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TECHNICAL NEWS BULLETIN

SUBJECT: Two-Way Loudspeaker Communications Using A Leased 600 Ohm Line

We are all familiar with the standard practice of communicating over a leased line by the use of a telephone instrument at each end. In specialized cases, a VOX or voice activated unit is substituted for the instrument at one end to obtain a hands-free talk-back arrangement using a loudspeaker as the listen/talk device. But, how do you communicate over this line at loudspeaker level at each end? The problem is common. Police or fire dispatchers, aircraft control, and security personnel all monitor a number of speakers at the same time and cannot limit their attention to a telephone handset in time of crisis. A VOX system will not work because of the sound from other speakers. Manual operation is required using a microphone and loudspeaker to talk and listen.

Bilateral communication using microphones and loudspeakers can be accomplished over a common 600 ohm leased line by borrowing a little technology from telephone theory. All standard telephone instruments incorporate a balancing network which cancels out the microphone signal heard in the headphone. This is referred to as the anti-sidetone circuit. (Sidetone is the amplification of your own voice heard in the earphone.) the use of such a circuit with a microphone and loudspeaker arrangement prevents the acoustic feedback normally caused by the proximity between the two devices. This balancing network is basically a bridge which cancels out the microphone voltage heard in the headphone by the use of a balancing transformer as the input to the headphone. The microphone voltage appears across the primary of this transformer as two equal and opposing signals. In one direction the signal goes out to the line; in the opposite direction the signal goes to a load which matches the impedance of the line. When these two impedances match, there is a cancellation of the microphone signal heard in the headphone. Since the line impedance characteristics varies with distance, there is never a perfect match for complete cancellation, but a separation of 20 to 30 db can be obtained under average conditions. The required matching impedance may vary from 600 to 900 ohms. An optimum value of 820 ohms is standard practice.

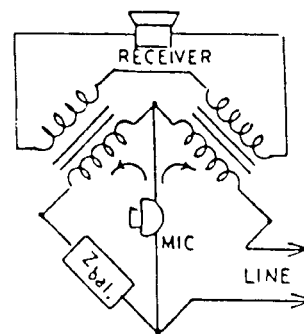


FIGURE 1. Basic bridge provides anti-sidetone circuit.

By using the primary windings of the Raymer Model TM-2 telephone matching transformer in a bridge configuration of this type, the output windings may be used as the input to an amplifier for loudspeaker operation in place of the headphone. The Raymer Model 701 may be used to drive a one watt monitor speaker, or other Raymer amplifiers up to 100 watts may be used for larger speaker systems. For the microphone input, a small microphone amplifier with 0db 600 ohm output may be used in place of a carbon microphone. (There is no "Talk Battery" on leased line to provide voltage to operate a carbon microphone. The Raymer Model 703 one watt microphone amplifier is ideal for this application since it includes a transformer isolated 600 ohm output and can accept either a low impedance balanced or high impedance unbalanced microphone input. A typical station is shown in figure 2. By connecting two such stations together over a leased 600 ohm line, bilateral two-way loudspeaker communication is possible. Both stations must be connected to obtain maximum separation between the microphone and speaker circuits at each end. If the line is disconnected there will most likely be a loud howl caused by the acoustic feedback between the microphone and speaker because the circuit is no longer balanced. To avoid feedback because of acoustic coupling within the loop, the microphone and speaker at each station should not face each other.

CAUTION: These circuits are for leased line operation only. Do not connect to the national telecommunications network. Such connection requires FCC registered equipment only.

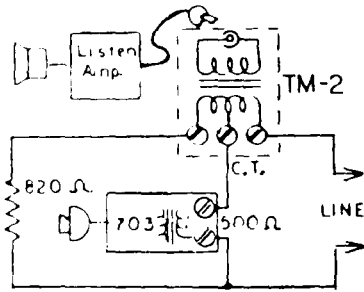


FIGURE 2. Typical connection using Raymer Model TM-2.

In cases where there is noise on the line, a Raymer Model ACR-1 Audio Controlled Relay may be used in place of the Model TM-2 to squelch the loudspeaker signal when the system is not in use. The input of the

Model ACR-1 is identical to that of the TM-2, allowing a retrofit modification in case of noise. Note: do not short the AUX output of the Model ACR-1 to obtain muting, as this will stop the unit from working.

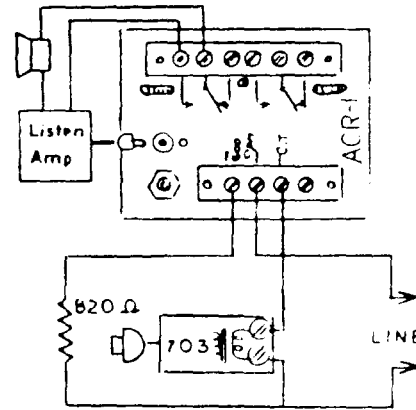


FIGURE 3. Model ACR-1 provides squelch on noisy lines.

MODEL 703 AMPLIFIER

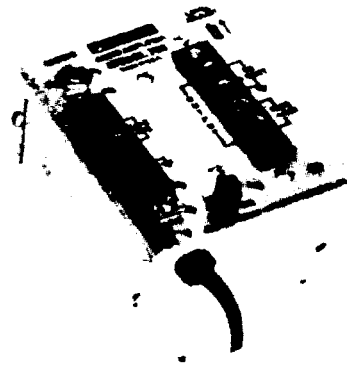
DESCRIPTION

The Raymer Model 703 is a one watt solid state audio amplifier with built in power supply housed in a sturdy flanged metal box measuring only 5" x 3½" x 2½". All connections and adjustments are made on the front of the unit. Two controls are provided: a thumbwheel adjustment to set the output level and a power switch to turn the unit on and off. Input provisions are provided for either Low Impedance or High Impedance microphone inputs. The Low Impedance input connections are made by means of screw terminals. This input will match balanced microphones in the 150 to 250 ohm range and has an input sensitivity of 0.5 millivolts to obtain a one watt output. The High Impedance input connection is made by means of a ¼" phone jack. This input will match unbalanced dynamic microphones and has an input sensitivity of 5 millivolts to obtain a one watt output.

Two outputs are provided: the 8 ohm output permits direct connection to a speaker voice coil, and the 500 ohm output may be used to drive a balanced line at a +4dbm (1.23V.) level.

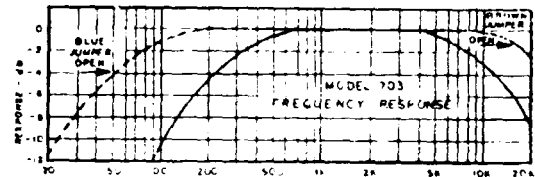
The Model 703 incorporates both a high pass and a low pass filter to contour the frequency response of the unit for maximum speech intelligibility. As supplied, the frequency response is -2db at 350Hz and 7.5KHz. Jumper wires are provided on the circuit board which may be cut to exclude these filters.

Manufactured in the USA



SPECIFICATIONS

Power Output: 1 Watt RMS @ 8 ohms; 3 MW RMS @ 500 ohms. **Outputs:** 8 ohms unbalanced (4 and 16 ohm loads with slight reduction in output); 500 ohms balanced + 4dbm (1.23V). **Distortion:** Less than 0.3% THD. **Frequency Response:**



Input: One microphone low impedance balanced or high impedance unbalanced. **Sensitivity:** 0.5 millivolts Lo-Z or 5 millivolts Hi-Z.

Hum and Noise: -65db (below rated output). **Semiconductors:** 2 integrated circuit, 2 silicon diodes, 1 light emitting diode. **Power Consumption:** 5 Watts, 120 Volts AC, 60Hz. **Size:** 5¼" x 3½" x 2½". **Shipping Weight:** 2 lbs.