PUB 42206

PRELIMINARY

Bell System Voice Communications
TECHNICAL REFERENCE

Connecting Arrangement

RC1

Interface Specification

February 1971

ENGINEERING DIRECTOR - CUSTOMER TELEPHONE SYSTEMS

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TECHNICAL REFERENCE

CONNECTING ARRANGEMENT RC1

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CONNECTING ARRANGEMENT RC1

1. GENERAL

1.1 Introduction

F.C.C. Tariffs and corresponding intrastate tariffs filed by the Bell System provide for the direct electrical connection of customer-provided terminal equipment and communications systems to the Bell System telecommunications network. The tariffs also provide for the indirect (acoustic or inductive) connection of such equipment or system. Both methods require compliance with network protection criteria given in the tariffs.

Direct electrical connection is made through a connecting arrangement and associated network control signaling unit furnished, installed, and maintained by the Telephone Company.

1.2 Application

Connecting Arrangement RC1 provides the means for customer-provided equipment to cause the connecting arrangement to transmit a short burst of 1400 Hz tone. This tone is to be transmitted only to the local telephone set (not to the distant party) at approximately 15 second intervals. In addition the connecting arrangement provides an indication of line seizure to the customer-provided equipment. The initiation and duration of the tone transmission (but not the repetition rate) is under the control of the customer's equipment. There is no transmission path provided to the customer's equipment. Connecting Arrangement RC1 may be associated with an individual telephone line with a PBX trunk, or with Centrex facilities where equipment permits. This arrangement is typically used with customer-provided call duration timing equipment.

1.3 Ordering and Identification

The connection service described in this Technical Reference is identified by the Bell System as Connecting Arrangement RC1. The local Telephone Company business office or Marketing representative will provide information regarding availability and rates for this service.

2. DESCRIPTION

2.1 Functions

The major functions of this 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 to the local telephone set but not to the distant party. The associated telephone set or PBX is used for network control signaling and provides access to and from the switched telecommunications network.

2.2 Physical

Connecting Arrangement RC1 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. A Telephone Company-provided plug-in transformer connected to a 117±12 volt, 60±1 Hz power source is required to supply the low voltage dc power for this unit.

2.3 Interface Leads

Two interface leads are provided from Connecting Arrangement RC1 and are terminated on a Cannon plug. Pins 7 and 2 of the Cannon plug (see Fig. 1) are designed ST1 and ST2, respectively, Technical information pertaining to these leads is discussed in Section 3.

The customer must provide the mating Cannon Plug SK-M7-21C-1/2 (or equivalent) and cable to connect his equipment to Connecting Arrangement RC1.

3. OPERATION

3.1 Originating a Call

A call using Connecting Arrangement RC1 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 Connecting Arrangement RC1 changes the potential across leads ST1-ST2 from 0 volts open circuit to 22 volts dc), assures that dial tone is being received and dials the desired telephone number. During the calling process, Connecting Arrangement RC1 is 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 bridges the connecting arrangement across the telephone line. The arrangement transmits, at each 15 second interval, a 1400 Hz tone frequency of approximately .5 second duration to the local party, the tone is not transmitted to the distant party. The tone is disabled by opening the

contract associated with leads ST1 and ST2. Connecting Arrangement RC1 is disconnected from the telecommunications network by replacing the handset on its cradle.

3.2 Receiving a Call

A call placed to a station equipped with Connecting Arrangement RC1 is handled in a manner similar to a regular telephone call. When the telephone station associated with the arrangement rings, the customer lifts the handset, Connecting Arrangement RC1 is enabled and as described above, the customer's equipment can subsequently cause a tone to be transmitted to the local party by closing a contact across ST1 and ST2 leads.

4. SPECIFIC DESIGN CONSIDERATIONS

4.1 Transmission Path

Since there is no transmission path between the customer-provided equipment and the telecommunications network, there are no specific transmission design considerations.

Under control of leads ST1 and ST2, the connecting arrangement will transmit to the local party a 1400 Hz tone of approximately .5 seconds duration once in each 15 second interval. The 15 second interval is automatically provided in the connecting arrangement.

4.2 DC Signaling Paths

Only two interface leads per circuit are provided from Connecting Arrangement RC1 for the customer's use. These leads are used for two purposes as indicated below.

Start (leads ST1, ST2) - a closure is applied and maintained by the customer's equipment to cause a 1400 Hz "beep" tone, generated in the coupler unit, of approximately .5 second duration repeated at 15 second intervals, transmitted to the local telephone set. The contact in the customer's equipment should be capable of handling 40 volts dc and 20 milliamperes.

Off-Hook (leads ST1, ST2) - the same leads may 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. 3). When the line is seized, contacts OH close 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 to start a timing sequence for measuring call duration.

5. GENERAL DESIGN CONSIDERATIONS

5.1 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 associated with the telephone line through the voice connecting arrangement, the customer's equipment is protected from longitudinal surges. 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.

5.2 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 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*

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.

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

5.3 Grounding

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 ground electrode to which the telephone protector is grounded but not using the telephone ground clamp. Self-powered or passive customer's equipment need not be grounded. 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. The run should be short, straight, and a continuous piece of wire. 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.

6. SERVICE AND MAINTENANCE CONSIDERATIONS

6.1 Responsibility of the Customer

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

> Where long distance message telecommunications service or WATS Service is available under the appropriate 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.

6.2 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 and WATS 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 qualify 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.

6.3 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

PRELIMINARY

APPENDIX A

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.

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

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APPENDIX A

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

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

CONNECTING ARRANGEMENT - Connecting Arrangement RC1 provided by the Telephone Company to provide the means to cause a tone to be transmitted by the connecting arrangement to the local party of over an established connection.

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APPENDIX B

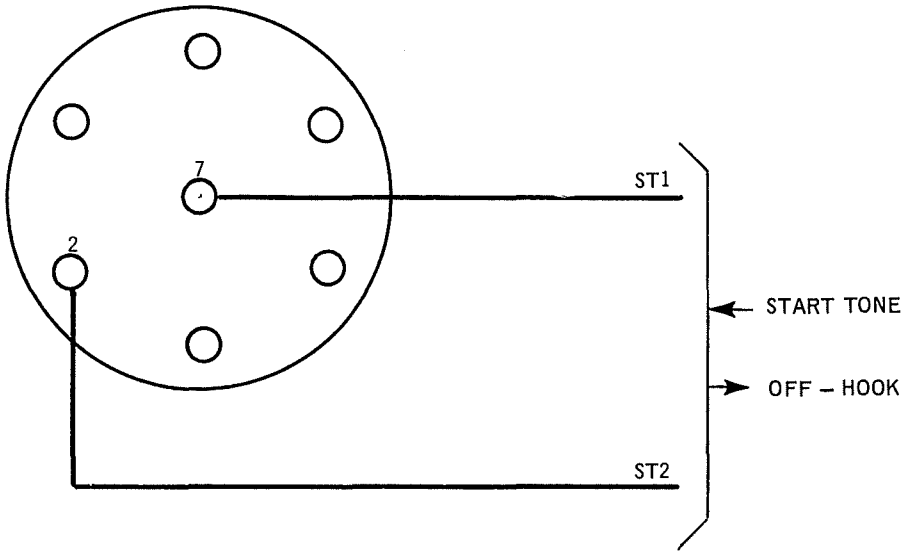
Some references describing various characteristics of the telecommunications network are listed below:

(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.

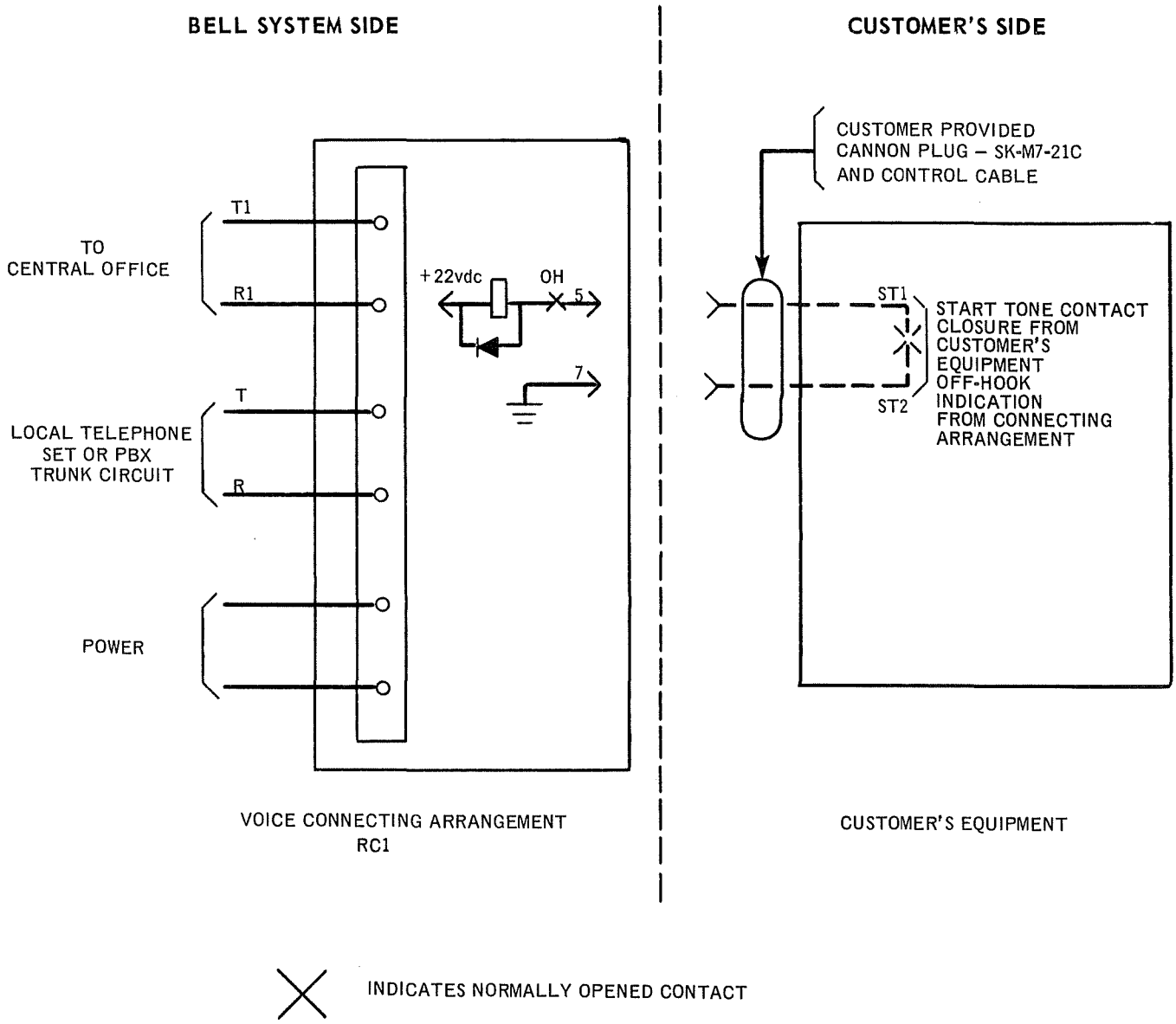
*(c) "Switching System," by American Telephone and Telegraph Company, New York, New York.

*Available through: Western Electric Company, Incorporated
Commercial Relations
P. O. Box 1579
Newark, New Jersey 07102



TYPICAL CONNECTIONS FOR SK-M7-21C CANNON PLUG

FIG. 1



TYPICAL CONNECTIONS FOR CONNECTING ARRANGEMENT RC1

FIG. 2