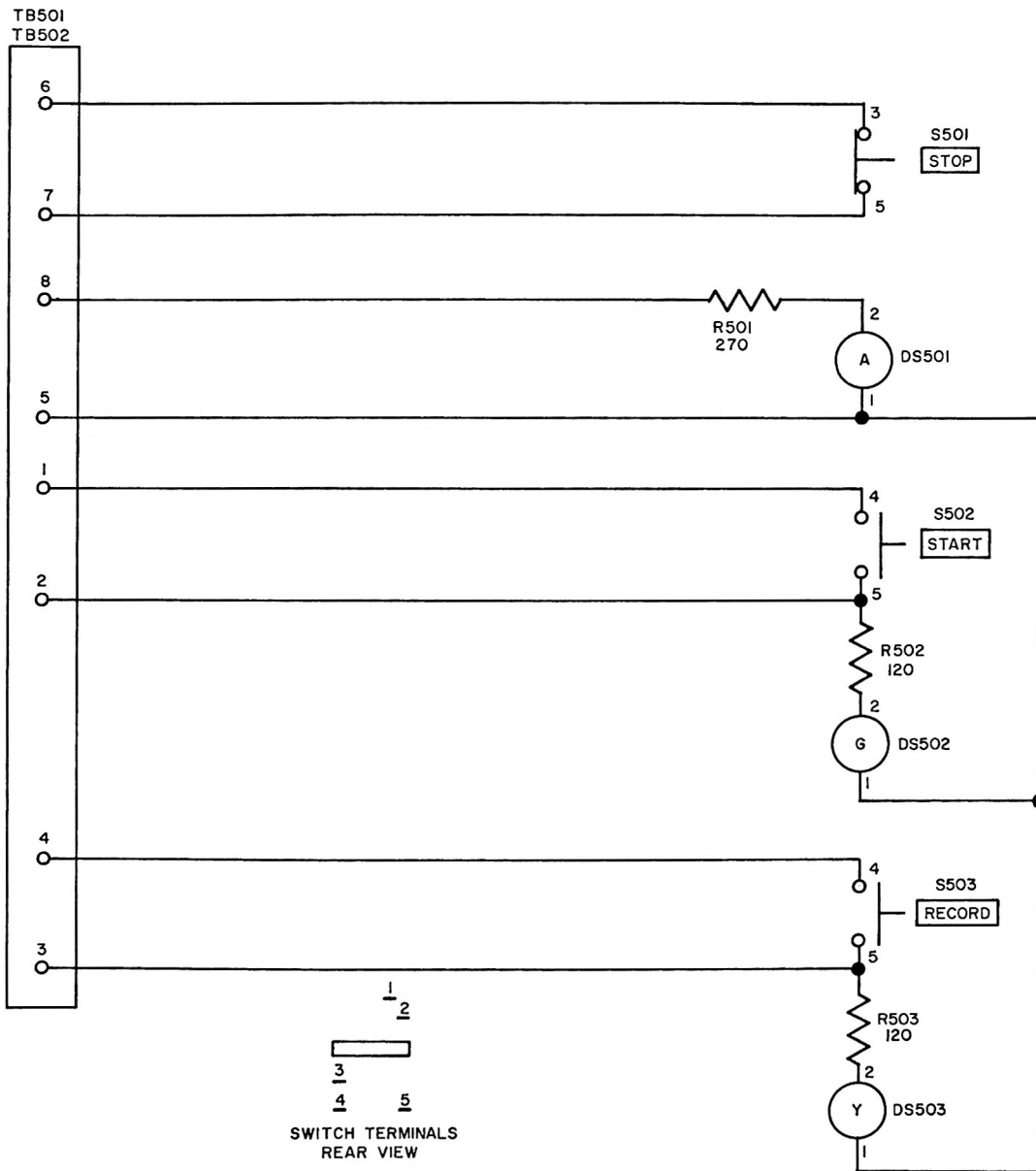


Figure 3. Remote Control Switching Unit 313T-1, Schematic Diagram

C754-43-3

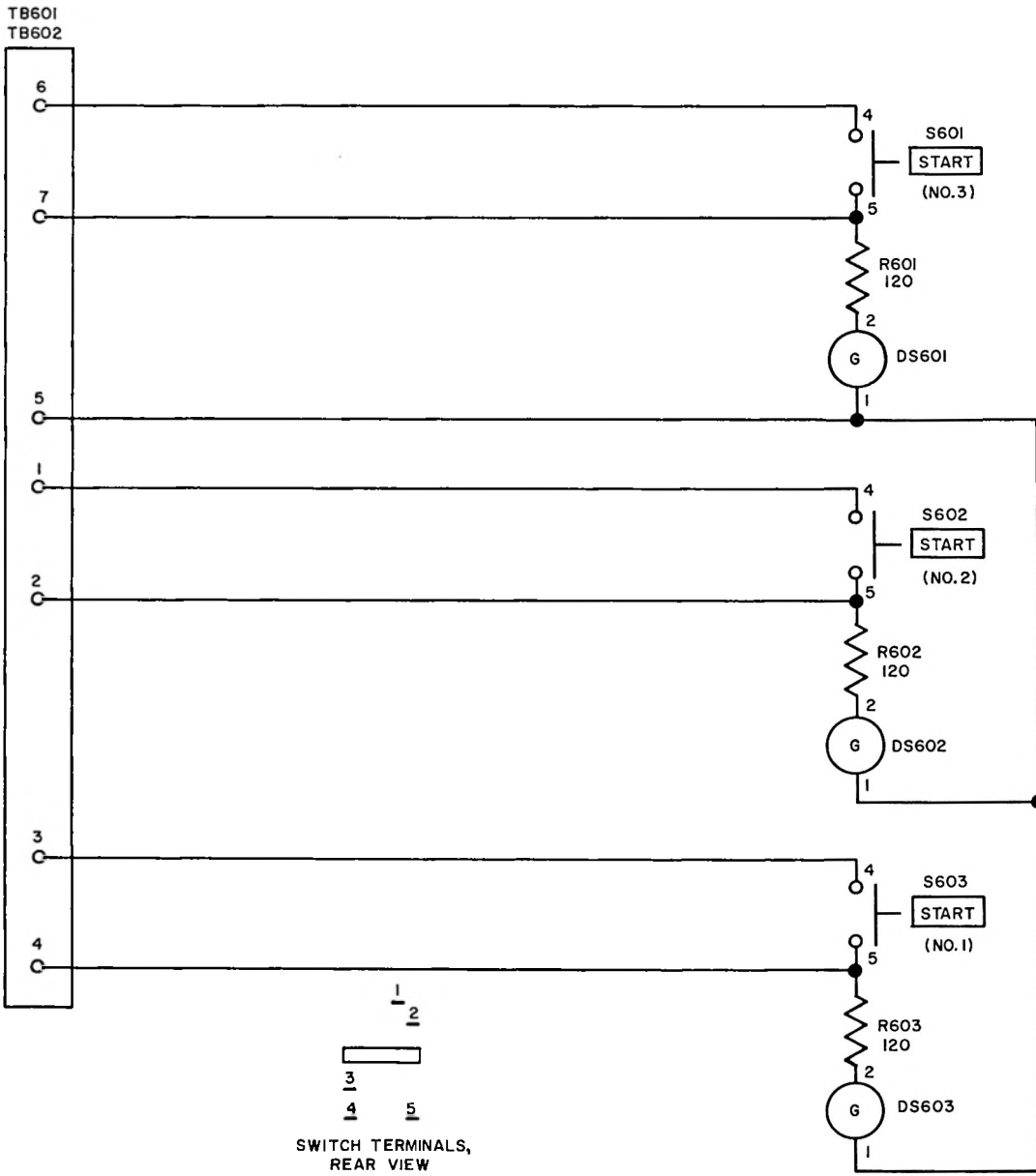


Figure 4. Remote Control Switching Unit 313T-3, Schematic Diagram

C754-42-3

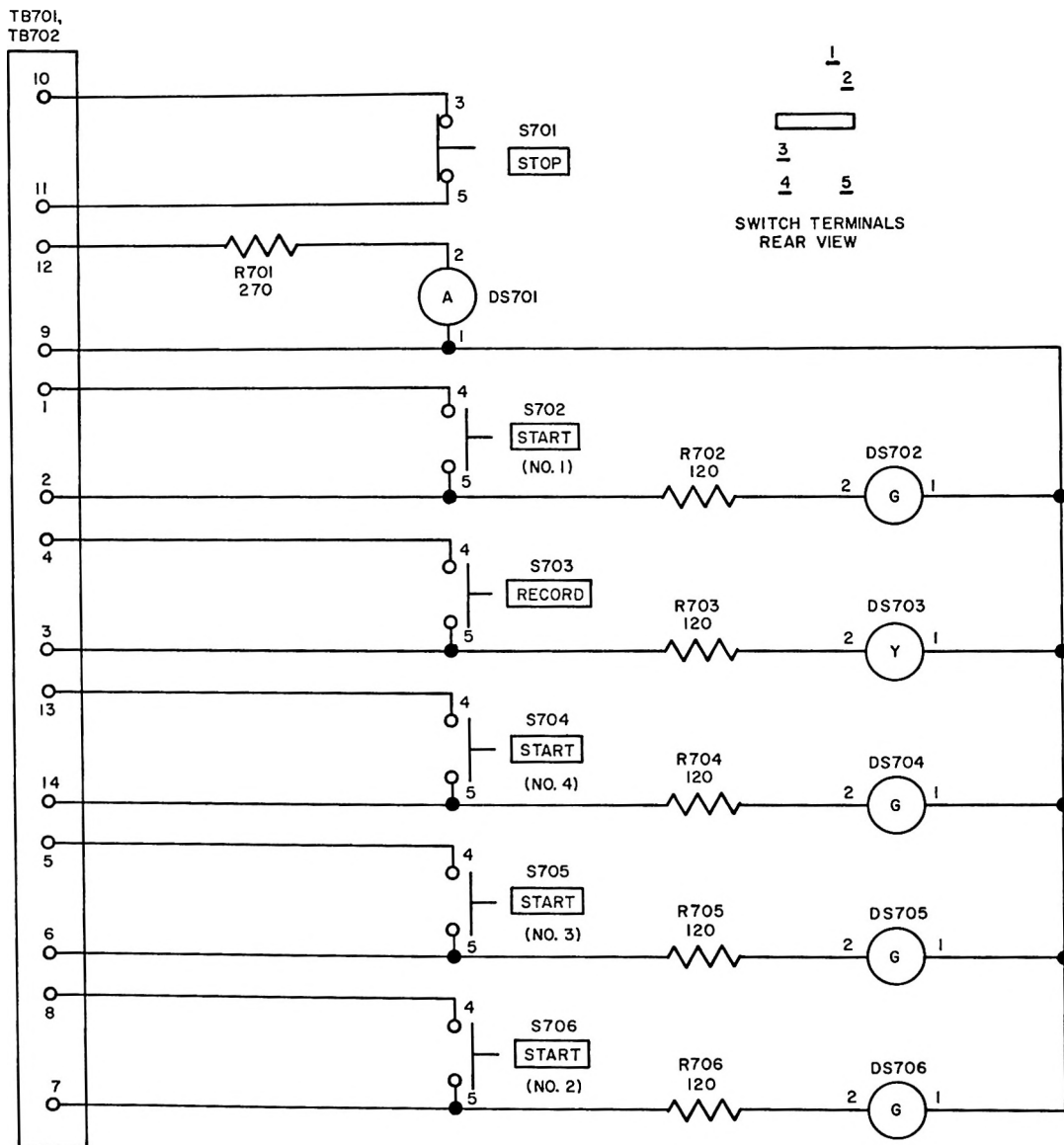


Figure 5. Remote Control Switching Unit 313T-4, Schematic Diagram

C754-44-3

SERVICE INFORMATION LETTER

EQUIPMENT TYPE: 216C-1 Recording Amplifier

MODULE AFFECTED: Cue Tone Oscillator

SUBJECT: Compatibility with 642A-2

The 216C-1 as wired is not compatible with the 642A-2. If it is desired to use the 216C-1 with the 642A-2, minor wiring changes are required. They are as follows:

1. Remove the shielded Cue Output from pins 7 of J402 and connect to pin 2 of J402.
2. Remove the lead of C432, 0.1 uf capacitor, from pin 4 of K401 and connect to pin 7 of J402.
3. Run a wire from the junction of R470-R460-C434 to pin 4 of K401.
4. Examine all changes for cold solder joints or shorts.
5. If the interconnect cable used between the 216C-1 and the 642A-2 does not have a wire between pin 2 of J101 on the 642A-2 and J402 of the 216A-1, install a wire.

TO USE A 216C-1 WITH A 642A-2, CHG. C106  
TO A 50 MFD/450 VOLT CAPACITOR. ADD A  
JUMPER BETWEEN J101-2 AND 11.



# SECTION VII ILLUSTRATIONS

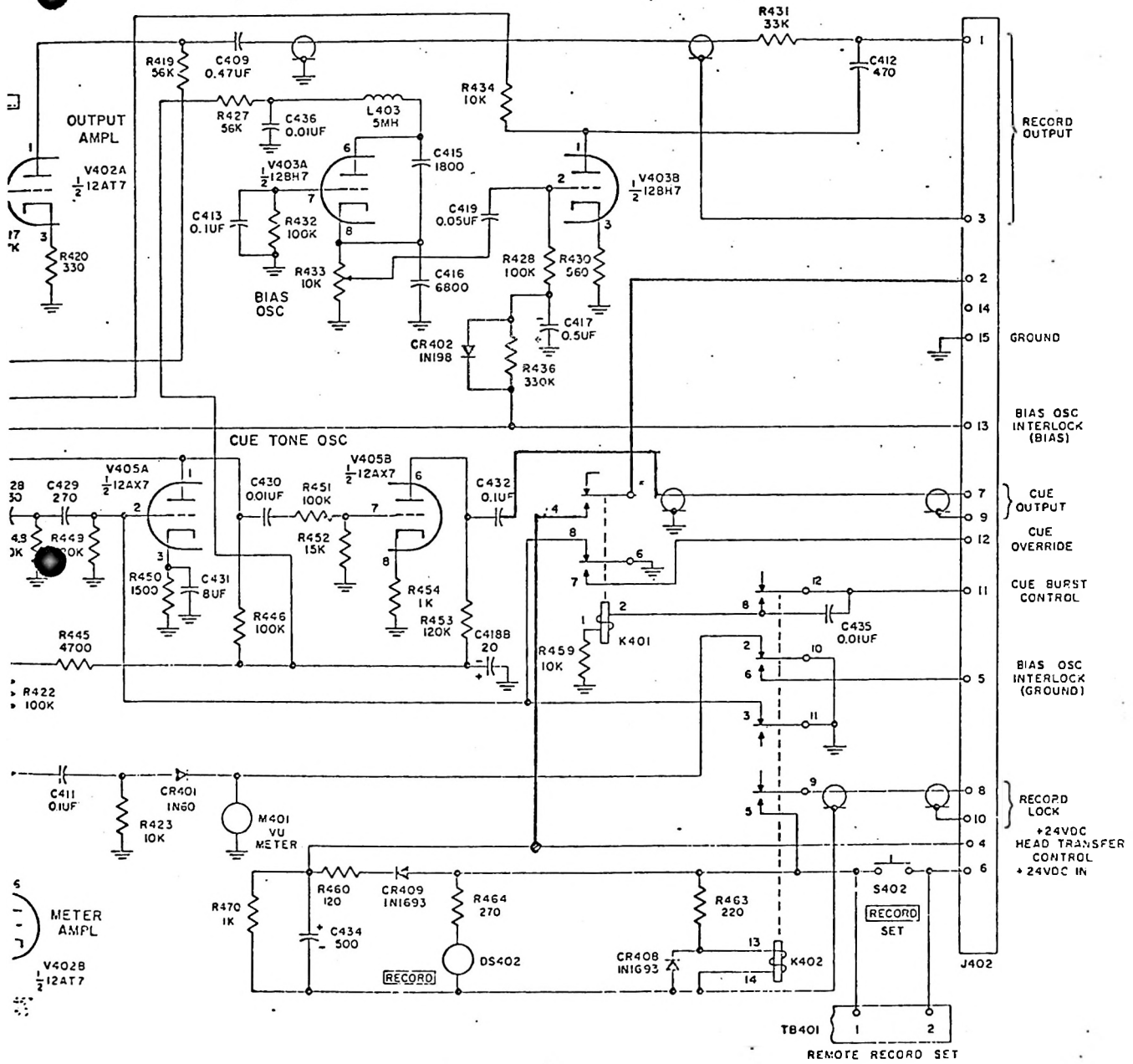


Figure 7-1. 210C-1 Recording Amplifier, Schematic Diagram

