Radio Frequency Interference

REDUCTION OF RADIO INTERFERENCE ON WIRED INTERCOM SYSTEMS

Intercom equipment usually has a single purpose, that of transmitting a message clearly from one point to another. Any interruption or interference with the message defeats this purpose. One of the most common and annoying types of interference is the undesired detection of radio signals. This problem is becoming more and more frequent due to the increased use of electrical and radio equipment.

THE NATURE OF THE PROBLEM

Interference from electrical devices may be caused by appliances, light switches and dimmers, thermostats, motors, x-ray equipment, etc. The source of the interference, in this case, is most often in the same building. The interference takes the form of clicks, pops, humming and buzzing sounds and disappears when the offending device is turned off.

Interference from radio transmissions may be from radio or TV stations, amateur radio equipment, CB equipment, radio paging systems, marine or radio aircraft, etc. The undesired reception of such signals is usually due to rectification in the amplification circuits of the intercom. The interference is usually from a local source, and may be picked up by the intercom speaker wiring, by the amplifier directly, or even by the building's electrical wiring.

This type of interference is not exclusive to properly-operating and correctly-used radio equipment, and its presence is not necessarily an indication of quality. Due to the wide frequency and power range of radio equipment, even interference suppression components are sometimes ineffective.

WHAT CAN BE DONE

The following suggestions deal directly with TekTone® intercoms. The suggested remedies that follow are divided into three sections: grounding, determining the point of input, and equipment modification.

Grounding: The metal case of TekTone® intercom amplifiers so equipped should always be grounded. Large metal panels or housings that are a part of an intercom should also be grounded. Grounding may be made to the electrical wiring conduit or to any other suitable electrical ground. Local electrical codes should be observed.

Grounding of the intercom circuit common (which is not always connected to the metal case) may or may not reduce the interference. A partial list of TekTone® intercoms and amplifiers indicating the common terminal is found in Fig. 1. The terminal should be grounded, or, if previously grounded, the ground should be removed and the effect observed.

CAUTION: If some other terminal is already grounded (whether intentionally or not), grounding the common terminal may cause the system to stop operating or be damaged.

Model No.	Common Terminal	Model No.	Common Terminal
EK704	A	PK205	G
PK103B	G	PK704	G
PK104B	G	SM103A	1
PK543	G	SM201	2

Fig. 1

Model No.	Terminals to be Connected by 47-ohm resistor
PK103B	1 and 5
PK104B	1 and 2
PK205	C and D
PK543(3 wire)	1 and 5
PK543(4 or 5wire)	1 and 2

Fig. 2

Determining Point of Input: To determine the point of signal input to the amplifier and to stop the signal at that point, if possible, the following trouble-shooting program may be used:

1. To determine if the interference is being picked up by the remote station wiring, disconnect the remote station wires at the amplifier and observe the result. NOTE: On some models, the system will not operate without the remote station connected. These models must be activated by connecting a 47-ohm 1/2 watt resistor from one terminal to another during the test. Terminals that must be connected are listed in Fig. 2. If this test eliminates or reduces interference, the remote station wires should be reconnected and the remote station terminals on the amplifier bypassed to the common terminal with a capacitor. The capacitor leads should be kept as short as possible without touching other terminals. Suitable capacitor values are from .01 to .1 uF. Ceramic capacitors are preferred and should be rated at 50 volts or more. Bypassing all remote station terminals may not be necessary, since the offending signal may be entering the amplifier on one wire only. In cases of severe interference, a choke in series with the offending input (in addition to the capacitor) may be needed. Suitable choke values are from 1 to 10 uH (see Fig. 5).

2. To determine if the interference is being picked up by the master station speaker wiring (or vestibule speaker wiring), disconnect the master station (or vestibule) speaker wires at the amplifier and listen for the interfering signal at the remote station while operating the necessary controls to switch the conversation in that direction. If the wiring to the master speaker is very short, or if the master speaker is permanently connected, this test may not be necessary. If this test eliminates or reduces interference, the speaker wires should be reconnected and the speaker terminals on the amplifier bypassed to

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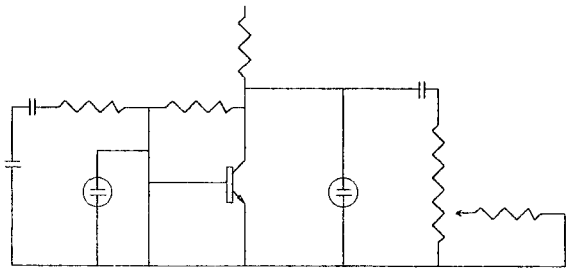
the common terminal with a capacitor. The capacitor leads should be kept as short as possible without touching other terminals. Suitable capacitor values are from .01 to .1 uF. Ceramic capacitors are preferred and should be rated at 50 volts or more. In cases of severe interference, a choke in series with the offending input (in addition to the capacitor) may be needed. Suitable choke values are from 1 to 10 uH. See Fig. 5.

3. To determine if the interference is being picked up by the power transformer or electrical wiring, first loosen the screws connecting the power transformer wiring at the amplifier. Then, while listening to the interference, remove both transformer wires from the amplifier simultaneously. If the interference fades away gradually, it is not being picked up by the power wiring. If the interference stops instantly, the transformer wiring should be reconnected and the transformer terminals bypassed to the common terminal by capacitor. The capacitor leads should be kept as short as possible without touching other terminals. Suitable capacitor values are from .01 to .047 uF. Ceramic capacitors are preferred and should be rated for 100 volts or more. Bypassing both transformer terminals may not be necessary. In cases of severe interference, a commercially-available RFI filter may be needed.

If the interference is very severe, the above suggestions may not solve the problem, or may only reduce the interference. In this case perhaps the the interfering signal is getting directly into the amplifier, and that some amplifier modification may be needed.

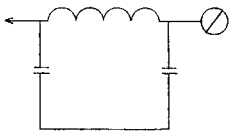
EQUIPMENT MODIFICATION

Amplifier modifications will usually be the addition of bypass capacitors at the input and output of one or more amplifying stages. Use physically-small capacitors; ceramic types are preferred. Suitable values are from 330 to 4700 pF rated for 50 volts or more, depending on the highest voltage available at the point of connection. Put capacitors as close to transistors or ICs as possible, keeping capacitor leads as short as possible and avoiding shorting other components. Use only as many bypass capacitors as needed. After modification, a check of the sound quality should be made to ensure that speech intelligibility does not suffer due to reduced frequency response. A partial schematic of typical TekTone® intercom amplifiers, both transistor and IC type, is shown in Fig. 3 and Fig. 4 to illustrate the existing location of bypass capacitors. Additional capacitors may be added in parallel. The locations for the added components are shown circled.



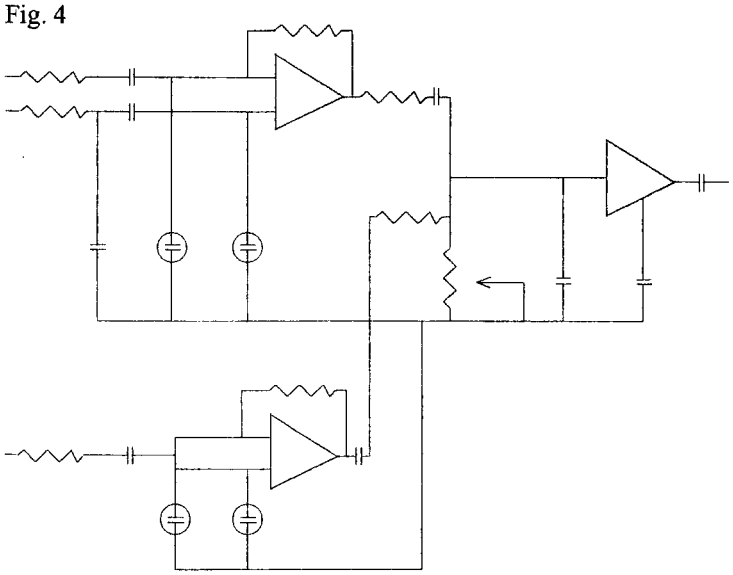
Typical Transistor Intercom Amplifier
(SM201 partial schematic)

Fig. 3



Choke and Capacitor combination
shown connected to input.

Fig. 4



Typical IC Intercom Amplifier
(PK704 partial schematic)

Fig. 5

ADDITIONAL SUGGESTIONS

It is possible that the above methods will not completely eliminate the undesired signal. In some cases the interference cannot be completely eliminated. Do not overlook the use of shielded wire for speaker, remote station, and transformer wiring. This was not mentioned above because, in most cases, the wiring will already be installed before the problem is known. If the interference is from a CB unit, it would be desirable to have someone operate another CB unit nearby while tests are being made.

If the interference is from an amateur radio station, the amateur operator would probably be willing to operate his station at a convenient time to make tests. Recording changes could prove beneficial for future reference if further work is ever required on the same system.