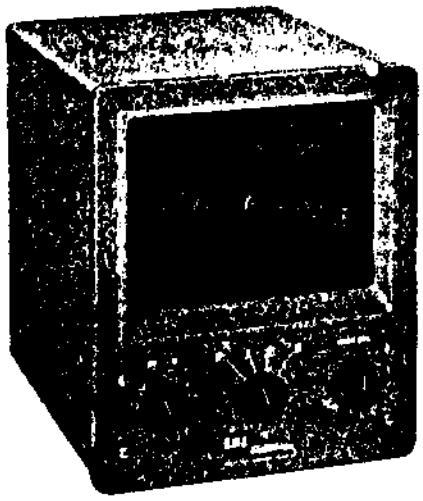
Electro-Voice

ELECTRO-VOICE, INC.
BUCHANAN, MICHIGAN

Instructions
RME Model 4301
Sideband Selector



The RME Model 4301 sideband selector has been developed to improve operation of receiving systems used in single sideband suppressed carrier (SSBSC) reception. A considerable improvement is possible in receiving system performance if certain circuitry is provided to make use of the inherent advantage of this type of operation. The Model 4301 adequately meets the requirements of equipment intended to make fullest use of SSBSC system advantages.

The Model 4301 sideband selector is designed for use with any receiver having an intermediate frequency of 455 KC. The unit is designed especially for use with the RME Model 4300 communications receiver and the interconnecting cables supplied with the unit can be inserted directly into the jacks provided for IF and audio circuit interconnection on the Model 4300. A built-in power supply furnishes the power required by the Model 4301.

The circuit provides instantaneous switching to either upper or lower sideband with approximately 40 db attenuation of the unwanted sideband. This improves the apparent overall system selectivity and signal-to-noise ratio, and also can be used to good advantage in AM and CW communication. AM phone interference can be reduced 50% by selecting the proper sideband.

Four vacuum tubes are used in the 4301 — a twin triode BFO and audio output tube, a twin diode balanced modulator, a twin triode phase shift coupling tube and a twin triode sideband combiner tube.

The BFO oscillator in the Model 4301 feeds into a phase splitter circuit in which two components of the BFO voltage are shifted 90 degrees with respect to each other. These two voltages are then impressed on the balanced modulator where they are modulated by the sideband voltage supplied by the receiver IF amplifier. This modulation produces the audio difference frequencies containing the signal information which are passed through RC filters to the audio phase shift system where a phase shift of each of the two components from the modulator is produced in such a manner that the two shifts in phase have a constant difference of 90 degrees over the major portion of the speech band of frequencies.

This portion of the circuit produces two sets of sideband audio components whose reference phases are shifted 90 degrees with respect to each other in addition to original phase displacement which they possessed due to the RF quadrature circuit. Because the quadrature circuit produces the lag or lead of one audio component with respect to the other, depending upon whether it is introduced to the modulator as an upper or lower sideband, the result after passing through the audio phase shift network is the selecting, by algebraic addition of the components, of either the upper or lower sideband information. This adding operation is done in the adder tube, a 12AT7, through which the phase shift network is fed to the audio output circuit, making possible a selection of either sideband signal information while excluding signals in the unwanted sideband frequency area by approximately 40 db.

Normal receiver operation is possible by setting the sideband selector switch to the AM position. This connects the audio circuits together, bypassing the sideband selector, and turns off the BFO.

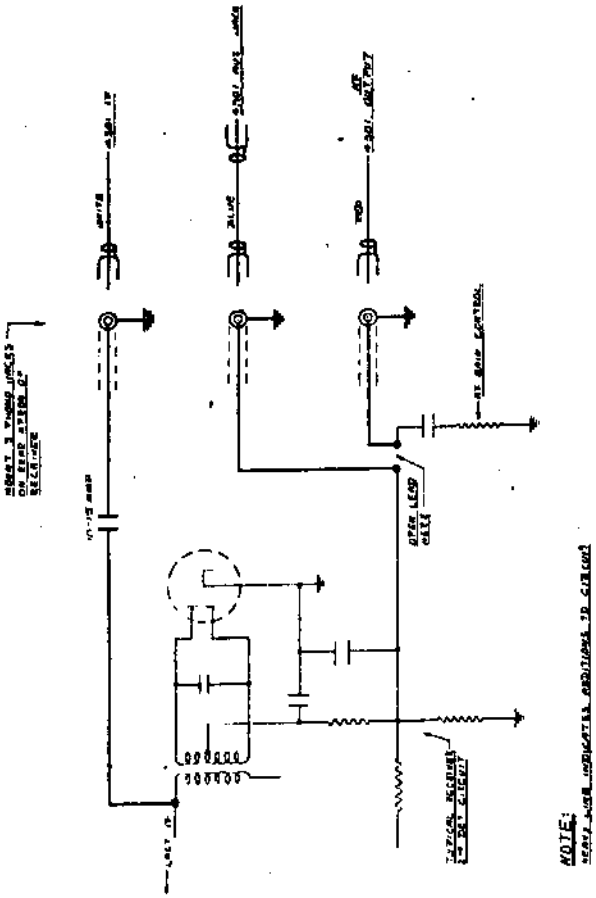


Fig. 1 — Receiver Circuit Modification
(for receivers other than RME 4300)

SPECIFICATIONS

Tubes:	3-12AT7 1-6AL5
Power Supply:	Self contained; uses transformer and selenium rectifier
IF Connection:	Shielded lead at rear and terminated with white phono plug
AF Connection:	Shielded lead at rear and terminated with red phono plug
Size:	8½ in. wide x 10 in. deep x 10 in. high
Weight:	16 lb shipping

PIN	V1 12AT7	V2 6AL5	V3 12AT7	V4 12AT7
1	230	0	230	230
2	0	—0.75	4**	5†
3	10	0	6.5	10
4	6.3 AC	6.3 AC	6.3 AC	6.3 AC
5	6.3 AC	0	6.3 AC	6.3 AC
6	230	0	230	230
7	-2*	—0.75	4**	5†
8	0	—	6.5	10
9	0	—	0	0

Voltages measured with 20,000 ohms-per-volt meter to chassis, no input signal.

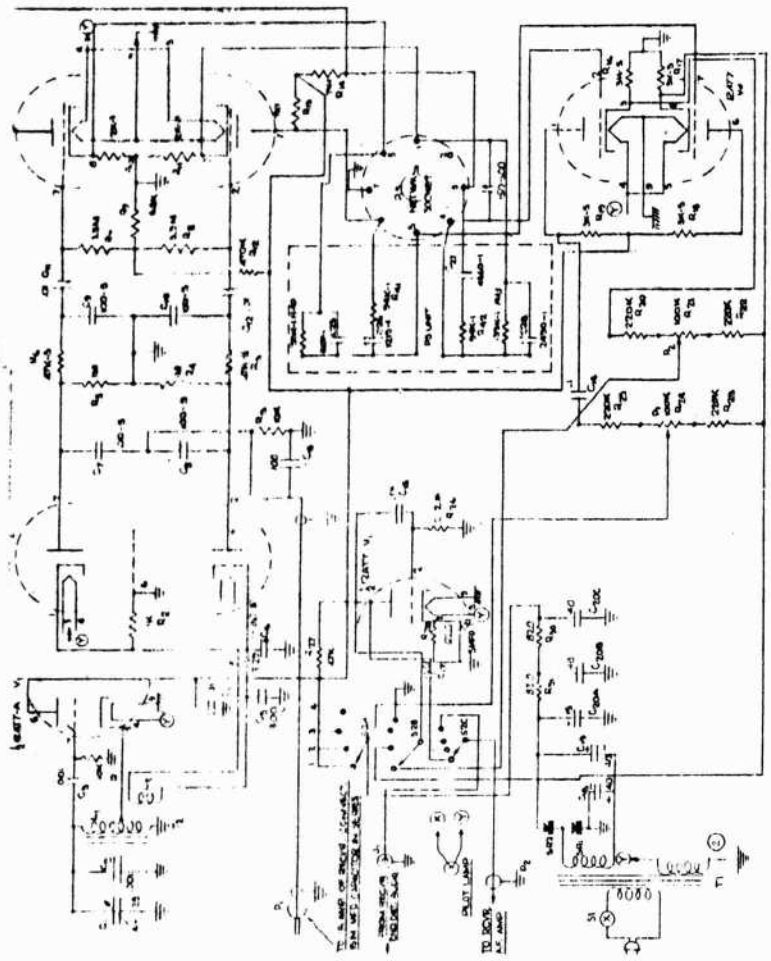
Note: Line voltage—117V AC

*Use isolating resistor of approx. 47K between point being measured and meter lead—for accurate measurement, do not touch meter lead ahead of this resistor. The point to be measured is at R.F. potential.

**Check only with vacuum-tube voltmeter having a resistance of 10 megohms. Ordinary meters will so load the circuit as to give incorrect measurements.

†Measure with meter on 50-volt scale or higher, or use meter with actual resistance of 1 megohm.

Fig. 2—Voltage Chart



Schematic Diagram

INSTRUCTIONS FOR SET-UP AND OPERATION

Immediately upon unpacking the unit, carefully inspect it for physical damage. If damage is evidenced, notify the dealer from whom the unit was purchased or the transportation company if the unit was shipped to you. Responsibility for shipping lies with the carrier and claim should be made for recovery.

INSTALLATION — Make certain that all tubes are firmly seated in the proper sockets as marked. The 4301 is connected to the Model 4300 receiver by two shielded cables, terminated with phono plugs, color coded red and white to match the color coded jacks on the rear apron of the receiver.

INSTALLATION WITH OTHER RECEIVERS—The 4301 is made to operate by supplying an IF voltage from the associated receiver to its input circuit and then connecting its output circuit into the audio amplifier of the receiver. The 4301, with a built-in power supply, need not be connected to the receiver power supply. The IF of the receiver must be in the range of 450 to 500 KC.

The IF input of the 4301 is connected through a 15 mmfd capacitor to the plate of the last IF amplifier tube of the receiver. The AF output of the 4301 (red connector) is connected to the receiver audio gain control after this control is disconnected from the receiver detector circuit as shown in Figure 1. The detector output circuit lead which formerly was connected to the AF gain control is connected to the 4301 by means of an auxiliary coaxial cable with phono type plugs. This cable is plugged into the 4301 thru an auxiliary jack provided for the purpose. It is not necessary to use the auxiliary cable when the 4301 is used with the RME 4300 receiver. With the 4301 function switch set to the AM position, the receiver will operate in a normal manner.

OPERATION — Three knobs are located on the front panel. One knob is the ON-OFF switch, the second knob controls sideband one, double sideband, sideband two, and normal receiver operation (AM), and the third knob controls the beat-frequency oscillator.

Connect the AC cord to a suitable 117 V, 60 cycle outlet. Turn the line switch of the 4301 to ON, turn on the receiver, and allow both units to warm up for several minutes. Set the receiver to the desired band and the receiver function switch to SSB/MGC. Now, set the Model 4301 function switch to D (standard BFO) or double sideband position. Adjust the BFO control on the 4301 to the IF of the system (minimum high-frequency hiss usually with knob indication straight up.) Tune in phone signals on the receiver using the least RF gain that will produce satisfactory audio output with audio level control set approximately 50% and 75% maximum. Overloading due to higher than required RF gain control setting will cause distortion and reduced performance.

It may be necessary to touch up slightly the alignment of L_1 because of variation in the 455KC IF of the receiver. To check for correct adjustment set the 4301 BFO adjustment knob so the pointer is straight up and set your function control to AM. Tune in a signal on the receiver. In case of the RME 4300 accurately tune in a signal with the function control set to PHONE and peak tuning with the S meter. Now set the function control to SSBAGC and the control on the 4301 from AM to D. If the alignment is correct the signal should be zero beat or close to it. If the 4301 is considerably off zero beat remove the plug button on top of the 4301 cabinet and slightly adjust the slug screw with a screw driver until the signal is zero beat. When receiving single sideband signals, no varying beat or whistle occur and the receiver should be tuned for a natural sound of the voice modulating the incoming signal. With the receiver so adjusted, and a single sideband signal, the 4301 function switch may be rotated to either SB1 or SB2 to ascertain which sideband is being used. If the switch is set for the sideband being transmitted, the voice quality being received will remain unchanged. If the other sideband position is selected, nothing will be heard, except possibly a low-level hash, depending upon the amount of suppression of the unwanted sideband effected by transmitter.

AM carrier-type phone transmission can be received with the 4301 in the circuit by zero beating the carrier with the receiver tuning and then selecting either sideband to reduce QRM. Selection of the proper sideband will reduce QRM by 50%. Selective fading is eliminated almost completely in this type of operation because the system provides exalted carrier reception, and any fading of the incoming carrier even to zero amplitude is of little consequence for the inserted carrier of the sideband selector usually will be adequate to prevent any resultant distortion.

For small zeroing adjustments, up to 10 cycles or so, of the incoming carrier, the panel control of the BFO or inserted carrier frequency in the 4301 can be used with vernier results. In any operation this control should not be adjusted for more than 100 cycles of total adjustment. Beyond this amount, the BFO control should be returned to center IF frequency and the zeroing adjustment should be made with the receiver tuning control. Because receiver overload will dilute the characteristics of the sideband selector, the RF gain control must be adjusted carefully to the least gain setting to provide good performance.

Normal receiver operation is restored by turning the 4300 function switch to the operation desired and the sideband selector switch to AM. The combination RME 4301 sideband selector and 4300 receiver can be used effectively with automatic gain control by switching the receiver function switch to SSB-AGC. This is advantageous when a number of stations, with considerable differences in signal strength, are being received in roundtable QSO. AGC will permit even the weakest to be heard while preventing the strong stations from overdriving the RF and audio circuits of the receiver.

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Part No. 53454

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