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PRELIMINARY

Bell System Voice Communcations
TECHNICAL REFERENCE

Voice Connecting Arrangement

RTT

Interface Specification

January 1970

ENGINEERING DIRECTOR - CUSTOMER TELEPHONE SYSTEMS

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NOTICE

This Technical Reference is specifically intended for the developers and designers of telephone voice communications systems and equipment which interface with the Bell System telecommunications network and for technical consultants to use in designing communications systems and arrangements requiring connections to the Bell System telecommunications network. The right to revise this Technical Reference for any reason, including conformity with USASI, EIA, CCITT or other standards, to utilize new advances in the state of the technical arts, or to reflect changes in the design of the equipment and/or service described herein, is expressly reserved.

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PREFACE

The material in this Technical Reference is intended for use by designers and manufacturers of telephone equipment who expect to connect their communications equipment to the Bell System telecommunications network. This material covers guides which, if followed, should permit the transmission and reception of voice signals without interference to other Telephone Company services.

The responsibility of the Bell System with respect to the use of customer-provided equipment is as set forth in the appropriate Tariff regulations.

In furnishing this material, the Bell System Telephone Companies make no claims or representations and assume no responsibility, beyond that set forth in the Tariff regulations, for the suitability of the transmission path or the performance of the telecommunications system. The Bell System is in no way responsible for the design, performance, installation, operation or maintenance of the communications systems or equipment provided by others which are connected to the telecommunications network and does not endorse or approve any such system or equipment. The material in this Technical Reference is furnished in the interest of preventing interference to other Telephone Company services and users, and is not furnished with the intent to provide complete design specifications or parameters, or to assure the quality or performance of customer-provided telephone systems and equipment.

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1. GENERAL

F.C.C. Tariff No. 263 and corresponding intrastate Tariffs filed by the Bell System provide for the direct connection of customer-provided voice transmitting and receiving terminal equipment and communications systems to the Bell System telecommunications network. Direct electrical connection is made through a voice connecting arrangement furnished, installed, and maintained by the Telephone Company. The Tariffs also provide for the indirect (acoustic or inductive) connection of such equipment or systems.

In addition, the Bell System retains responsibility for network control signaling. This includes the switchhook, dialing and control functions, as well as the function of voice signal limiting and isolation of Central Office battery from the customer-provided equipment.

2. SYSTEM DESIGN CONSIDERATIONS

2.1 Voice Connecting Arrangement RTT

Voice Connecting Arrangement RTT provides the means for customer-provided equipment to cause a short burst of 440 Hz tone to be transmitted over the telecommunications network at approximately 15 second intervals and in addition provides an indication of line seizure. The initiation and duration of the tone transmission is under the control of the customer's equipment. There is no transmission path provided to the customer's equipment. Voice Connecting Arrangement RTT may be associated with an individual telephone line or with a PBX trunk. For new or additional service, contact your local Telephone Company business

office or Marketing representative. For ready identification, the Telephone Company describes this service as Voice Connecting Arrangement RTT.

2.2 Service and Maintenance Considerations

2.21 Responsibility of the Customer

The Tariffs permitting direct electrical connection of customer-provided terminal equipment state that:

> Where long distance message telecommunications service is available under this Tariff for use in connection with customer-provided equipment, the operating characteristics of such equipment 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 customer-provided equipment does not endanger the safety of Telephone Company employees or the public; damage, require change in or alteration of, the equipment or other facilities of the Telephone Company; interfere with the proper functioning of such equipment or facilities; impair the operation of the telecommunications system or otherwise injure the public in its use of the Telephone Company's services. Upon notice from the Telephone Company that the customer-provided equipment is causing or is likely to cause such hazard or interference the customer shall make such change as shall be necessary to remove or prevent such hazard or interference.

2.22 Responsibility of the Telephone Company

The Tariffs permitting direct electrical connection of customer-provided terminal equipment state that:

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 service; 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, or (ii) the reception of signals by customer-provided systems.

The Telephone Company shall not be responsible to the customer or otherwise if changes in the criteria contained in the Tariffs and Paragraph 3 of 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.

2.23 Trouble Reporting Procedure

When trouble is experienced with this service, the customer should perform the necessary testing to sectionalize the difficulty, i.e., determine whether the service impairment is located in the customer-provided equipment or in the equipment provided by the Telephone Company. If the tests indicate that the trouble is in the Telephone Company-provided equipment, it should be promptly reported to the Telephone Company. Trouble reports should be called to the listed "Repair Service" number which 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) Customer's contact for additional information

2.3 Foreign and Surge Voltage Protection

Where telephone lines are exposed to lightning, power circuit contact, or induction, 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. Since the customer's equipment is connected to the telephone line through the voice connecting arrangement, the customer's equipment is protected from longitudinal surge. The maximum surges between conductors at the coupler jack terminals due to foreign potential that the customer's equipment should encounter is 30 volts.

The customer is responsible for providing protection, internal to his equipment and facilities, against foreign and surge voltages from his equipment and facilities being applied to the voice connecting arrangement. The surge potential between conductors on the customer-provided plug must be limited to 30 volts. Voltage surges between either conductor and ground must be limited to about 600 volts.

2.4 Voltage Limitations

When it is necessary for the customer to apply an operational voltage to facilities interconnected with telephone facilities, certain voltage limitations shall be observed. These limitations are for the purpose of providing adequate protection to personnel and plant facilities, and unless otherwise specified in Paragraph 3 of this Technical Reference, steady-state voltages applied by customer-provided equipment to conductors connected to the voice connecting arrangement should not exceed the following:

	dc	ac (RMS)
Maximum voltage, any conductor to ground	135	50
Maximum voltage, conductor to conductor	(135 (270*	(50 (100*

*Permitted only if voltage source is center-tapped to ground.

The power supplies and wiring methods used in the customer-provided equipment should meet the provisions of the National Electrical Code, (NEC), Article 725, for Class 2 remote control and signal circuits.

3. DESCRIPTION OF VOICE CONNECTING ARRANGEMENT RTT

3.1 Physical

Voice Connecting Arrangement RTT 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 unit weighs approximately four pounds. A receptacle is provided at the bottom of the unit to connect the control leads to the customer's equipment. The customer must provide the connecting cable and mating receptacle (SK-M7-21C Cannon plug or equivalent). A Telephone Company-provided plug-in transformer connected to a 115 volt, 60 Hz power source is required to supply the low voltage ac power for this unit.

3.2 Functions

The major functions of this voice connecting arrangement are:

(a) To provide dc isolation to the customer-provided equipment and protect personnel against hazardous voltages.

(b) To provide an indication of a line or trunk seizure to the customer-provided equipment.

(c) To provide a tone to be transmitted over the line or trunk associated with the telephone set or PBX. The associated telephone set or PBX is used for all network control signaling and provides voice-only access to and from the switched telecommunications network.

3.3 Interface Leads

Four interface leads per circuit are provided from Voice Connecting Arrangement RTT for the customers' use. These leads are:

Start (leads ST1, ST2) - a closure is applied and maintained by the customer's equipment to cause a 440 Hz beep tone, generated in the coupler unit, of approximately .5 second duration repeated at 15 second intervals, transmitted over the telecommunications network. The contact in the customer's equipment should be capable of handling 40 volts dc and 20 milliamperes.

Off-Hook (leads OH1, OH2) - a contact closure occurs automatically when the line or trunk is seized. This closure may be used to enable the customer's device to start timing the call. This contact is rated at 100 milliamperes and 28 volts dc.

3.4 Originating and Receiving a Call

A call using the Voice Connecting Arrangement RTT is placed in a manner similar to a regular telephone call. To initiate a call, the customer lifts the handset of the associated telephone set (at this time Voice Connecting Arrangement RTT closes the contacts across leads OH1 and OH2; for PBX trunks the closure occurs when the PBX trunk is seized), assures that dial tone is being received and dials the desired telephone number. During the calling process, Voice Connecting Arrangement RTT is automatically in a standby condition. After a time delay determined by the customer-provided equipment, the customer can cause a tone to be sent over the connection by applying and maintaining a closure between the START leads (ST1 and ST2). This closure automatically bridges the voice connecting arrangement across the telephone line. The arrangement transmits, at each 15 second interval,

a 440 Hz beep-tone frequency of .5 second duration on the telecommunications network; the tone is disabled by opening ST1 and ST2. Voice Connecting Arrangement RTT is disconnected from the telecommunications network by replacing the handset on its cradle.

A call placed to a customer with a Voice Connecting Arrangement RTT is handled in a manner similar to a regular telephone call. When telephone station associated with the arrangement rings, the customer lifts the handset, Voice Connecting Arrangement RTT closes the contacts across leads OH1 and OH2, and as described above, the customer's equipment can subsequently cause a tone to be transmitted over the connection by closing a contact across ST1 and ST2 leads.

3.5 Grounding

In general, it is desirable that circuits in the customer's equipment which connect to the voice connecting arrangement have some path to ground. A direct or resistive ground on one side of the power supply would be an example of such a path. This practice avoids the possibility of the entire circuit involved being at an indeterminate potential with respect to ground. Such a potential, perhaps as a result of electrostatic induction, could result in an insulation breakdown in the arrangement. It is expected that the customer's equipment, if powered from commercial power, will be grounded in accordance with applicable electrical codes (NEC) and should be bonded to the telephone protection ground electrode when available. Self-powered or passive customer's equipment need not be grounded.

As an example, a good ground may be obtained with a proper connection to a metallic cold water pipe, using a single No. 6 AWG copper conductor. The other end should be connected to the ground return terminal of the customer's equipment. The run should be short, straight, and if possible, a continuous piece of wire. Proper attention should be given to provide 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 as the telephone protector or signal ground but not using the telephone ground clamp. This lead shall not be fused.

4. REFERENCES

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

(a) Bodle, D. W., and Gresh, P. A., "Lightning Surges in Paired Telephone Cable Facilities," Bell System Technical Journal, 40, No. 2 (March 1961).

*(b) "Principles of Electricity Applied to Telephone and Telegraph Work," by American Telephone and Telegraph Company, New York, New York.

*(c) "Switching Systems," by American Telephone and Telegraph Company, New York, New York.

*(d) "Notes on Distance Dialing - 1968," by American Telephone and Telegraph Company, New York, New York.

*Available through Graybar Electric Company.

5. GLOSSARY*

COMMUNICATIONS SYSTEMS - denotes channels and other facilities which are capable, when not connected to Long Distance Message Telecommunication service, of communications between customer-provided terminal equipment or Telephone Company stations.

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 system, are so connected either electrically, acoustically, or inductively.

DIRECT ELECTRICAL CONNECTION - denotes a physical connection of the electrical conductors in the communications path.

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 system.

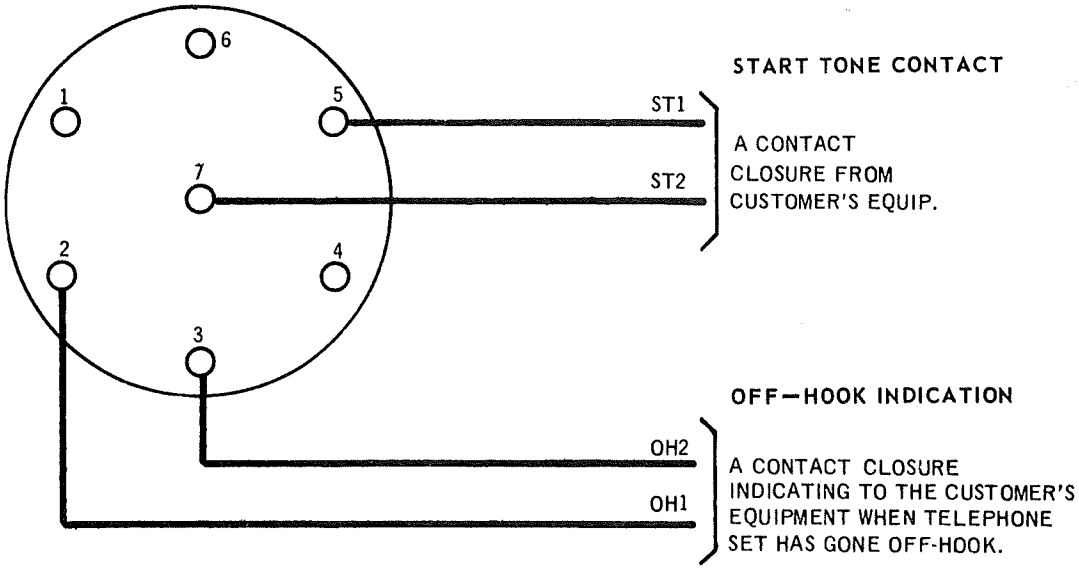
NETWORK CONTROL SIGNALING UNIT - denotes the equipment furnished, installed and maintained by the Telephone Company for the provision of network control signaling used with the voice connecting arrangement.

TELECOMMUNICATIONS NETWORK - the Bell System switched message network including switching equipment, associated interconnecting facilities and station equipment which connects its customers together.

*May differ in letter from exact wording as used in the Tariffs.

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

VOICE CONNECTING ARRANGEMENT - Voice Connecting Arrangement RTT provided by the Telephone Company to provide the means to cause a tone to be transmitted over an established connection over the telecommunications network.



TYPICAL CONNECTIONS FOR SK-M7-21C CANNON PLUG

Fig. 1

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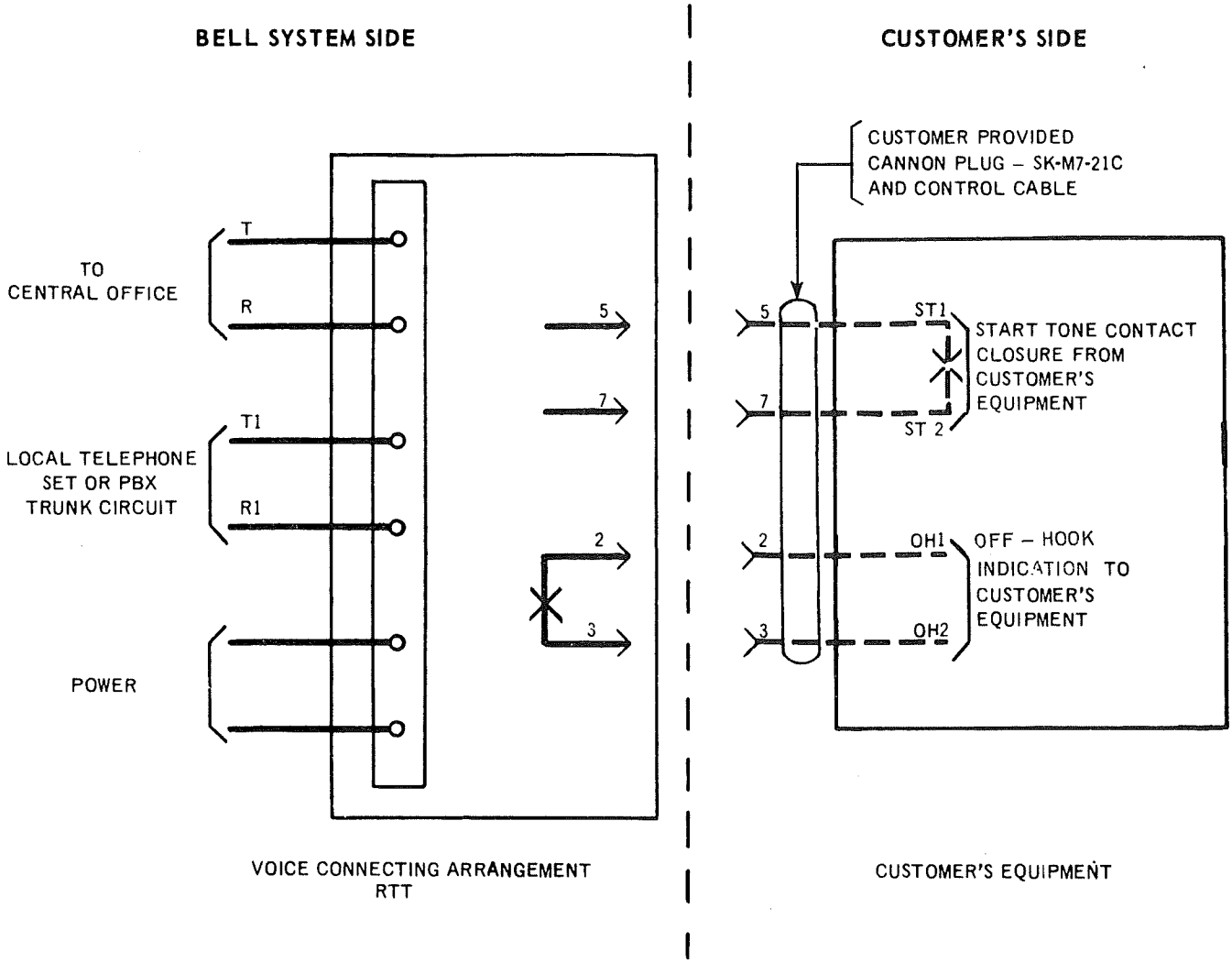

INDICATES NORMALLY OPENED CONTACT

TYPICAL CONNECTIONS FOR VOICE CONNECTING ARRANGEMENT RTT

Fig. 2