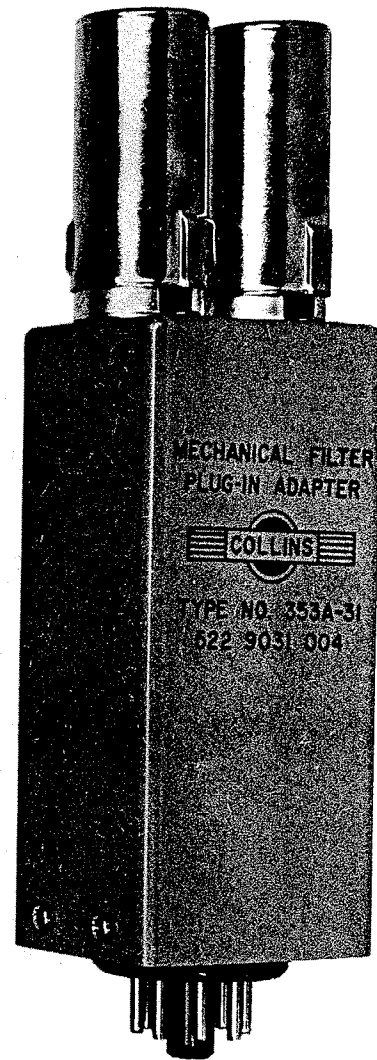




# MECHANICAL FILTER PLUG-IN ADAPTERS

353A-08, 353A-12  
353A-31, AND 353A-60

FOR USE WITH  
SP-400 AND HRO-60 RECEIVERS



# COLLINS RADIO COMPANY



INSTRUCTION BOOK  
FOR THE  
INSTALLATION OF COLLINS TYPE NO'S  
353A-08, 353A-12,  
353A-31, AND 353A-60  
MECHANICAL FILTER PLUG-IN ADAPTERS  
IN THE  
HAMMARLUND SP-400  
AND  
NATIONAL HRO-60 RECEIVERS

COLLINS RADIO COMPANY  
WESTERN DIVISION  
BURBANK, CALIFORNIA

520 6014 00  
Second edition  
15 June 1955

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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

- (a) Notice of the claimed defect is given Collins within one (1) year from date of delivery and goods are returned in accordance with Collins' instructions.
- (b) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.
- (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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The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

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Sales Service Department  
Cedar Rapids, Iowa

**INFORMATION NEEDED:**

- (A) Type number, name, and serial number of equipment
- (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 sub-assemblies involved in trouble
- (J) Remarks

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**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 sub-assembly number (where applicable)

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## SECTION I DESCRIPTION

The 353A Mechanical Filter Plug-In Adapter is a unit about the size of an i-f transformer and contains a Collins Mechanical Filter, two i-f amplifier tubes and accompanying circuitry, and an octal plug for inserting the unit into the first i-f amplifier tube socket in the National HRO-60 Receiver or the second i-f amplifier tube socket in the Hammarlund SP-400 Receiver. This adapter enables the Collins Mechanical Filter to be installed in either of these receivers with no modification of the receiver. At any time the adapter may be removed and the receiver returned to its original condition.

The adapter schematic is shown in Figure 1. The plug (P201) connects the adapter to the receiver i-f amplifier. The 6BA6 (V201) in the adapter replaces the tube removed from the receiver and drives a Mechanical Filter (FL201), which may be considered an electrical bandpass filter having a voltage step down of 3 to 1 (a more detailed description of the filter is given in Section IV).

The filter is followed by a 6AU6 (V202), which compensates for the loss in the filter and which is connected in the plate circuit of the tube the filter replaces. The gain of the adapter is approximately the same as that of the tube replaced, but the selectivity of the receiver corresponds to that of the Mechanical Filter. The 353A Adapter is available in any one of four bandwidths, 0.8 kc, 1.2 kc, 3.1 kc, and 6.0 kc; the four adapter types are referred to as the 353A-08, 353A-12, 353A-31, and 353A-60 Mechanical Filter Plug-In Adapters, respectively.

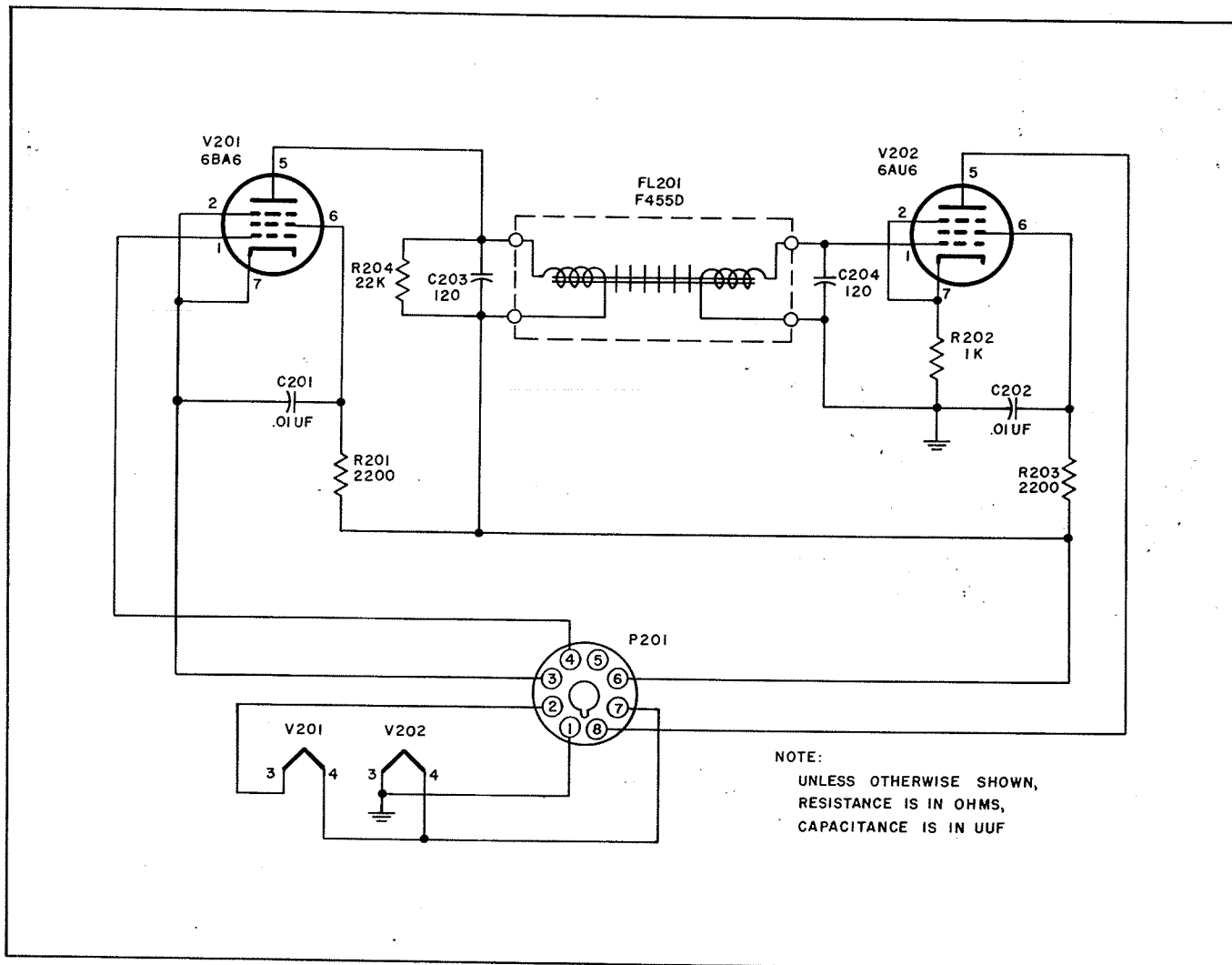


Figure 1. 353A Series Adapter Schematic

## SECTION II INSTALLATION

The installation procedure consists simply of replacing one receiver tube with the adapter unit. Refer to Figure 2 to locate the i-f amplifier tube to be replaced. Remove the tube and plug the adapter into the vacant tube socket.

When installing the unit in the HRO-60 receiver only, rotate the plug approximately 45 degrees to align the plug and socket correctly. This may best be done by plugging the adapter into an octal socket and rotating it by hand.

The lead capacity in the adapter may differ slightly from that of the tube removed; so, if necessary, repeak the i-f transformers on either side and reset the "S" meter. This is the same procedure that would be followed if any tube in the i-f strip were replaced. If necessary, carefully re-align the entire receiver as outlined in the receiver instruction book to be sure of obtaining best results from the Mechanical Filter adapter.

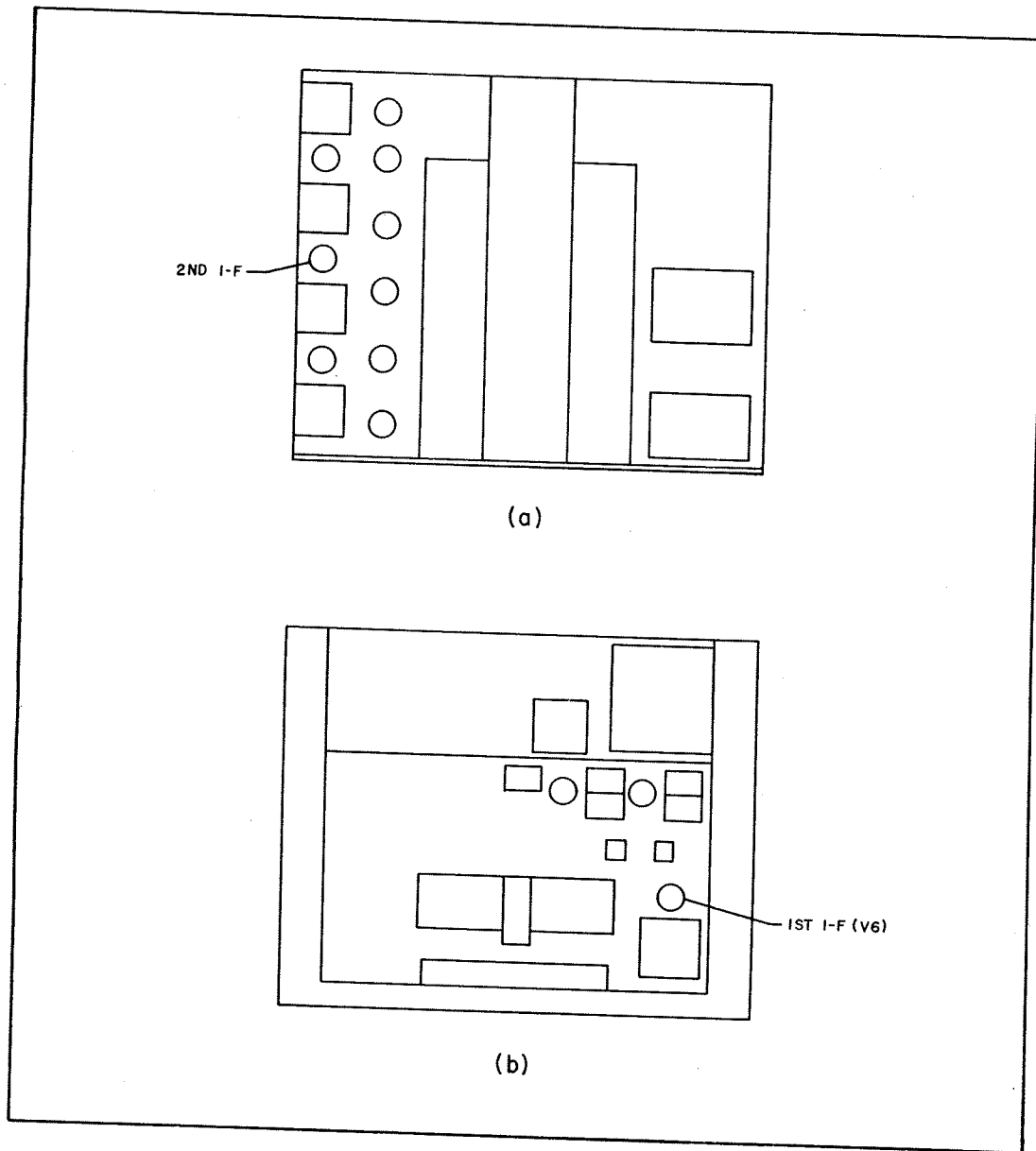


Figure 2. Top View of (a) SP-400, (b) HRO-60 Receivers

## SECTION III OPERATION

The operating controls will function as before, but for some types of reception a slightly different tuning technique should be employed to obtain best results with the improved selectivity. Tuning procedure and the unique advantages of the Mechanical Filter will be outlined for some common types of signals.

### A. CW

The 353A-08 Adapter should be used for c-w reception. Signals are tuned in the normal manner, but even without the crystal filter the receiver will have true single-signal response. Transmitter drift or chirp may become more noticeable because of the increased selectivity of the receiver. The crystal filter may be used in conjunction with the Mechanical Filter for certain interference problems.

### B. A-M Phone

The 353A-31 or 353A-60 Adapters should be used for phone reception. The receiver should be operated with the selectivity or bandwidth control in its widest position to utilize to the fullest the flat-topped selectivity characteristic of the Mechanical Filter. The 353A-31 is wide enough to pass only one sideband and the carrier of a phone signal. So, in tuning a signal, detune the receiver from the center of the signal until the "S" meter reading just begins to drop off. The receiver is then tuned to one sideband and the carrier. If the receiver is further detuned, the carrier will drop out of the pass band, and the sideband will remain as unintelligible "monkey chatter." When the receiver is so detuned it will sound very noisy, since the avc voltage will be reduced and the gain will be at maximum.

To eliminate interference on one sideband of the signal, tune to the other sideband. If the interference is present on both sidebands, or if the signal is undergoing selective fading, use the following method for local carrier reinsertion. Detune the signal in either direction to a point where the modulation just becomes unintelligible. Back off the r-f gain control, turn on the bfo, turn the avc off, and set the audio gain control near maximum. Slowly rotate the bfo knob until the modulation becomes readable. Use the r-f gain control to regulate volume, and leave the audio gain control near maximum.

The 353A-60 is wide enough to pass both sidebands of a communications quality signal; and the receiver may be tuned in the normal manner. For receiving wider bandwidth signals or for receiving under conditions of interference, use the same tuning technique as outlined above for the 353A-31.

### C. Single Sideband

The 353A-31 Adapter should be used for single-sideband suppressed-carrier reception. Set the selectivity control to its widest position, the audio gain control to near maximum, and the avc switch to off, and adjust the r-f gain control for comfortable volume. Tune in the station for maximum volume and turn the bfo on. Rotate the bfo knob until the modulation becomes intelligible. For subsequent operation leave the bfo in the same position and tune in the station as if it were transmitting a full carrier.

### D. FSK Teletype

The 353A-12 Adapter should be used for fsk teletype reception. The signal is tuned in by the normal procedure, but the position of the signal in the pass band of the receiver is much less critical than before.

## SECTION IV THEORY OF OPERATION

A photograph of the Mechanical Filter is shown in Figure 3; and in Figure 4 the frequency response curves are compared to those obtained by conventional means.

The Mechanical Filter achieves this unusual selectivity by a combination of electrical and mechanical elements. The filter is composed of three general sections: the input transducer, the resonant section, and the output transducer. The input and output sections of the filter are identical, and function to convert the electrical signal to a mechanical form and vice versa.

The input signal is impressed on a small coil which surrounds a nickel wire. By means of magnetostriction, the magnetic field variations are converted to mechanical vibrations.

One end of the nickel wire is welded to the first of a series of disks which comprise the resonant section of the filter. There are six of these resonant disks composed of a special alloy which has a very sharp resonance and excellent frequency stability. The vibrations of the nickel wire cause the end disk to vibrate, and these vibrations are coupled to the other disks by wires welded to their edges.

The output end of the filter is identical to the input end and is composed of a nickel wire and a coil. Here the magnetostriction action of the nickel wire converts the mechanical vibrations of the disk into a varying magnetic field. The coil intercepts this field and supplies the output voltage.

The entire unit is housed in a hermetically sealed case smaller than a normal i-f transformer.

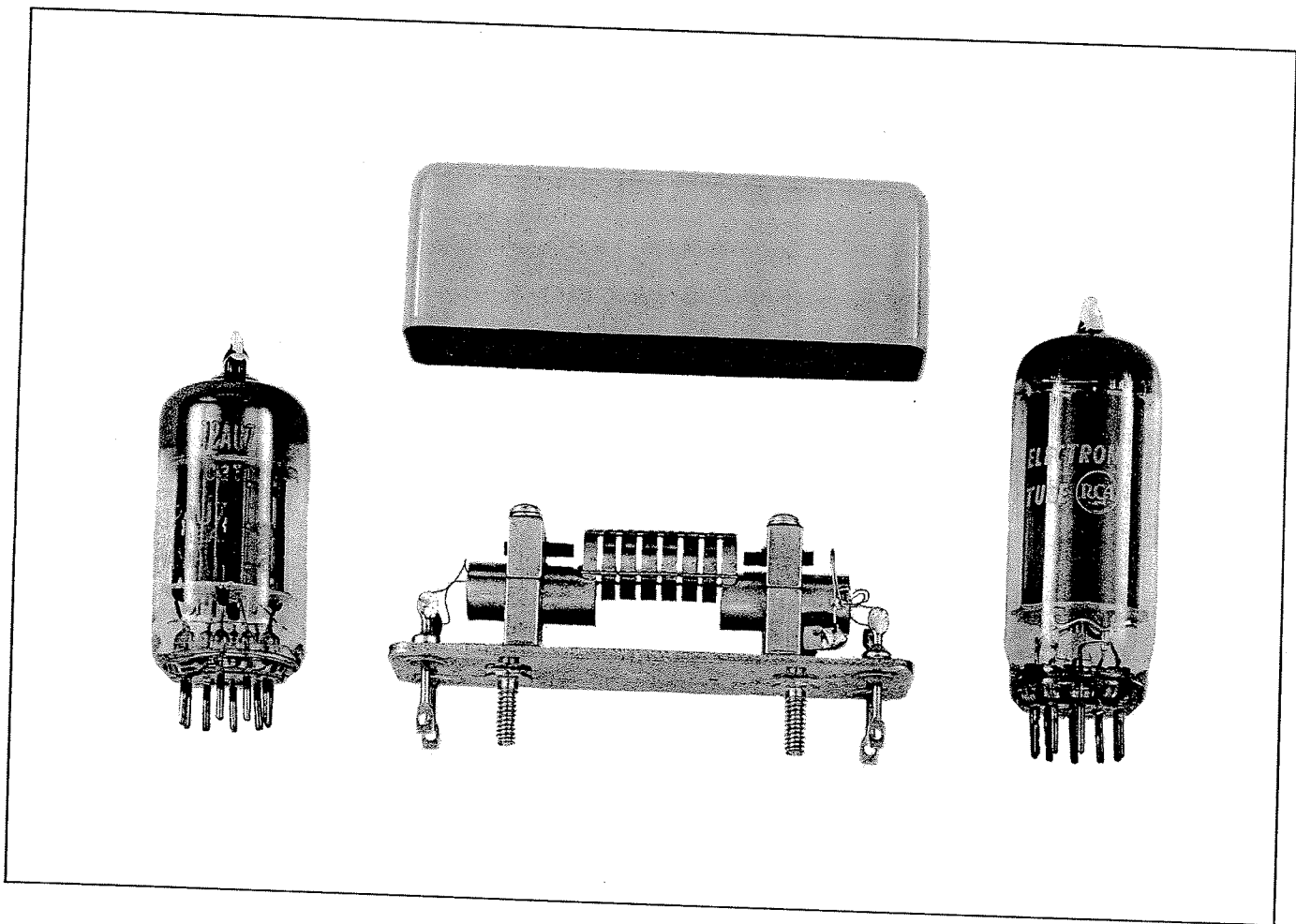
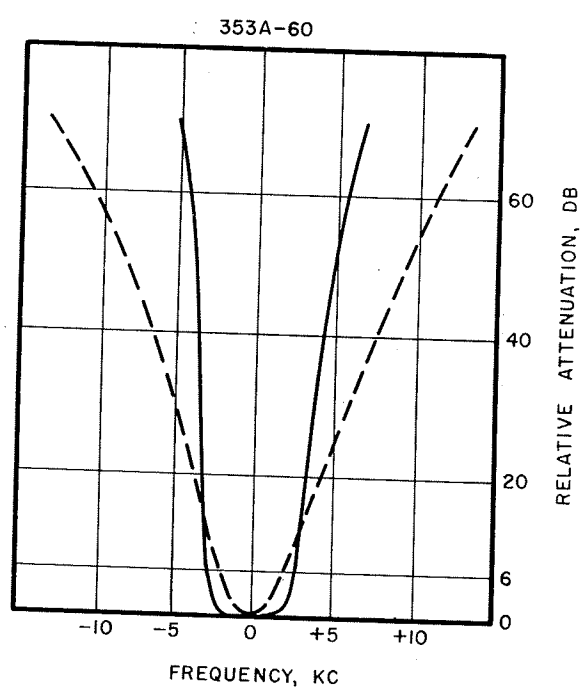
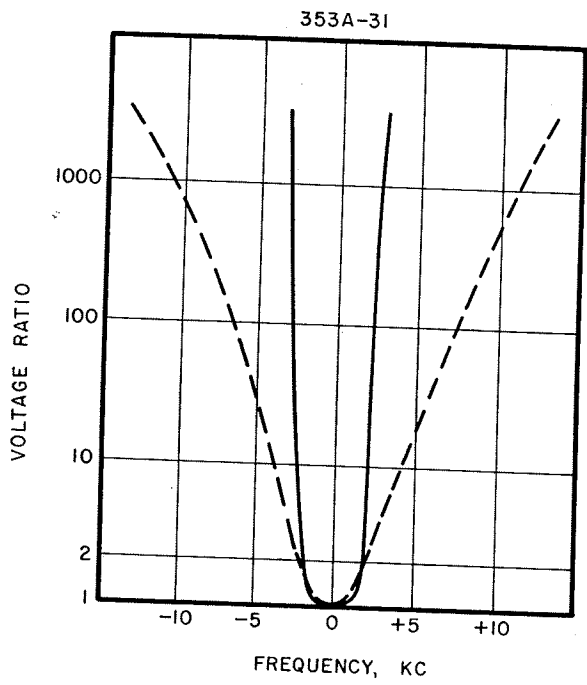
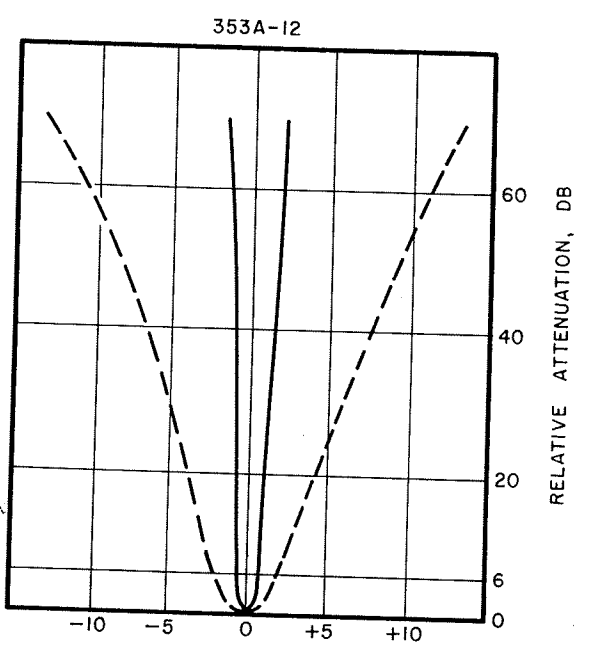
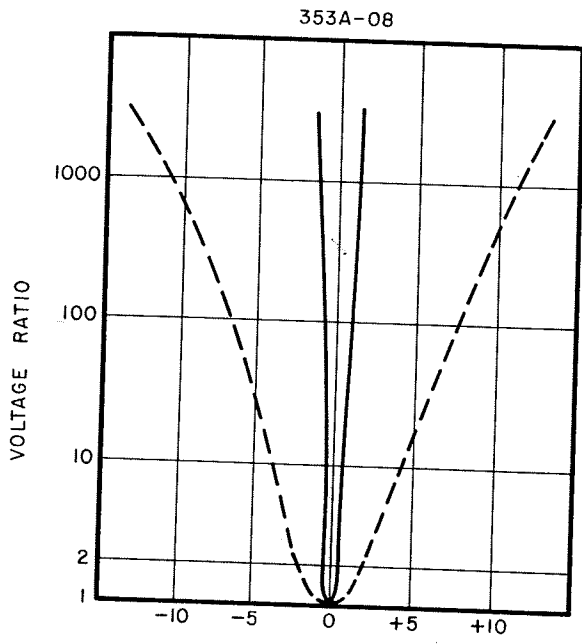


Figure 3. Mechanical Filter, Case Removed





-----NORMAL SP-400 RECEIVER (3 KC SELECTIVITY)  
 ————SP-400 RECEIVER WITH 353A ADAPTER

Figure 4. SP-400 Receiver Selectivity

## SECTION V MAINTENANCE

If a defect in the adapter is suspected, replace the unit with the tube normally used, and realign the receiver i. f. as mentioned in Part II. If the receiver then operates normally, the trouble is in the adapter.

The adapter voltage and resistance measurements in the following table will be an aid in locating most troubles which might occur. However, should obscure troubles arise, only a trained and competent communications receiver repairman should be allowed to service the receiver or adapter. The Mechanical Filter itself is a sealed unit just as a vacuum tube is, and no attempt should be made to open the case.

### Tube Socket Resistance and Voltage Measurements

Conditions: No signal, avc off, r-f gain maximum, 80-meter band, B+ on, noise limiter off; all measurements to ground with a Simpson Model 303 VTVM. Caution: Disconnect line cord before making resistance measurements.

At adapter tube pins with adapter plugged in:

Tube	Pin No.	SP-400		HRO-60	
		Resistance	Voltage	Resistance	Voltage
V201 (6BA6)	1	270K	-2.6	470K	0
	2	0	0	1000*	3.2*
	3	0	0	0	0
	4	-	6.3 ac	-	6.3 ac
	5	11K	120	47K**	65
	6	13K	115	49K**	65
	7	0	0	1000*	3.2*
V202 (6AU6)	1	45	0	45	0
	2	1000	2.0	1000	1.0
	3	0	0	0	0
	4	-	6.3 ac	-	6.3 ac
	5	18.5K	200	2200**	215
	6	13K	115	49K**	65
	7	1000	2.0	1000	1.0

Tube Socket Resistance and Voltage Measurements (cont'd)

At adapter base with adapter plugged in:

Pin No.	SP-400		HRO-60	
	Resistance	Voltage	Resistance	Voltage
1	0	0	0	0
2	0	0	0	0
3	0	0	1000*	3.2*
4	270K	-2.6	470K	0
5	0	0	1000*	3.2*
6	11K	120	47K**	65
7	-	6.3 ac	-	6.3 ac
8	18.5K	200	2200**	215

\*Resistance varies from 100 to 1000 ohms depending on receiver. Voltage will vary accordingly.

\*\* Measured to pin 2 of rectifier V17.

**SECTION VI  
PARTS LIST**

ITEM	CIRCUIT FUNCTION	DESCRIPTION	PART NUMBER
C201	V201 screen bypass	CAPACITOR, ceramic; 0.01 $\mu$ f, 600 wv	913-1188-00
C202	V202 screen bypass	Same as C201	
C203	Resonates FL201 input	CAPACITOR, mica; 120 $\mu$ f $\pm$ 5%, 500 wv	912-0500-00
C204	Resonates FL201 output	Same as C203	
FL201	Bandpass filter, 0.8 kc bandwidth	FILTER, mechanical; Type F455D-08	522-9054-002
	Bandpass filter, 1.2 kc bandwidth	FILTER, mechanical; Type F455D-12	522-9055-002
	Bandpass filter, 3.1 kc bandwidth	FILTER, mechanical; Type F455D-31	522-9056-002
	Bandpass filter, 6.0 kc bandwidth	FILTER, mechanical; Type F455D-60	522-9057-002
P201	Power and signal connector	PLUG, octal	369-1010-00
R201	V201 screen decoupling	RESISTOR, carbon; 2200 ohms $\pm$ 10%, 1/2 w	745-1100-00
R202	V202 cathode bias	RESISTOR, carbon; 1000 ohms $\pm$ 10%, 1/2 w	745-1086-00
R203	V202 screen decoupling	Same as R201	
R204	Loads FL201	RESISTOR, carbon; 22K $\pm$ 10%, 1/2 w	745-1142-00
V201	I-f amplifier	TUBE; type 6BA6	255-0185-00
V202	I-f amplifier	TUBE; type 6AU6	255-0202-00

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# **COLLINS RADIO COMPANY**

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