

Bell System

TECHNICAL REFERENCE

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VOICE CONNECTING ARRANGEMENTS DCK/DCL

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Bell System Voice Communications
TECHNICAL REFERENCE

Voice
Connecting
Arrangements

DCK
DCL
Interface
Specification

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ENGINEERING DIRECTOR – CUSTOMER EQUIPMENT SYSTEMS



NOTICE

This Technical Reference is published by American Telephone and Telegraph Company as a guide for the designers, manufacturers, and consultants of customer-provided systems and equipment which connect with Bell System communications systems or equipment. American Telephone and Telegraph Company reserves the right to revise this Technical Reference for any reason, including, but not limited to, conformity with standards promulgated by ANSI, EIA, CCITT, or similar agencies; utilization of new advances in the state of the technical arts; or to reflect changes in the design of equipment or services described therein. The limits of responsibility and liability of the Bell System with respect to the use of customer-provided equipment and systems are set forth in the appropriate tariff regulations.

This Technical Reference supersedes and replaces Bell System Voice Communications Technical Reference for Voice Connecting Arrangement DCK dated May 1972.

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**TECHNICAL REFERENCE
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1. GENERAL

1.1 Introduction

FCC tariffs and corresponding intrastate tariffs filed by the Bell System 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 connecting arrangement. The connecting arrangement includes circuit elements to provide signaling functions as well as certain other protection functions and is furnished, installed, and maintained by the Telephone Company. In addition, the tariffs require compliance by the customer-provided equipment with certain protection criteria specified therein.

1.2 Application

Voice Connecting Arrangements DCK and DCL typically provide one-way outgoing access from stations of a Bell System PBX or Centrex switching system to customer-provided terminal equipment which does not have access to the message network (typically, a radio paging system, dictation equipment, or information retrieval system) via a trunk level connection using a dial access code (eg, dial "7"). Voice Connecting Arrangement DCK provides this service when the customer-provided terminal equipment is located on the same premises as the switching equipment. Voice Connecting Arrangement DCL is used when the customer-provided terminal equipment and the switching equipment are located on different premises.

These protective connecting arrangements (Fig. 1) are intended for voice-only transmission (including TOUCH-TONE[®] signals) from stations (including off-premises) that are either directly connected to the switching system on which the arrangement is installed, or connected to such a switching system over dial tie lines from another switching system furnished to the same customer. No provision is

made for connections between Voice Connecting Arrangement DCK or DCL and the long distance message telecommunications network. The arrangements will accommodate both rotary dial and TOUCH-TONE stations. The dial control information is passed to the customer-provided equipment as dial pulses over a separate path. TOUCH-TONE control signals are passed directly over the voice transmission path.

1.3 Ordering and Identification

The protective connection services described in this Technical Reference are identified by the Bell System as Uniform Service Order Codes (USOC) DCK and DCL. When ordering these services, the customer should specify these codes. 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 these protective connecting arrangements are:

- (a) To protect Telephone Company personnel and facilities from hazardous voltages which may be applied by the customer-provided equipment.
- (b) To limit abnormally high speech and supervisory signal levels from the customer-provided equipment.
- (c) To provide dial pulse or TOUCH-TONE access from stations to the customer-provided equipment.
- (d) To permit stations to dial additional dial pulse or TOUCH-TONE digits after access, when required, for control of the customer-provided equipment.
- (e) To provide the capability for two-way voice transmission between the Bell System switching system and the customer-provided equipment.
- (f) To provide for accepting answer supervision and out-of-service indication signals from the customer-provided equipment.

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2.2 Physical

Voice Connecting Arrangements DCK and DCL consist of relay equipment mounted on one 23-inch mounting plate. The plate will be mounted either on a relay rack or in a wall-mounted apparatus box on the customer's premises near the PBX equipment. In the case of Voice Connecting Arrangement DCL which is remotely located from the switching equipment, a -48 volt rectifier power supply is provided. The power supply requires a grounded outlet connection to a non-switched customer-furnished nominal 117 ± 12 volt, 60 ± 1 Hz source, fused at 15 amperes. The protective connecting arrangements will function satisfactorily within a temperature range of 0° to 55° C and a relative humidity range of 5 to 95 percent.

2.3 Interface Leads

Ten leads per circuit are provided from Voice Connecting Arrangements DCK and DCL for the customer's use. Technical information pertaining to the interface leads is covered in Section 4. The leads and their functions are as follows:

<u>Lead Designation</u>	<u>Function</u>	<u>Direction</u>
CT } CR }	Voice transmission and TOUCH-TONE signals	To and from customer-provided equipment
CS1 } CS2 }	Seizure of arrangement	To customer-provided equipment
CDP1 } CDP2 }	Serial dial pulsing	To customer-provided equipment
CS } CG }	Answer supervision	From customer-provided equipment
COS } COSG }	Out-of-service indication	From customer-provided equipment

Leads from these protective connecting arrangements will be terminated on a Telephone Company-provided Interface Connecting Block conveniently located within 25 feet of the connecting arrangement 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 the customer-provided equipment to the voice connecting arrangement at this block.

A typical Interface Connecting Block is shown in Fig. 2. The "quick connect" type "66" connecting block utilizes tin-plated spring clip terminal strips which accommodate unstripped, polyethylene or polyvinyl chloride-insulated (8 mils maximum thickness) conductors of 20 through 26 AWG. A Reliable Electric R714B Tool or equivalent is used to press the insulated wire down into the slot. The spring pressure of the clip cuts away the insulation and makes the electrical connection. The Telephone Company will provide the bridging clips between the second and third terminals of the block to interconnect the leads. The clips should be removed by the customer's representative when it is necessary to test toward the customer-provided equipment and then replaced 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 CS-CG or COS-COSG leads measured at the block shall not exceed 900 ohms when indicating a closure.

3. OPERATION

3.1 General

By dialing an assigned access code (eg, "7"), the station user of a PBX or Centrex system will be connected automatically by the switching system to Voice Connecting Arrangement DCK or DCL which, if idle, will immediately complete the connection to the customer-provided equipment without an alert indication tone (ringing indication). If the arrangement is busy or out of service, busy tone will be returned by the switching equipment. After seizure, call status information, eg, ringing or second dial tone, is only returned to the caller when

provided by the customer-provided equipment. If dialed digit control of the customer-provided equipment is necessary, the caller dials the required digital code. The dialed information is repeated directly into the customer-provided equipment over a separate pair on a dial pulse basis from rotary dial stations or, if from TOUCH-TONE stations, it is passed directly over the transmission path as TOUCH-TONE signals (Fig. 3).

If answer delay or dial delay is required for the customer-provided equipment, appropriate call progress tones should be provided by the customer-provided equipment. This tone should then be removed as an indication that the caller may begin voice transmission and/or dialed digit control. These control digits may be dialed at any time during the connection. Under normal operation, the arrangement remains in this condition until the calling party disconnects, restoring the circuit to the idle condition.

With Voice Connecting Arrangement DCK or DCL, the attendant obtains access by dialing the assigned access code in the same manner as a station user.

3.2 Idle Condition

When the customer-provided equipment is ready to accept calls, it shall provide a closure between the COS and COSG leads which operates a relay in the arrangement removing the out-of-service busy indication to dial access. It is not necessary to remove and reapply this continuity after each call.

3.3 Seizure

By dialing an assigned access code from a station, the caller will automatically be connected by the switching equipment to Voice Connecting Arrangement DCK or DCL which, if idle, will complete the connection to the customer-provided equipment. If the arrangement is busy, busy tone will be returned. The arrangement will provide contact closures between the CS1 and CS2 leads and between the CDP1 and CDP2 leads indicating seizure to the customer-provided equipment.

3.4 Answer Supervision

Answer supervision can be provided by the

customer-provided equipment by connecting CS to CG. This answer signal may come at any point in the call subject to the following conditions:

- (a) When access to the DCK or DCL has been through tie trunk circuits, some of these trunks can no longer transmit dial pulses after answer supervision has been returned.
- (b) The answer signal sent by DCK or DCL in response to the customer-provided signal on CS and CG consists of a polarity reversal. This reversal will make TOUCH-TONE dials inoperative unless they have been specially equipped with polarity guards.

When an answer signal is provided, it should be removed when the calling party disconnects as indicated by an open on CBS1 and CBS2. Answer supervision can also be removed prior to the calling party release signal on the CBS1 and CBS2, but the DCK or DCL will not be available for another call until the calling party releases the connection.

3.5 Dialing to the Customer-Provided Equipment

After seizure has been sent to the customer-provided equipment, it is desirable that a audible equipment-ready indication (ie, second-dial tone) be returned over the CT and CR leads as an indication for the caller to begin dialing.

3.51 Dial Pulses

Dial pulses from rotary dial stations are repeated over the CDP1 and CDP2 leads for control of the customer-provided equipment. These leads are closed by the arrangement on seizure and opened with each dial pulse.

3.52 TOUCH-TONE Signals

Tone signals from TOUCH-TONE stations are passed directly over the voice transmission path, the CT and CR leads, for control of the customer-provided equipment.

3.53 Customer-Provided Equipment Response to Dialed Digits

After the customer-provided equipment has received the required digits (either dial pulse or TOUCH-TONE signals) and if additional connection time is required before voice transmission can begin, it is desirable for the customer-provided equipment to return an audible alert tone (ringing indication) to the caller over the CT and CR leads.

When the customer-provided equipment is ready to receive or transmit voice signals, it should remove the alert tone (if provided) as an indication that the calling party may now transmit to, or receive voice messages from, the customer-provided equipment. At any time during the call, the calling station dial (TOUCH-TONE or dial pulse) may be used for incidental signaling, for example, for control of dial dictation equipment.

3.6 Disconnect

When the calling party goes on-hook, the closures between the CS1 and CS2 leads and between the CDP1 and CDP2 leads are opened, thereby causing Voice Connecting Arrangement DCK or DCL to return to the idle condition. If the customer-provided equipment gave an answer signal (CS-CG), it should be removed at this time.

Release of an answer signal (CS-CG) by the customer-provided equipment will not cause the voice connecting arrangement to become available for another call; the calling party must go on-hook.

4. SPECIFIC DESIGN CONSIDERATIONS

4.1 Transmission Path

The speech transmission circuit provides a two-way path for voice transmission, for passing tone control signaling information to the customer-provided equipment, and for receiving various call progress signals from the customer-provided equipment.

4.11 Insertion Loss

The insertion loss of Voice Connecting Arrangements DCK and DCL is a nominal 1 dB

over the voice-frequency range of approximately 300 Hz to 3000 Hz. No voice signal amplification is provided.

4.12 Impedance

Voice Connecting Arrangements DCK and DCL provide approximately a one-to-one impedance transformation. For design purposes, the input impedance of this arrangement should be considered to be 600 ohms. Therefore, the impedance of the customer-provided equipment likewise should be 600 ohms for optimum speech transmission performance.

4.13 Bandwidth

The nominal voice-frequency bandwidth of the connection between the extension station and the customer-provided equipment extends from about 300 Hz to 3000 Hz.

4.14 Signal Power Level

The maximum available power from a customer-provided source (to the voice connecting arrangement) when averaged over any 3-second interval (measured at the CT and CR leads with a 600-ohm load substituted for the connecting arrangement) should not exceed -12 dBm. This limit has been set so as to be compatible with levels set for tie line service at the switching equipment in order to prevent excessive noise or crosstalk from interfering with other services.

Using measuring Method A (see Paragraph 4.15), the maximum power averaged over any 3-second interval will, in almost all cases, not exceed -12dBm if the maximum meter swing does not exceed 81 dBm. With the additional damping of measuring Method B, the power averaged over any 3-second interval will not exceed -12 dBm if the maximum meter swing does not exceed 79 dBm.

4.15 Measuring Maximum Available Inband Power

The measuring methods described below are satisfactory for estimating the maximum power averaged over a 3-second interval to determine that the inband signal power criteria specified in Paragraph 4.14 are being met.

Method A

Operate the customer-provided equipment into a 600-ohm load (this assumes that the customer-provided equipment has 600-ohm source impedance), bridged by a Hewlett-Packard Transmission and Noise Measuring Set — Model 3555B, or a Western Electric 3-Type Noise Measuring Set or the equivalent.* To ensure a proper measurement technique, the control settings on these meters should be as shown below.

Western Electric 3-Type Noise Measuring Set

<u>Control</u>	<u>Setting</u>
FUNCTION (Switch)	BRDG
NORM/DAMP (Switch)	DAMP
WTG (Plug-in Network)	3K Hz FLAT

Hewlett-Packard Transmission and Noise Measuring Set Model 3555B

<u>Control</u>	<u>Setting</u>
INPUT (Switch)	NOISE/BRDG
FUNCTION (Pushbutton)	VF/Nm-600 BAL
NOISE WTG (Switch)	3K Hz FLAT
NORM/DAMP (Switch)	DAMP

Method B

The accuracy of Method A can be somewhat improved by increasing the size of the damping capacitance in the Western Electric 3-Type Noise Meter by 150 microfarads. To do this, connect the negative lead of a 150 microfarad capacitor to either terminal of the NORM/DAMP switch and connect the positive lead to ground. This allows the meter to more nearly approximate a 3-second averaging meter. (NOTE: This modification does not necessarily hold for the Model 3555B or noise meters other than the Western Electric 3-Type.)

*These meters do not have a 3-second averaging time but, when used to measure speech, they give a reliable estimate of a 3-second average. The use of meters with shorter time constants, such as VU meters or standard voltmeters, is not recommended.

4.16 Signal Power Distribution

A tandem tie trunk network may incorporate tone signaling devices that are used for tandem network control functions. These devices, when used, are connected at all times to the telephone circuit and are designed to detect a single-frequency tone at 2600 Hz. They are, however, relatively insensitive to energy at this frequency if sufficient energy is present at the same time at other frequencies in the voiceband.

In order to prevent the interruption or disconnection of a call, or interference with network control signaling, it is necessary that the signal applied by the customer-provided equipment to the protective voice connecting arrangement at no time have energy solely in the 2450 Hz to 2750 Hz band. If signal power is in the 2450 to 2750 Hz band, it must not exceed the power present at the same time in the 800 to 2450 Hz band.

4.17 Out-of-Band Signal Power Limits

To protect other services, it is necessary that the signal which is applied by the customer-provided equipment to the Telephone Company interface, located on the customer's premises, meet the following limits:

- (a) The power in the band from 3995 Hz to 4005 Hz shall be at least 18 dB below the signal level specified in Paragraph 4.14.
- (b) The power in the band from 4000 Hz to 10,000 Hz shall not exceed 16 dB below one milliwatt.
- (c) The power in the band from 10,000 Hz to 25,000 Hz shall not exceed 24 dB below one milliwatt.
- (d) The power in the band from 25,000 Hz to 40,000 Hz shall not exceed 36 dB below one milliwatt.
- (e) The power in the band above 40,000 Hz shall not exceed 50 dB below one milliwatt.

4.18 Tone Address Signaling

The signaling code for the Bell System TOUCH-TONE calling system provides for 16 distinct signals. Each signal is composed of two voiceband frequencies, one from each of two mutually exclusive frequency groups of four

frequencies each. The signal frequencies are spaced and selected on the basis that the two frequencies of any valid signal combination are not harmonically related. The frequency pairs assigned for the signaling are as follows:

		<u>Nominal High</u>			
		<u>Group Frequencies (Hz)</u>			
		<u>1209</u>	<u>1336</u>	<u>1477</u>	<u>1633</u>
<u>Nominal</u>	<u>697</u>	1	2	3	Spare
<u>Low Group</u>	<u>770</u>	4	5	6	Spare
<u>Frequencies</u>	<u>852</u>	7	8	9	Spare
<u>(Hz)</u>	<u>941</u>	*	0	#	Spare

Bell System TOUCH-TONE signals can be expected to have the following characteristics at the originating station:

1. Frequency Deviation
Tone frequencies should be within ± 1.5 percent of their nominal values.
2. Extraneous Frequency Components
The total power of all extraneous frequencies accompanying the signal should be at least 20 dB below the signal power, in the voiceband above 500 Hz.
3. Voice Energy Suppression
Voice energy from the telephone transmitter or other source should be suppressed (eg, the transmitter should be muted) at least 45 dB during tone signal transmission. In the case of automatic dialing, the suppression should be maintained continuously until pulsing is completed.
4. Rise Time
Each of the two frequencies of the signal should attain at least 90 percent of full amplitude within 5 ms, and preferably within 3 ms for automatic dialers, from the time that the first frequency begins.

5. Tone Leak
Tone leak during signal off time should be less than -55 dBm.

6. Transient Voltages
Peak transient voltages generated during tone signaling should be no greater than 12 dB above the zero-to-peak voltage of the composite two-frequency tone signal.

The levels of the received TOUCH-TONE signals are dependent upon the levels of the signals transmitted, which vary widely, since they are affected by the type of switching equipment, the length of the station loop from the switching system, and whether the calling station is dialing over a tie trunk from another switching system. Therefore, the levels of the received TOUCH-TONE signals will experience even wider variations, and hence cannot be specified.

4.19 Signal Limiting

A voice signal limiter is incorporated in the transmission path of Voice Connecting Arrangements DCK and DCL to protect the tandem tie trunk network from applications of abnormally high signal levels. This has no effect on normal voice or tone address signal levels. This limiter does not abrogate the customer's responsibility to meet the network protection criteria, as prescribed in the tariffs and as outlined in Paragraph 4.14.

4.2 DC Signaling Paths

4.21 General Description

The equipment provided for Voice Connecting Arrangements DCK and DCL by the Telephone Company consists of an arrangement of relays and other components designed to translate pulses received from a station set into control signals for the customer-provided equipment (Fig. 3).

4.22 Seizure Path

The CS1 and CS2 leads provide a contact closure to the customer-provided equipment when the arrangement is seized on an incoming call. These leads open upon disconnect of the caller. The open circuit resistance is greater than

100,000 ohms and the closed circuit resistance is less than 5 ohms (equivalent to 80 feet of 24-gauge wire, including contact resistance). The customer-provided equipment load on the CS1 and CS2 leads shall not exceed 350 milliamperes peak. The customer's equipment shall ensure that the peak current limitation is not exceeded.

4.23 Pulsing Path

The CDP1 and CDP2 leads provide a contact closure to the customer-provided equipment on seizure and repeat dial pulses from the calling station. These leads are closed when the trunk is seized, opened with each dial pulse, and opened upon disconnect of the caller. The open circuit resistance is greater than 100,000 ohms and the closed circuit resistance is less than 5 ohms (equivalent to 80 feet of 24-gauge wire, including contact resistance). The customer-provided equipment load on the CDP1 and CDP2 leads shall not exceed 350 milliamperes peak. The customer-provided equipment shall ensure that the peak current limitation is not exceeded.

The dial pulses will be generated at a nominal rate of 10 pulses per second, with a minimum of 8 pulses per second and a maximum of 11 pulses per second. When the calling party is connected directly to the PBX, the percent break will be in the range of 50 to 70 percent. The percent break will be between 25 percent and 90 percent when the calling party is connected by way of a tie trunk. The minimum interdigital time will be 600 ± 30 milliseconds. The contact used to supply dial pulse information over the CDP1 and CDP2 leads will provide bounce-free transitions during dialing.

4.24 Supervisory Path

Leads CS and CG provide -44 to -52 volts dc (-48 volts nominal) through a 640-ohm relay on lead CS and ground on lead CG. When indicating a closure, the external resistance, including contact resistance, across these leads measured at the Interface Connecting Block toward the customer-provided equipment shall not exceed 900 ohms.

4.25 In-Service Path

Continuity shall be provided by the customer-provided equipment between the COS and

COSG leads to indicate that the equipment is available for service. An open on this pair will busy out the switching equipment access to the circuit. It is not necessary to remove and reapply this continuity after each call.

These leads provide -48 volts (nominal) dc through a 640-ohm relay on the COS lead and ground on the COSG lead. When indicating a closure, the external loop resistance, including contact resistance, across these leads measured at the Interface Connecting Block toward the customer-provided equipment shall not exceed 900 ohms.

4.3 Grounding

Voice Connecting Arrangements DCK and DCL are provided with a common signal ground (a metallic cold water pipe or other approved ground) which is always bonded to the electric power ground and the telephone protector ground, where present. Interface leads COSG and CG are grounded in the protective connecting arrangement and may be used only to supply ground for the voice connecting arrangement control relays. It is not permitted to use these leads to derive the main ground for the customer's equipment. The general grounding requirements for the customer-provided equipment are covered in Paragraph 5.2.

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 voice 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. 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. 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.

5.3 Tie Line Network Characteristics

Transmission engineering information for tie trunks is described in Transmission Engineering Technical Reference "Private Line Interconnection - Voice Applications" (PUB 43201).

This may be obtained as described in Appendix B.

6. SERVICE AND MAINTENANCE CONSIDERATIONS

6.1 Responsibility of the Customer

The tariffs regulating the connection to the telecommunications network by means of connecting arrangements of customer-provided terminal equipment or communications systems state that where telecommunications service is available under these tariffs for use in connection with terminal equipment or communications systems, 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 system 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 or make such change as shall be necessary to remove or prevent such hazard or interference.

The customer shall determine the protective connecting arrangement code (this information is supplied by the manufacturer of the customer-provided equipment) and order the quantity required by contacting the local Telephone Company and specifying the appropriate code. The arrangements described in this Technical Reference are ordered by specifying DCK or DCL.

6.2 Responsibility of the Telephone Company

The tariffs regulating the connection to the telecommunications network by means of connecting arrangements of customer-provided terminal equipment and communications systems state that the Telephone Company shall not be responsible for the installation, operation, or maintenance of said terminal equipment or communications systems. Telecommunications service is not represented as adapted to the use of customer-provided equipment or systems and where such equipment or systems are connected to Telephone Company facilities, the responsibility of the Telephone Company shall be limited to the furnishing of facilities, including the protective connecting arrangements and network control signaling units, suitable for telecommunications service and to the maintenance and operation of such facilities in a

manner proper for such 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 systems or for the quality of, or defects in, such transmission, (ii) the reception of signals by customer-provided equipment or systems, or (iii) address signaling where such signaling is performed by customer-provided tone-type signaling equipment. The Telephone Company shall not be responsible to the customer 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 facilities obsolete or require modification or alteration of such equipment or systems 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 at the interface to sectionalize the difficulty, ie, 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 in 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) Uniform Service Order Code (USOC) DCK or DCL
- (e) Description of the trouble
- (f) Customer's contact for additional information

If a Telephone Company service call results in the location of the trouble in the customer-provided equipment, the customer will be charged for the service call.

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.

CONNECTING ARRANGEMENT — protective equipment provided by the Telephone Company to accomplish the electrical connection of customer-provided equipment and the telecommunications network.

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.

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 voice connecting arrangement.

NETWORK CONTROL SIGNALING — denotes the transmission of signals used in the telecommunications network 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.

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.

VOICE CONNECTING ARRANGEMENT — a protective connecting arrangement designed primarily to transmit speech signals as contrasted to one designed primarily to transmit data signals.

APPENDIX B
REFERENCES

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

- *(a) McAdoo, K.L., "Speech Volumes on Bell System Message Circuits — 1960 Survey," Bell System Technical Journal (BSTJ), Vol. 42, No. 5 (September 1963), p. 1999.
- *(b) Gresh, P.A., "Physical and Transmission Characteristics of Customer Loop Plant," BSTJ, Vol. 48, No. 10 (December 1969), p. 3337.
- *(c) Breen, C., and Dahlbom, C.A., "Signaling Systems for the Control of Telephone Switching," BSTJ, Vol. 39, No. 6 (November 1960), p. 1381.
- *(d) Bodle, D.W., and Gresh, P.A., "Lightning Surges in Paired Telephone Cable Facilities," BSTJ, Vol. 40, No. 2 (March 1961), p. 547.
- ** (e) Bell System Transmission Engineering Technical Reference — PUB 43201 — Private Line Interconnection Voice Applications — June 1970.
- ** (f) Bell System Data Communications Technical Reference — PUB 41007 — 1969-1970 Switched Telecommunications Network Connection Survey (Reprints of Bell System Technical Journal Articles) — April 1971.
- *** (g) "Principles of Electricity Applied to Telephone and Telegraph Work," by American Telephone and Telegraph Company, New York, New York.
- *** (h) "Switching Systems," by American Telephone and Telegraph Company, New York, New York.
- (i) "Notes on Transmission Engineering," by United States Independent Telephone Association, Washington, D.C.
- *** (j) "Transmission Systems for Communications," by Bell Telephone Laboratories, Inc.
- *** (k) "Notes on Distance Dialing — 1968," by American Telephone and Telegraph Company, New York, New York.

*These journals may be purchased by writing to:

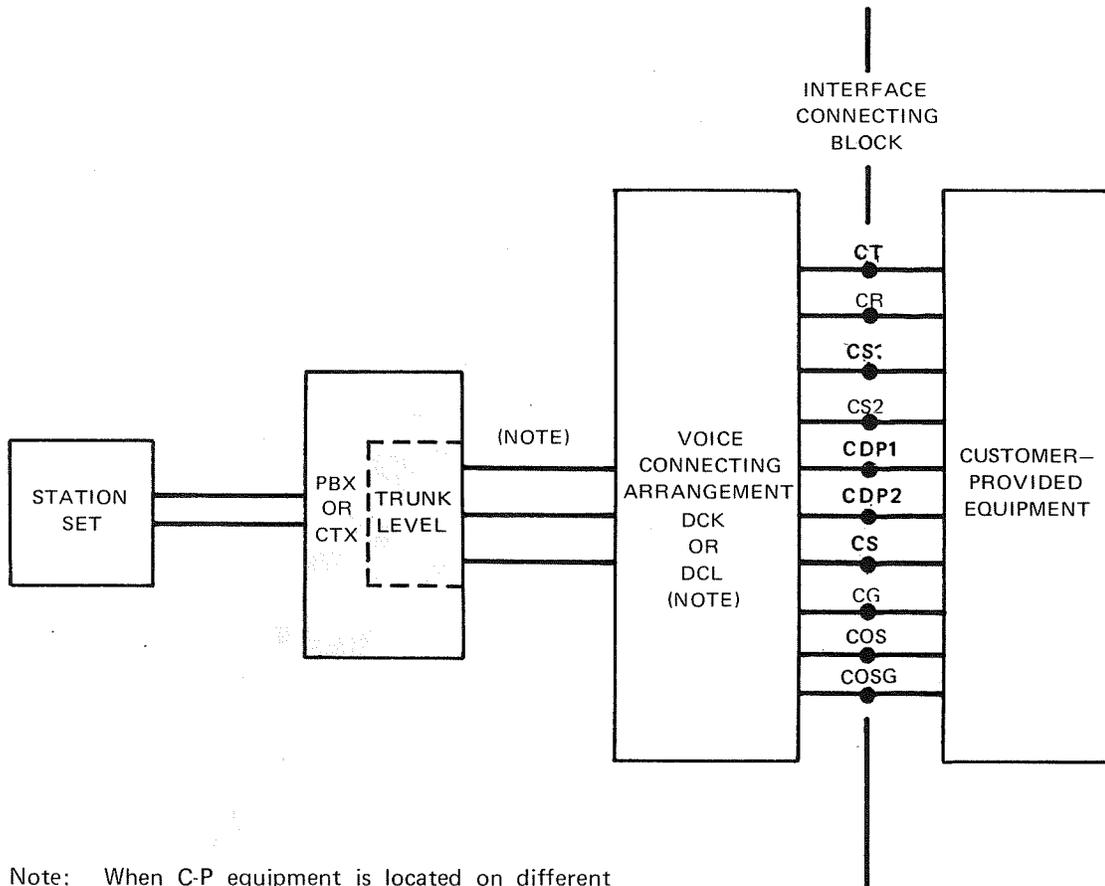
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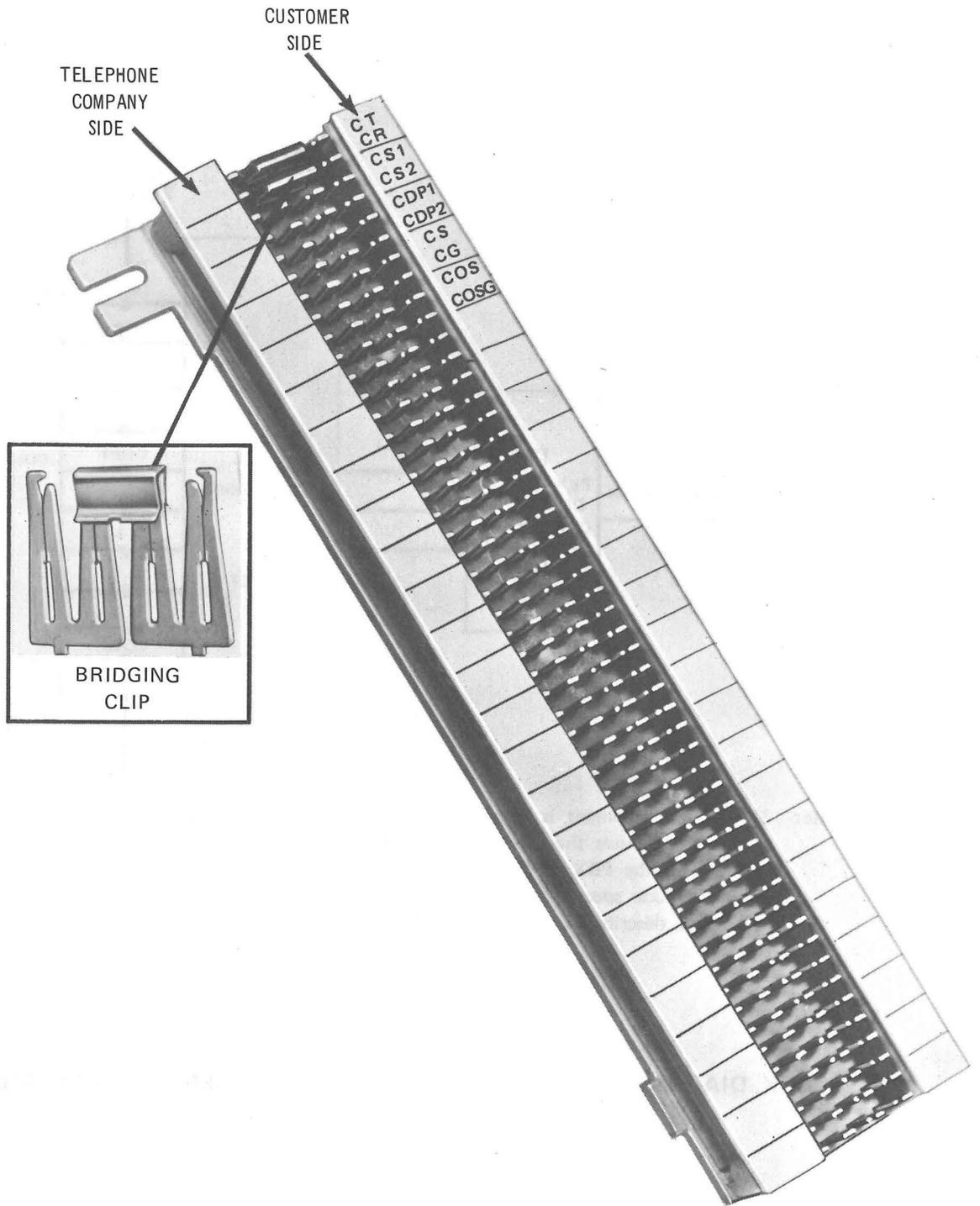
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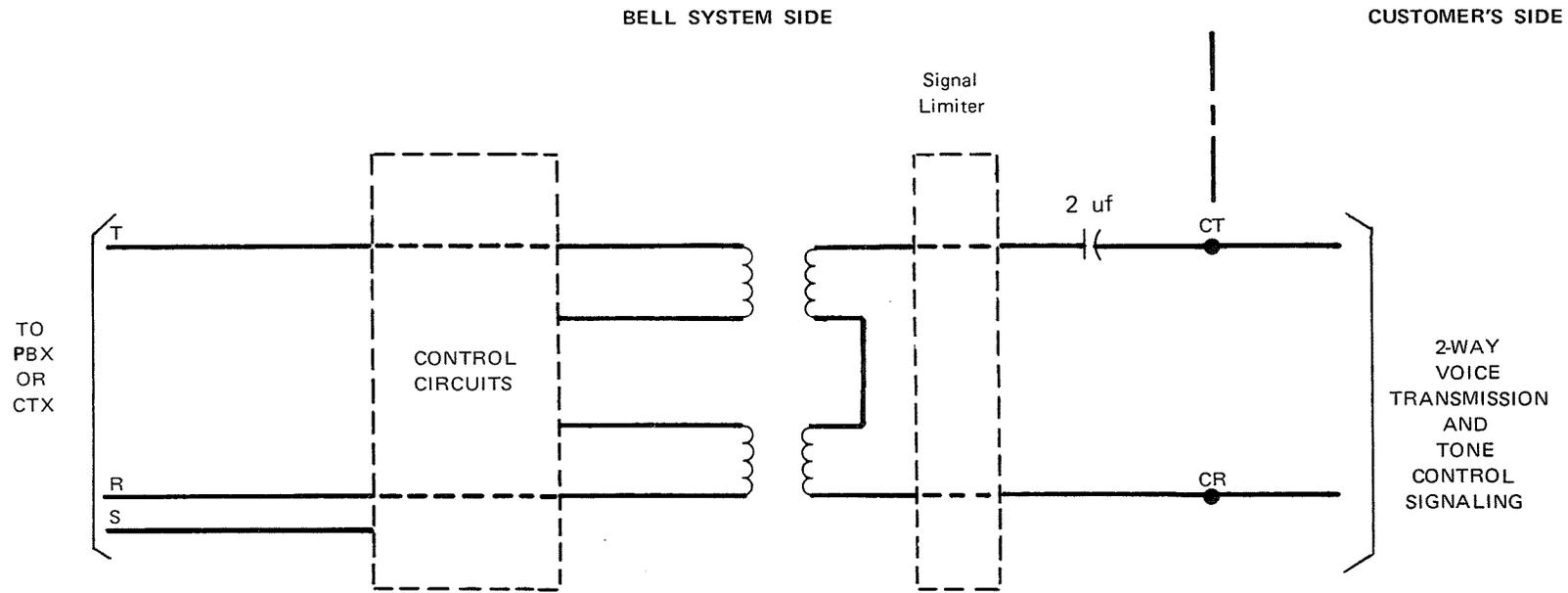
Note: When C-P equipment is located on different customer premises than the TELCO switching equipment, the PBX to DCK (DCL) arrangement would include special cable facilities and power supply as described in this technical reference.

BLOCK DIAGRAM – VOICE CONNECTING ARRANGEMENTS DCK AND DCL
FIG. 1

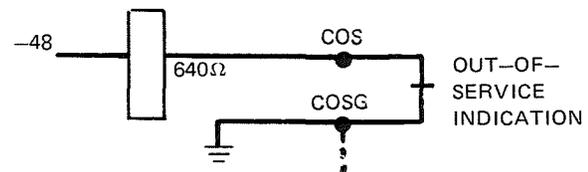
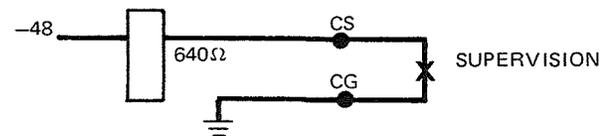
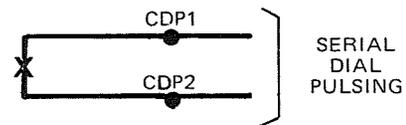
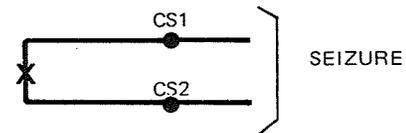


TYPICAL INTERFACE CONNECTING BLOCK

FIG. 2



Note: See footnote on Fig. 1 for DCL applications



SIMPLIFIED SCHEMATIC — VOICE CONNECTING ARRANGEMENTS DCK AND DCL
FIG. 3