

Bell System

# TECHNICAL REFERENCE

PROTECTIVE CONNECTING  
ARRANGEMENT RCZ

INTERFACE SPECIFICATION  
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**TECHNICAL REFERENCE**  
**PROTECTIVE CONNECTING ARRANGEMENT RCZ**  
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Fig. 1 Interface Connecting Block

Fig. 2 Typical Connections for Protective Connecting Arrangement RCZ

## 1. GENERAL

### 1.1 Introduction

FCC tariffs and corresponding intrastate tariffs filed by the Bell System Companies provide for the electrical connection of customer-provided voice transmitting and receiving terminal equipment and communications systems to the Bell System telecommunications network by means of a protective connecting arrangement. The connecting arrangement includes circuit elements to provide network control signaling unit functions as well as certain other network protection functions and is furnished, installed, and maintained by the Telephone Company. In addition, the tariffs require compliance by the customer-provided equipment with network protection criteria specified therein. This Technical Reference is being revised to enable the customer to connect his equipment to screw terminals rather than a Cannon Connector and to include general revisions in the text.

### 1.2 Application

Protective Connecting Arrangement RCZ provides the means for connecting a customer-provided recorder-reproducer to the telecommunications network for the recording of two-way telephone conversations. This protective connecting arrangement provides a high impedance bridging connection between the customer's equipment and Telephone Company-provided equipment which is physically located on the customer's premises. It gives an indication of line seizure to the customer-provided equipment and provides a transmission path from the telephone line to the customer's equipment with amplification and automatic volume control (AVC). A "beep" tone of 1400 Hz at approximately 15 second intervals is also provided to alert both parties that recording is taking place. The "beep" tone need not be recorded on the customer's recorder-reproducer recording medium.

The "beep" tone generated by this protective connecting arrangement is required by Federal Communications Commission regulations whenever two-way telephone conversations are being recorded. The F.C.C. has ordered two exceptions to this requirement. The "beep"

tone is not required when the recording equipment is used by: 1) an F.C.C. licensed broadcast station customer for the recording of two-way conversations solely for broadcast over the air, and 2) the United States Secret Service of the Department of Treasury under certain conditions. Where telephone service is used solely in intrastate applications, other exceptions under the intrastate tariffs may apply for certain telephone services for emergency agencies, such as, municipal police and fire departments. The local Telephone Company should be consulted concerning applicability of these exceptions. These exceptions do not eliminate the need for a protective connecting arrangement when direct electrical connection is used.

It should be noted that the tariffs do not permit the recording of two-way conversations by means of an acoustic or inductive connection except as may be applied per the above exceptions.

### 1.3 Ordering and Identification

The protective connection service described in this Technical Reference is identified by the Bell System as Uniform Service Order Code (USOC) RCZ. When ordering this service, the customer should specify this code. The local Telephone Company business office or marketing representative will provide information regarding availability, rates, and tariff applications for this service. If the exceptions in Section 1.2 above apply, the customer should specify (USOC) RCZ and must request that the "beep" tone feature be disconnected and specify the reason for exception.

## 2. DESCRIPTION

### 2.1 Functions

The major functions of this protective connecting arrangement are:

- (a) To protect Telephone Company personnel and equipment from hazardous voltages which may be applied by the customer-provided equipment.
- (b) To provide isolation against longitudinal imbalance.

- (c) To provide a "beep" tone alerting signal to both parties of a telephone conversation that is being recorded.
- (d) To provide a high impedance bridging connection between the customer's equipment and Telephone Company-provided equipment which is physically located on the customer's premises.
- (e) To provide an off-hook indication to the customer-provided equipment.
- (f) To provide a unidirectional voice transmission path with amplification and automatic volume control (AVC) from the telephone line to the customer's recorder.
- (g) To provide a rejection filter (inserted only during the "beep" tone) to eliminate the "beep" tone signal from the input signal to the customer-provided recorder.
- (h) To provide a filter (inserted only during the "beep" tone) to attenuate the "beep" tone being transmitted to the local party so that it is not received at an uncomfortably high level.
- (i) To provide a means for the customer-provided equipment to activate the protective connecting arrangement.

## 2.2 Physical

Protective Connecting Arrangement RCZ is contained in a wall mounted apparatus box measuring approximately 6-7/8 inches wide, 7-3/8 inches high, and 3-3/8 inches deep. The arrangement weighs approximately four pounds. Power for the unit is obtained from a Telephone Company-provided power supply. The power supply requires a grounded outlet connection to a nonswitched customer-furnished nominal 117  $\pm$  12 volt, 60  $\pm$  1 Hz source, fused at 15 amperes.

## 2.3 Interface Leads

Four interface leads per circuit are provided from Protective Connecting Arrangement RCZ to the Interface Connecting Block for the customer's use (Fig. 1). Technical information pertaining to these leads is discussed in Section 4.

The leads and their functions are as follows:

Lead Designation	Functions
ST1 ) ST2 )	Start signal from customer's equipment and off-hook indication to customer's equipment
CT ) CR )	One-way transmission path from the telephone line to the customer's recorder

Leads from this protective connecting arrangement will be terminated on a Telephone Company-provided Interface Connecting Block conveniently located to permit testing, maintenance, trouble isolation, and ease of connection to the customer-provided equipment. The customer must provide and install the conductors and make the necessary connections from his equipment to the connecting arrangement at this block.

A typical Interface Connecting Block is shown in Fig. 1. The customer must terminate his leads on the screw terminals in the following manner:

Lead Designation	Screw Terminal
CT	4
CR	6
ST1	9
ST2	1

The Telephone Company will provide metal straps between the customer's and Telephone Company's screw terminals to interconnect the leads. The straps must not be removed. When it is necessary to test toward the customer-provided equipment the customer's representative should remove the customer's leads from terminals 1, 4, 6, and 9, make his tests, and then replace the leads to restore the circuit to service.

The customer-provided equipment must be located so that the maximum external loop resistance, including contact resistance, across the ST1 and ST2 leads measured at the block shall not exceed 100 ohms when indicating a closure.

### **3. OPERATION**

#### **3.1 Incoming Call From the Central Office**

An incoming call from the central office is handled in a manner similar to a regular telephone call. When the telephone station associated with the protective connecting arrangement rings, the attendant lifts the telephone handset. At this time, the OH relay operates and the potential across leads ST1 and ST2 changes from 0 volts open circuit to 22 volts dc. The connecting arrangement is now in the standby condition. If a recording is desired, a closure must be applied and maintained between leads ST1 and ST2. This closure bridges the connecting arrangement across the telephone line and provides a one-way transmission path on the CT and CR leads. After approximately 15 seconds and at approximately 15 second intervals thereafter, the connecting arrangement transmits a 1400 Hz "beep" tone over the telephone network to inform both parties that recording is taking place. (See Section 1.2 for exceptions.) The connecting arrangement is deactivated by removing the closure between leads ST1 and ST2 and/or placing the telephone handset on the cradle.

#### **3.2 Outgoing Call to the Central Office**

An outgoing call to the central office is handled in a manner similar to a regular telephone call. To originate a call, the attendant lifts the handset of the associated telephone set (at this time, the OH relay operates and the potential across leads ST1 and ST2 changes from 0 volts open circuit to 22 volts dc), waits for dial tone, and dials the desired number. (The OH relay may open momentarily on dial pulses — one or more pulses per digit. These opens should be ignored by the customer-provided equipment.) During the calling process, the connecting arrangement is in the standby condition. When dialing is completed and the call acknowledged, the protective connecting arrangement can be activated by applying and maintaining a closure between leads ST1 and ST2 as described in Section 3.1.

If it is desired to have the connecting arrangement activated for every call, leads ST1 and ST2 may be strapped together in the customer-provided equipment; the arrangement will then be activated every time the switchhook of the associated telephone set is operated.

#### **3.3 Disconnect**

The protective connecting arrangement is disconnected from the telecommunications network by removing the closure between leads ST1 and ST2 and/or placing the telephone handset on the cradle.

### **4. SPECIFIC DESIGN CONSIDERATIONS**

#### **4.1 Transmission Path (Leads CT and CR)**

##### **4.1.1 Amplification and Automatic Volume Control**

The CT and CR leads provide a unidirectional voice transmission path with amplification and automatic volume control (AVC) from the telephone line to the customer's recorder. The AVC feature will, when fully activated, provide a relatively constant amplifier output level at output leads CT and CR of approximately 0 VU for input signals from the telephone line ranging from -40 to 0 VU. The gain of the AVC circuit may be adjusted by the Telephone Company.

##### **4.1.2 Impedance**

An output impedance of approximately 600 ohms is presented to the customer's equipment.

##### **4.1.3 Bandwidth**

The nominal voice-frequency bandwidth of the telecommunications network extends from about 300 to about 3000 Hz. In general, an end-to-end connection may be expected to have a loss characteristic which increases on either side of this band. This protective connecting arrangement does not limit this bandwidth.

#### **4.2 DC Signaling Paths (Leads ST1 and ST2)**

A closure applied and maintained between leads ST1 and ST2 when the telephone handset is off-hook will activate the connecting arrangement. If the customer wishes to have the connecting arrangement activated for every call, leads ST1 and ST2 may be strapped together in the customer-provided equipment; the

arrangement will then be activated every time the switchhook of the associated telephone set is operated.

The ST1 and ST2 leads may also be used by the customer-provided equipment to detect an off-hook condition on the line. In the idle condition, the potential across leads ST1 and ST2 is 0 volts open circuit (see Fig. 2). When the line is seized, contact OH closes and the potential across leads ST1 and ST2 will be a nominal 22 volts dc. This change in potential may be used by the customer-provided equipment as a signal to start his recorder. (The OH relay may open momentarily on dial pulses — one or more pulses per digit. These opens should be ignored by the customer-provided equipment.) The resistance of the customer's detecting circuit should be high enough (greater than 600 ohms) so that the current flow through ST1 and ST2 is less than the operate current for relay TWR. When indicating a closure, however, the resistance of the customer's equipment shall be 100 ohms or less.

When indicating a closure, the contact in the customer's equipment should be capable of handling 40 volts dc and 20 milliamperes dc.

#### 4.3 "Beep" Tone

The protective connecting arrangement, when activated, generates the "beep" tone required by Federal Communications Commission regulations whenever two-way conversations are being recorded. (See Section 1.2 for exception.) This tone is defined to be one of 1400 Hz  $\pm$  2%, lasting for .5 second and recurring approximately every 15 seconds. The "beep" tone must be audible to both parties to the conversation but it can be filtered from the recording itself.

The connecting arrangement contains a 1400 Hz rejection filter which is adjusted by the Telephone Company to provide a minimum "beep" tone output at leads CT and CR while the "beep" tone is being transmitted to the line. A 1400 Hz limiting filter is also contained in the connecting arrangement to attenuate the "beep" tone being transmitted to the local party so that it is not received at an uncomfortably high level. Both filters are effective only during the interval when the "beep" tone is being transmitted.

## 5. GENERAL DESIGN CONSIDERATIONS

### 5.1 Foreign and Surge Voltage Protection

Where telephone lines are exposed to power line contact, lightning exposure, power line induction, or a rise in ground potential exceeding 300 volts RMS, protective devices are installed at the central office and on the customer's premises that will provide a path to ground for foreign voltages that exceed about 600 volts peak.

The manufacturer is responsible for designing his equipment and facilities in such a way that foreign and hazardous voltages from his equipment and facilities are not applied to the protective connecting arrangement.

### 5.2 Grounding

It is expected that the customer's equipment, if powered from commercial power, will be grounded in accordance with applicable electrical codes, eg, National Electrical Code (NEC), and should be grounded to the ground electrode to which the connecting arrangement is grounded but not using the telephone ground clamp. Provisions should be made within the customer's equipment for connecting together all internal signal grounds. This connection shall be isolated from both the grounding (green) conductor run with the power supply primary conductors and the chassis or frame of the customer-provided equipment.

The customer's signal ground may be obtained with a proper connection to a metallic cold water pipe, using a single No. 14 AWG, or larger, copper conductor. The other end should be connected to the ground return terminal of the customer's equipment. Proper attention should be given to providing the lowest possible resistance connection at each end of the circuit. It is imperative that this ground be connected at the same location to the water piping system or ground electrode as the telephone protector or signal ground lead but not using the Telephone Company ground clamp. This lead shall not be fused.

Control leads ST1 and ST2 should be isolated from earth or power system grounds in the customer's equipment. An isolated contact is preferable.

### **5.3 Telecommunications Network Characteristics**

#### **5.31 End-to-End Electrical Loss**

The end-to-end electrical loss of a connection is a function of the impedances of both end terminations and the losses of the interoffice trunks, the serving central offices, and the facilities to the serving offices. The REFERENCES in Appendix B may be used to determine the statistical loss distributions for different types of calling patterns on the telephone network.

#### **5.32 Nonlinearities**

Nonlinearities such as compression, clipping, phase shift, and harmonic distortion can exist on the telecommunications network. Normally, these are insignificant for speech transmission. It is expected that harmonic distortions will result in single tones which are no greater than about 5% of the fundamental.

## **6. SERVICE RESPONSIBILITIES**

### **6.1 Responsibility of the Manufacturer**

The manufacturer of the terminal equipment is responsible for the following:

- a) Informing the purchaser as to which protective connecting arrangement his equipment has been designed to work with.
- b) Advising the purchaser to order this protective connecting arrangement by code RCZ from the Telephone Company.
- c) Providing information to the purchaser that specifies installation, operational, routine maintenance, and repair procedures which, if properly employed by the purchaser, will assure compliance with this Technical Reference.
- d) All patent or other liability arising out of the use, offering or distribution of such equipment by or to them.

### **6.2 Responsibility of the Customer**

The tariffs regulating the connection of customer-provided terminal equipment or communications systems through connecting

arrangements to the telecommunications network state that the operating characteristics of such equipment or systems shall be such as not to interfere with any of the services offered by the Telephone Company. Such use is subject to the further provisions that the equipment or systems provided by a customer do not endanger the safety of Telephone Company employees or the public; damage, require change in or alteration of, the equipment or systems or other facilities of the Telephone Company; interfere with the proper functioning of such equipment or systems or facilities; impair the operation of the telecommunications network or otherwise injure the public in its use of the Telephone Company's services. Upon notice from the Telephone Company that the equipment or system provided by a customer is causing or is likely to cause such hazard or interference, the customer shall take such steps as shall be necessary to remove or prevent such hazard or interference.

The customer desiring to use customer-provided equipment is responsible for the following:

- a) Informing the Telephone Company of his intention to use customer-provided equipment and ordering the protective connecting arrangement by code RCZ.
- b) Connecting the equipment to the interface connecting block.
- c) Assuring that the equipment in use continues to comply with all the requirements of the applicable tariffs and this Technical Reference.
- d) Following the installation, operational, routine maintenance and repair procedures specified by the manufacturer.
- e) Removing the equipment from use if the customer detects that it is defective or if the Telephone Company notifies the customer that the equipment is causing a hazard or interference as specified above.

### **6.3 Responsibility of the Telephone Company**

The Telephone Company shall not be

responsible for the installation, operation or maintenance of any customer-provided terminal equipment. Long distance message telecommunications service is not represented as adapted to the use of customer-provided equipment and where such equipment is connected to Telephone Company facilities, the responsibility of the Telephone Company shall be limited to the furnishing of facilities suitable for long distance message telecommunications service and to the maintenance and operation of such facilities in a manner proper for such telecommunications services. Subject to this responsibility the Telephone Company shall not be responsible for (i) the through transmission of signals generated by the customer-provided equipment or for the quality of, or defects in such transmission, (ii) the reception of signals by customer-provided equipment, or (iii) address signaling where such signaling is performed by the customer-provided tone-type signaling equipment.

The Telephone Company shall not be responsible to the customer or otherwise if changes in minimum network protection criteria contained in the tariffs and in this Technical Reference or in any of the facilities, operations or procedures of the Telephone Company render any customer-provided equipment obsolete or require modification or alteration of such equipment or otherwise affect its use or performance.

## **7. MAINTENANCE OF SERVICE**

Maintenance of equipment supplied by the Telephone Company shall be done only by the Telephone Company.

When trouble is experienced with this service, the customer should disconnect the recorder to determine whether the service impairment is located in the customer-provided equipment or in the equipment provided by the Telephone Company. If the recorder is determined to be defective, the customer shall immediately discontinue its use until such time as the customer has it repaired. If the tests indicate that the trouble is in the Telephone Company-provided equipment, a trouble report should be promptly referred to the Telephone Company's "Repair Service" whose number can be found in the front of the telephone directory. The repair attendant should be given:

- (a) Customer's name
- (b) Customer's address
- (c) Listed telephone number
- (d) Description of the trouble
- (e) Uniform Service Order Code (USOC) RCZ
- (f) Customer's contact for additional information

The customer shall be responsible for the payment of a service charge for visits by the Telephone Company to the customer's premises where the service difficulty or trouble report results from the use of customer-provided equipment.

## APPENDIX A

### GLOSSARY

**ADDRESS SIGNALS** — denotes dc dial pulses or appropriate pairs of tone signals transmitted to a central office that represent the telephone number of the distant party.

**COMMUNICATIONS SYSTEM** — denotes channels and other facilities which are capable, when not connected to the Long Distance Message Telecommunications Service, of communications between customer-provided terminal equipment or Telephone Company stations.

**CUSTOMER** — the term "Customer" denotes the person, firm or corporation which orders service and is responsible for the payment of charges and compliance with Telephone Company regulations.

**CUSTOMER-PROVIDED TERMINAL EQUIPMENT** — denotes devices or apparatus and their associated wiring, provided by a customer, which do not constitute a communications system and which, when connected to the communications path of the telecommunications network, are so connected either electrically, acoustically, or inductively.

**DIAL PULSE RATE** — repetition of pulses for switching purposes, usually expressed in pulses-per-second.

**INTERDIGITAL TIMING** — the minimum time required between digits for the switching equipment to respond to the last digit received and ready itself for receiving the next digit.

**INTERFACE CONNECTING BLOCK** — the Telephone Company-provided connecting point to which the customer brings and connects the leads of his equipment and to which the Telephone Company brings and connects leads from the protective connecting arrangement.

**NETWORK CONTROL SIGNALING** — denotes the transmission of signals used in the telecommunications system which perform functions such as supervision (control, status, and charging signals), address signaling (dialing), calling and called number identification, audible tone signals (call progress signals indicating reorder or busy conditions, alerting, coin denominations, coin collect and coin return tones) to control the operation of switching machines in the telecommunications network.

**NETWORK CONTROL SIGNALING UNIT** — denotes the terminal equipment furnished, installed, and maintained by the Telephone Company for the performance of network control signaling. (See Note below.)

**PERCENT BREAK** — the period of time of an open interval in a dial pulse sequence compared to the total time of an open and closed interval, expressed as a percentage.

**PROTECTIVE CONNECTING ARRANGEMENT** — protective equipment provided by the Telephone Company to accomplish the electrical connection of customer-provided equipment with the telecommunications network. It is designed to transmit speech signals as contrasted to one designed to transmit data signals.

**SUPERVISORY SIGNALS** — signals used to initiate a request for service by the calling party (off-hook); to notify the called party that he is being called (ringing); to indicate an answered call (off-hook); to indicate a disconnect (on-hook); and to recall an operator or distant party to a connection (switchhook flash).

NOTE: Under the tariff regulations, the terms "connecting arrangement" and "network control signaling unit" are separate and distinct from each other; however, the term "connecting arrangement" is generally used to include the functions of network control signaling.

**TELECOMMUNICATIONS NETWORK** — the central office switching equipment, associated interoffice and intraoffice facilities, and terminal equipment which provide Long Distance Message Telecommunications Service or private line service.

**TELEPHONE COMPANY** — denotes the American Telephone and Telegraph Company, the Long Lines Department, its concurring carriers, and its connecting carriers, either individually or collectively.

## APPENDIX B REFERENCES

Some references describing various transmission characteristics of the telecommunications network are listed below:

- \*(a) Gresh, P.A., "Physical and Transmission Characteristics of Customer Loop Plant," Bell System Technical Journal (BSTJ), Vol. 48, No. 10 (December 1969), p. 3337.
- \*(b) Breen, C., and Dahlbom, C.A., "Signaling Systems for the Control of Telephone Switching," BSTJ, Vol. 39, No. 6 (November 1960), p. 1381.
- \*(c) Bodle, D.W., and Gresh, P.A., "Lightning Surges in Paired Telephone Cable Facilities," BSTJ, Vol. 40, No. 2 (March 1961), p. 547.
- \*\* (d) "Principles of Electricity Applied to Telephone and Telegraph Work," by American Telephone and Telegraph Company, New York, New York.
- \*\* (e) "Switching Systems," by American Telephone and Telegraph Company, New York, New York.
- (f) "Notes on Transmission Engineering," by United States Independent Telephone Association, Washington, D.C.
- \*\* (g) "Transmission Systems for Communications," by Bell Telephone Laboratories, Inc.
- \*\* (h) "Notes on Distance Dialing — 1975," by American Telephone and Telegraph Company, New York, New York.

\*These journals may be purchased by writing to:

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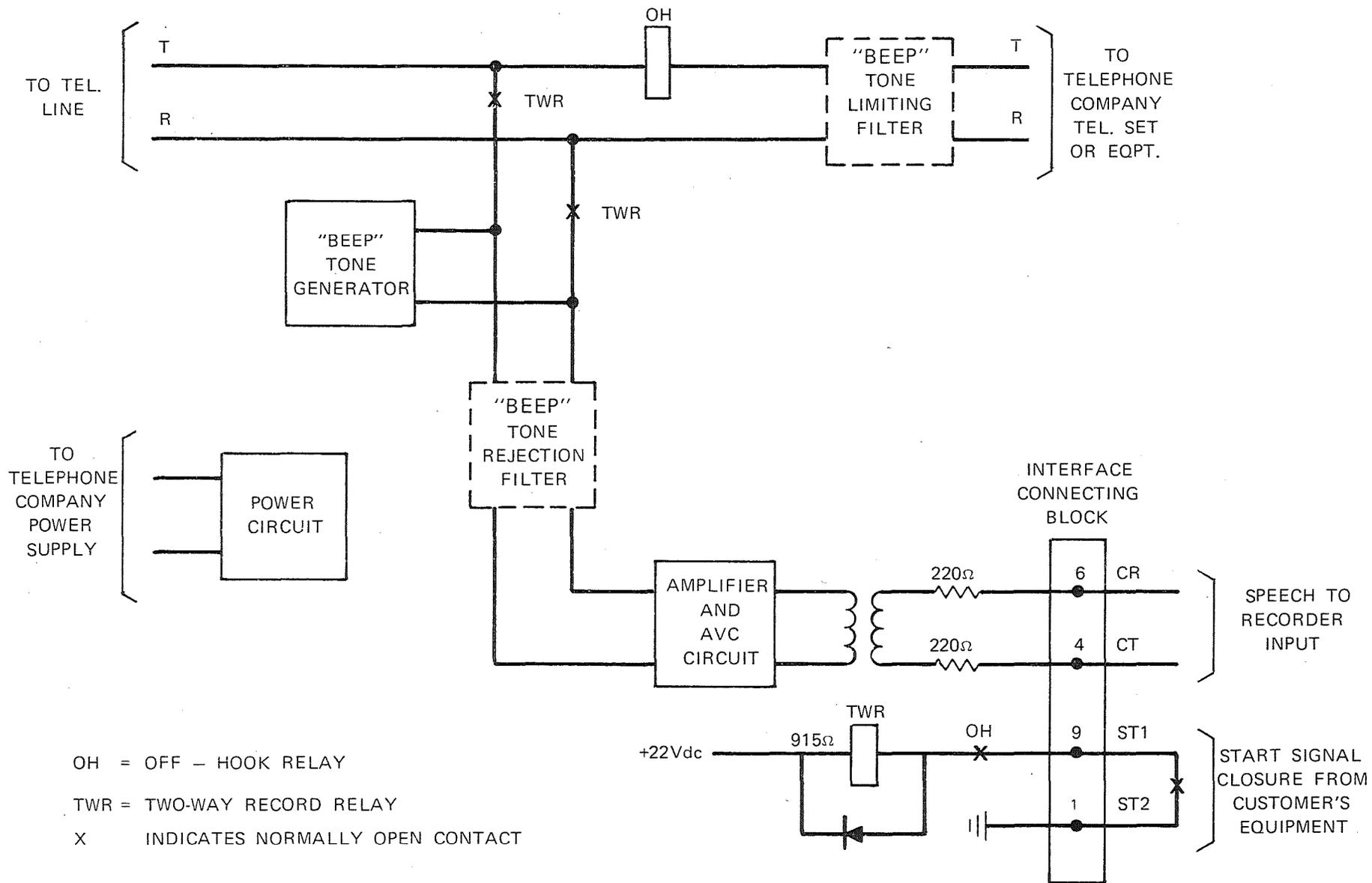
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SIMPLIFIED SCHEMATIC  
 PROTECTIVE CONNECTING ARRANGEMENT RCZ

FIG. 2