

*BSM#834B-1*

# PRIVATE LINE TELEPHONE SYSTEMS

## CHANNELS FOR POLLING TELEVISION RECEIVERS

### DESCRIPTION

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#### 1. GENERAL

1.01 This practice describes a multistation telephone circuit and system used by the American Research Bureau (ARB) to check television program listening. Data obtained from their customers are compiled into an index in approximately 90 seconds.

1.02 Equipment at ARB headquarters in each geographical area where a telephone circuit is provided is called the central station or ARBITRON. The equipment installed on the television receiver by ARB is called a transponder.

#### 2. OPERATION OF SYSTEM

2.01 The central station equipment is designed to serve as many as twelve backbone routes. Each route may connect through several central offices and may operate on a 2-wire or 4-wire basis. ARB customers are connected to a backbone route by means of ordinary subscriber loop facilities and a bridging circuit at the central office. As many as thirty customers may be connected in this manner. Fig. 1 shows a single line diagram of the over-all system for one route connected to the ARB equipment.

2.02 The central station equipment samples (interrogates) the television sets connected to each route and compiles the informa-

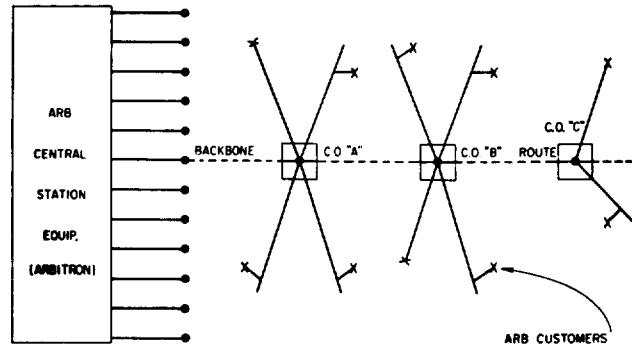


Fig. 1 – Simplified Telephone Circuit for Over-all System

tion it receives. As many as 15 interrogating frequencies may ultimately be transmitted in the band from 300 to 700 cycles.

2.03 A transponder is installed on each TV set which is tuned to a specific interrogating frequency by means of a reed relay. Two transponders on one backbone route will respond to a specific interrogating frequency. These two transponders transmit spurts of either 730 or 1010 cycles back to the central station. Fig. 2 shows a single line diagram for a simplified system using two interrogating frequencies.

2.04 The central station is arranged so that it will transmit one interrogating frequency to all routes simultaneously. The central station equipment, in turn, receives spurts of 730 or 1010 cycles in response to the interrogating frequency. The number of spurts of tone at each frequency (730 or 1010) denotes what channel the TV set is tuned to and if the set is turned on. Using this system, 360 TV sets can be interrogated in about 90 seconds.

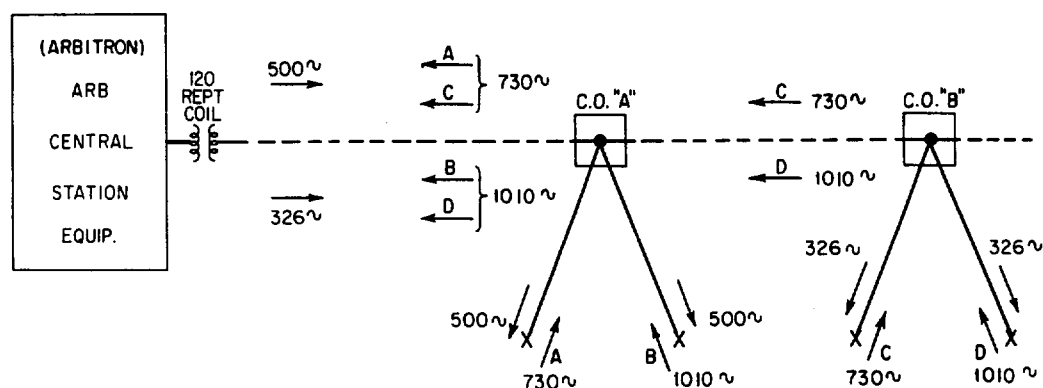


Fig. 2 – Operation of ARB Equipment over Telephone Circuit

**2.05** The transponder on the customer's TV set has an impedance of about 5000 ohms in the receiving condition and is installed by ARB. The customer on each loop is bridged across a 600-ohm resistor which is mounted on an 11C connecting block or equivalent. A Western Electric-type 145A resistor or equivalent is suitable and is installed by the Telephone Company.

### 3. DESCRIPTION OF TELEPHONE CIRCUIT

**3.01** The telephone circuits may be divided into two parts, namely: the backbone route and subscriber loop. This provides a convenient means for considering the design and maintenance aspects of the over-all circuit.

**3.02** The backbone route is that portion of the telephone circuit which connects the central station (ARB) equipment to the telephone central offices. The route may operate on a 2-wire or 4-wire basis in order to meet the transmission design requirements.

**3.03** The subscriber loops are 2-wire and are made up of facilities similar to those used to serve telephone customers. A loop is designed to serve only one residence but may have as many as two transponders connected to it. Equipment arrangements at the central office permit one or more loops to be bridged to the route.

**3.04** Fig. 3 shows a telephone circuit using 2-wire facilities throughout. Each subscriber loop is connected to the bridging circuit by means of a 120P repeating coil strapped for a 3:1 ratio. Pads are inserted in each loop to minimize the impedance mismatch between the loop and bridging circuit. These are 89-type resistor (pads) and are selected on the basis of loop length, gauge and backbone route loss to the bridge. One repeater strapping will take care of as many as seven loops. A 234-ohm resistor is added to the bridging circuit for each 120P coil which is not provided. When a loop is added to the bridge, the resistor is removed and replaced by a coil, pad and cable pair. The series repeater is strapped for sufficient gain so as to present approximately zero bridging loss to the backbone route. With this arrangement, a maximum of seven loops may be connected to a single bridge. The entire bridging circuit is coupled to the backbone route by means of a 119E repeating coil. The windings are connected in series with the tip and ring conductors of the route so as to be series aiding. This provides a better frequency response at the low end of the voice band.

**3.05** The backbone route of the 2-wire circuit is terminated in a 115-type network at the most remote central office on the route. This improves the return loss characteristics of the circuit. A 59,700-ohm, type 145A resistor is connected across the network in order to check the continuity of the cable pair. The resistance is high so as not to upset the impedance characteristics of the network.

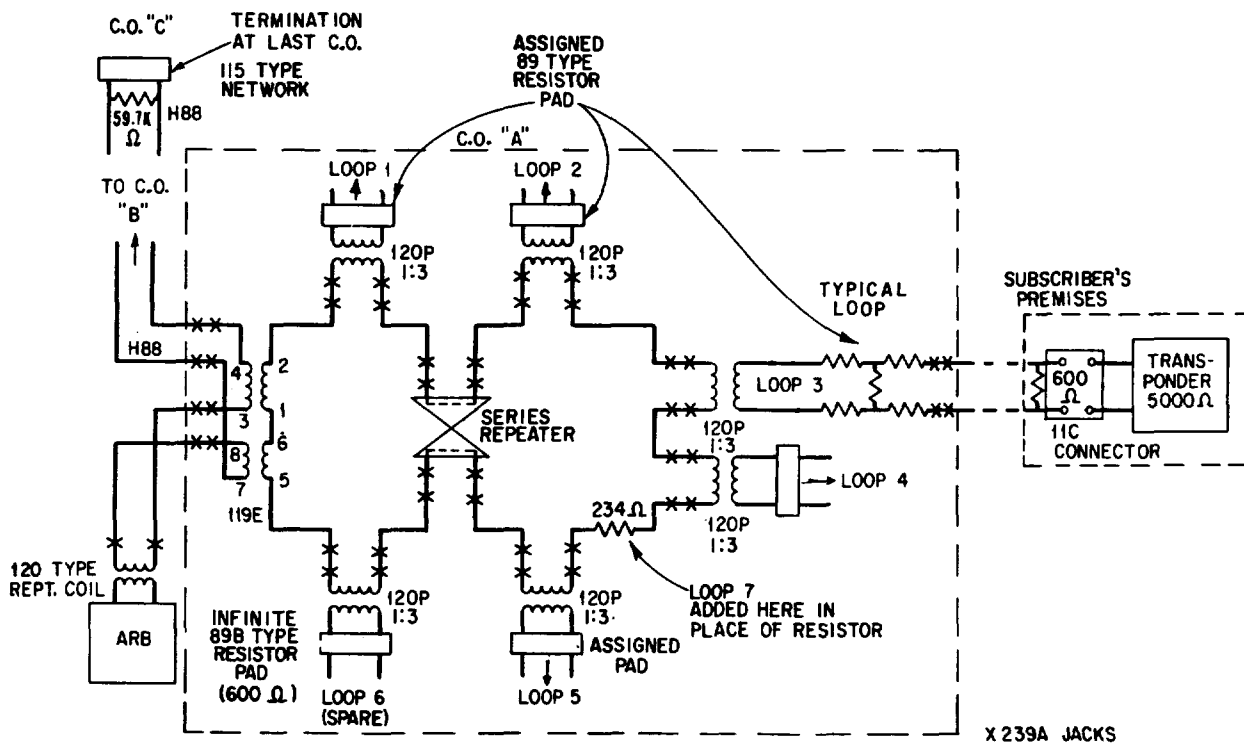


Fig. 3 - 2-Wire Operation of Telephone Circuit

**3.06** In some cases the above resistor may be replaced by two 25,200-ohm, type 145A resistors connected in series. The junction of the two resistors is connected to central office ground. This arrangement is used when sealing current is simplexed to minimize noise. Battery is applied at ARB headquarters.

**3.07** Spare 120P coils are strapped for a ratio of 3:1 and terminated in an infinite 89B-type resistor (pad). This terminates the coil in 600 ohms.

**3.08** In some offices it may be necessary to serve more than seven loops. These situations may be handled by providing more than one bridging circuit at that office.

**3.09** Fig. 4 shows a simplified single line diagram of a circuit where the backbone route is 4-wire. The subscriber loops in this arrangement are connected to the 173-type repeating coil hybrid as shown in detail in Fig. 5. Standard conference bridging arrangements are used as discussed in Section 310-405-100 pertaining to multistation private line telephone circuits.

**3.10** The subscriber loops are connected as shown. The condensers and equalization normally used with the hybrid are strapped out since they are not required in this arrangement. The two groups of loops are balanced against each other in order to provide a satisfactory balance to the hybrid arrangement. In some cases it may be necessary to build out the shorter loops to obtain the required balance.

#### 4. MAINTENANCE

**4.01** The ability to sectionalize trouble on these circuits quickly and efficiently is important. ARB may use the circuit to poll any television program. For this reason, troubles should be cleared quickly without disrupting service any more than necessary.

**4.02** To facilitate testing, the circuits are equipped with 239A-type jacks. They are placed in the circuit so that trouble in the backbone route, bridging circuit or subscriber loop can be located and isolated quickly.

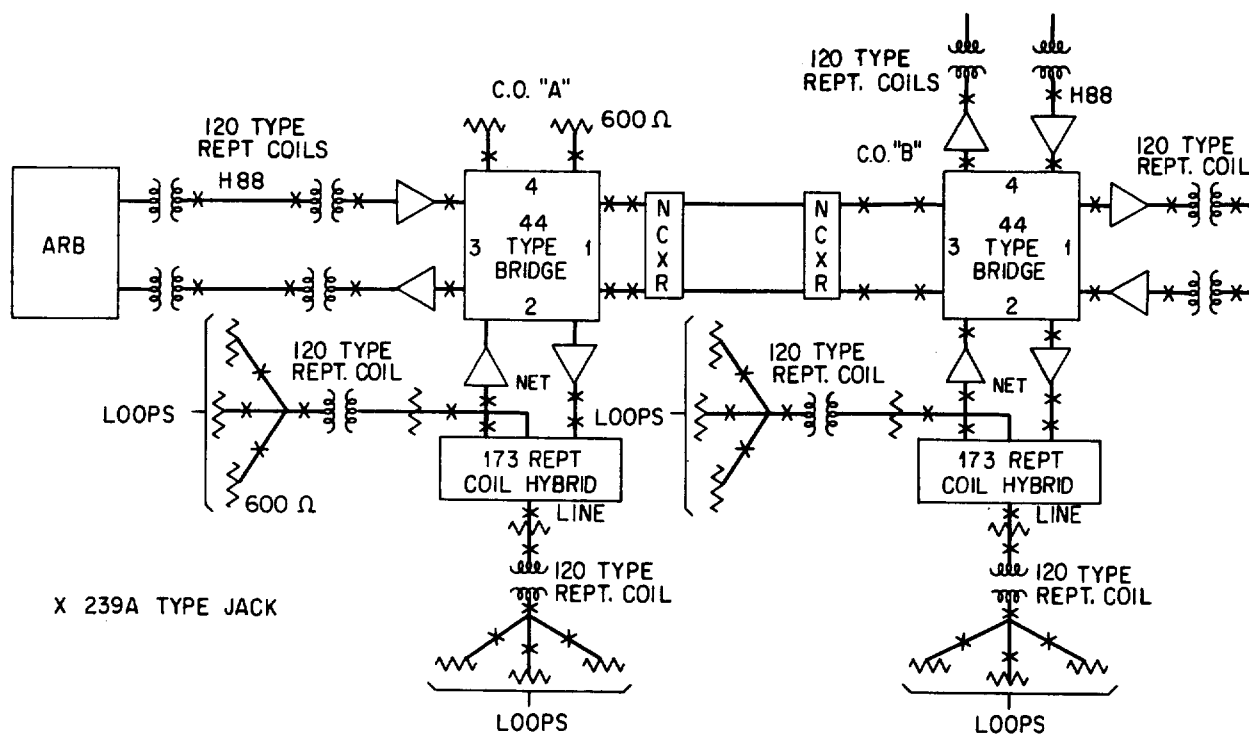


Fig. 4 - 4-Wire Operation of Telephone Circuit

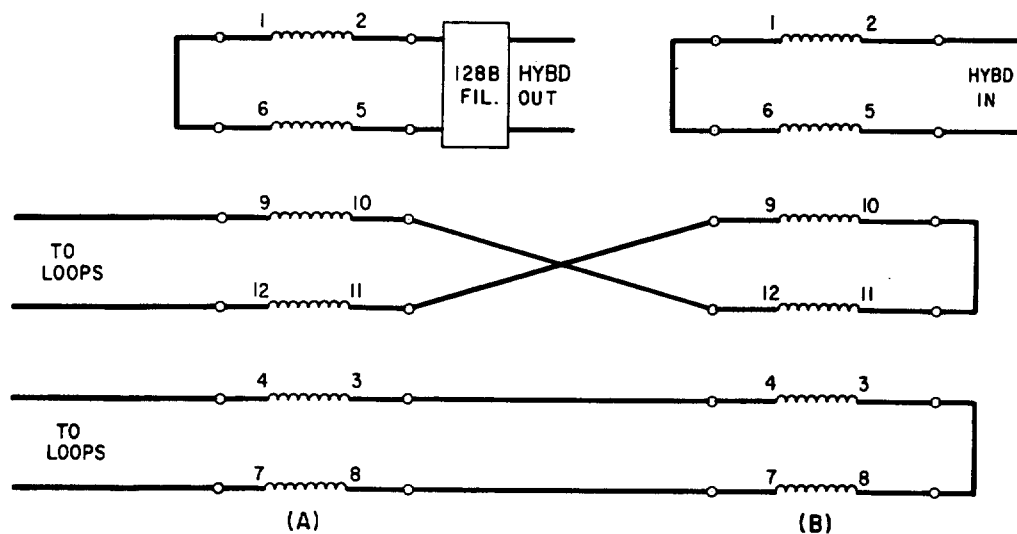


Fig. 5 - Schematic of 173-Type Hybrid and External Connections