

# PRELIMINARY

**Bell System Voice Communications  
TECHNICAL REFERENCE**

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**Voice  
Connecting  
Arrangement**

**C234W**

**Interface  
Specification**

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**February 1971**

**ENGINEERING DIRECTOR - CUSTOMER TELEPHONE SYSTEMS**



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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 systems and equipment are set forth in the appropriate tariff regulations.

If further information is required, please contact:

Engineering Director - Customer Telephone Systems  
American Telephone and Telegraph Company  
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New York, New York 10007

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VOICE CONNECTING ARRANGEMENT C234W

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## 1. GENERAL

### 1.1 Introduction

Tariff F.C.C. No. 260 and corresponding intrastate Tariffs filed by the Bell System provide for the direct electrical connection of customer-provided voice transmitting and receiving terminal equipment and communications systems to Bell System private line facilities. The Tariffs also provide for the indirect (acoustic or inductive) connection of such equipment or systems. Both methods require compliance with network protection criteria stated in the Tariffs.

Direct electrical connection is made through a voice connecting arrangement furnished, installed, and maintained by the Telephone Company.

### 1.2 Application

Voice Connecting Arrangement C234W provides a 4-wire voiceband connection between a customer-provided communications systems and a Bell System-provided private line facility (Fig. 1). Two pairs of transmission leads (receive pair and transmit pair) provide the voice transmission paths between this arrangement and the customer-provided communications system. No signaling or supervisory functions are provided by this arrangement. It is anticipated that the customer-provided terminal equipment will contain an inband signaling system. (See Section 3.2.)

### 1.3 Ordering and Identification

The connection service described in this Technical Reference is identified by the Bell System as Voice Connecting Arrangement C234W. One Voice Connecting Arrangement C234W should be ordered for each trunk

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which is to be connected to the customer-provided equipment. Contact your local Telephone Company business office or Marketing representative for information regarding rates for, and the availability of, this voice connecting arrangement for both new and additional service.

### 2. DESCRIPTION

#### 2.1 Functions

The major functions of this voice connecting arrangement are:

- (a) To protect Telephone Company personnel and facilities from hazardous voltages which may be applied to the voice connecting arrangement by the customer's equipment.
- (b) To provide voiceband and inband signaling transmission to and from a Telephone Company-provided private line facility (channel).
- (c) To limit abnormally high voice signal levels to the private line facility (channel).
- (d) To provide longitudinal balance.

#### 2.2 Physical

Voice Connecting Arrangement C234W consists of a 4-wire voice repeater circuit arranged to be assembled on a standard 23-inch relay rack provided and mounted by the Telephone Company in an appropriate location so that the front and back of this arrangement are accessible for testing and maintenance. Each equipment group provides facilities for two tie trunks. A -48 volt dc power supply (12 trunk circuit capacity) is also mounted on the relay rack. Each power supply requires a grounded outlet connection to a non-switched customer-furnished nominal 117  $\pm$ 12 volt, 60  $\pm$ 0.1 Hz source, fused at 15 amperes. This arrangement will function

satisfactorily within a temperature range of 0° to 55°C and a humidity range from 5 to 95 percent.

### 2.3 Interface Leads

Four interface leads (2-pair) per tie trunk are provided from Voice Connecting Arrangement C234W to an interface connecting block (see Fig. 1) for the customer's use. Technical information pertaining to these leads is discussed in Section 3.

The first pair, designated CT1 and CR1, provides a one-way voice transmission path from the transmission facility to the customer-provided equipment (receive pair). The second pair, designated CT and CR, provides a one-way voice transmission path from the customer-provided equipment to the transmission facility (transmit pair).

Leads from this 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 of his equipment to the voice connecting arrangement at this block.

A typical interface connecting block is shown in Fig. 2. This "quick connect" type "66" connecting block utilizes tin plated spring clip terminal strips which accommodate unstripped, insulated conductors of 20 to 26 gauge. 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 strapping wires between the second

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and third terminals of the block to interconnect the leads. The straps 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.

3. SPECIFIC DESIGN CONSIDERATIONS

3.1 Transmission Path

3.1.1 Insertion Loss

Voice Connecting Arrangement C234W contains voice frequency amplifiers (Fig. 3) in both the transmit and receive paths to compensate for facility loss and to establish the specified Transmission Level Points (TLP) at the interface. (See Paragraph 3.15.)

3.1.2 Impedance

The impedance of Voice Connecting Arrangement C234W is 600 ohms for both the transmit and receive pairs. Therefore, the customer-provided equipment should be 600 ohms for optimum voice signal power transfer across the interface.

3.1.3 Bandwidth

The nominal voice-frequency bandwidth of the voice grade private line facilities 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 with increasing frequencies in the upper half of the band and with decreasing frequencies in the lower half of the band. The voice connecting arrangement does not limit this bandwidth.

3.1.4 Voice Signal Power Levels

In order to prevent interference to other Telephone Company services, customer-generated voice signal levels must comply with certain

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minimum protection criteria. Tariff F.C.C. No. 260 and corresponding intrastate Tariffs which provide for the direct electrical connection of customer-provided communications systems with facilities furnished for private line service by the Telephone Company state that:

"Since private line channels utilize Telephone Company facilities in common with other services, it is necessary in order to prevent excessive noise and crosstalk that the power of the signal applied to the Telephone Company lines be limited. Because each private line service is individually engineered a single valued limit for all applications cannot be specified. Therefore, the power of the signal which may be applied by the customer-provided equipment to the Telephone Company interface located on the customer's premise will be specified by the Telephone Company for each application to be consistent with the signal power allowed on the telecommunications network."

For Voice Connecting Arrangement C234W the maximum acceptable voice signal power at the interface connecting block is -29 dBm on leads CT and CR (transmit pair) when averaged over any 3-second interval.

Voice Connecting Arrangement C234W is suitable for passing customer generated data signals provided they meet the 3-second average power limits outlined above. Further information on the data transmission characteristics of voice grade private lines can be found in the Data Communications Technical Reference, "Transmission Specifications for Voice Grade Private Line Data Channels" dated March 1969. In addition, if the transmitted signal level exceeds -29 dBm by more than 6 dB for a period exceeding 20 milliseconds, distortion may occur due to the properties of the limiter circuit in the voice connecting arrangement.

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Using measuring Method A (see Paragraph 3.16), in almost all cases, the speech power (averaged over any 3-second interval) will not exceed -29 dBm if the maximum meter swing does not exceed 64 dBrn. With the additional damping of measuring Method B, the power averaged over any 3-second interval will not exceed -29 dBm if the maximum meter swing does not exceed 62 dBrn.

3.15 Transmission Level Points (TLP)

In order to specify the levels between which the tie trunks will operate, common reference levels between the Telephone Company and the customer-provided equipment are required. For a tie trunk, the PBX switch in the outgoing (transmit) direction, at each end, is normally designated the 0 Transmission Level Point (0 TLP) for that direction of transmission, (see Fig. 1). All other level points on the tie trunk are referred to this point by the nominal loss (-) or gain (+) in dB between them at 1000 Hz. In designing their tie trunk facilities the Telephone Company will provide +7 (receive pair) and -16 (transmit pair) Transmission Level Points (TLP) at the interface connecting block as shown in Fig. 2. These values were chosen to provide standard interface levels which are readily available in commercial channel, signaling, and terminal equipment. Another advantage is that the customer's terminal equipment is not required to have gain devices.

The value -16 TLP at the interface connecting block requires the customer to provide a variable pad in the transmitting direction so that the loss from the PBX switch (0 TLP) to the interface connecting block (-16 TLP) is 16 dB (see Fig. 1).

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The desired loss in the receive direction, i.e., between the +7 TLP and the PBX switch, is a function of several factors including the intended use of the trunk, its length, and the type of channel facilities provided by the Telephone Company. Suggested loss values and other transmission engineering information for tie trunks is covered in Transmission Engineering Technical Reference "Private Line Interconnection - Voice Applications" available from:

Engineering Director - Transmission Services  
American Telephone and Telegraph Company  
195 Broadway  
New York, New York 10007

Those persons seeking further information should contact the local Telephone Company Transmission Engineering representative through their local business office or Marketing representative.

3.16 Measuring Maximum Available Inband Speech Power

The measuring methods described below are satisfactory for estimating the maximum power averaged over a 3-second interval to determine that the inband criteria discussed in Paragraph 3.14 is being met.

Method A

Operate the customer-provided equipment into a 600 ohm load, (this assumes that the customer-provided equipment has a 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 insure a proper measurement technique, the control

\* These meters do not have a 3-second averaging time but, when used on 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.

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settings on these meters should be as shown below:

<u>Western Electric 3-Type Noise Measuring Set</u>		<u>Hewlett-Packard Transmission and Noise Measuring Set Model 3555B</u>	
<u>Control</u>	<u>Setting</u>	<u>Control</u>	<u>Setting</u>
FUNCTION (Switch)	BRDG	INPUT (Switch)	NOISE/BRDG
NORM/DAMP (Switch)	DAMP	FUNCTION (Pushbutton)	VF/Nm-600 BAL
WTG (Plug-in Network)	3Kc FLAT	NOISE WTG (Switch)	3 kHz 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.)

3.17 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 47 dB below one milliwatt.
- (b) The power in the band from 4000 Hz and 10,000 Hz shall not exceed 32 dB below one milliwatt.

- (c) The power in the band from 10,000 Hz to 25,000 Hz shall not exceed 40 dB below one milliwatt.
- (d) The power in the band from 25,000 Hz to 40,000 Hz shall not exceed 52 dB below one milliwatt.
- (e) The power in the band above 40,000 Hz shall not exceed 66 dB below one milliwatt.

### 3.18 Signal Limiting

A voice signal limiter is incorporated in the transmission path to protect the Bell System private line network from applications of abnormally high signal levels. This has no effect on normal voiceband 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 3.14.

### 3.2 Signaling Methods

Voice Connecting Arrangement C234W does not provide any signaling functions. It is anticipated that the customer-provided terminal equipment would contain some type of inband signaling system. A discussion of inband single frequency signaling systems will be found in the Transmission Engineering Technical Reference "Private Line Interconnection - Voice Applications" (see Paragraph 3.15). The requirements outlined in that Technical Reference should be met where the customer-provided equipment must be compatible with Telephone Company-provided single frequency (SF) signaling systems.

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In situations where the customer-provided switching system can be connected to the telecommunications network, any 2600 Hz energy must be blocked by the customer's trunk equipment. Signal power distribution criteria for connecting arrangements used on Central Office trunks require that at no time shall energy solely in the 2450 to 2750 Hz band be applied to the connecting arrangement. 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. The customer-provided channel signaling equipment must be designed to insure that these requirements are met when the private line facilities using C234W is connected to the telecommunications network through the customer-provided switching equipment.

3.3 Grounding

Voice Connecting Arrangement C234W is provided with a common signal ground (a metallic cold water pipe or other ground approved by the NEC) which is bonded to the electric power ground and telephone protector ground, where present. The general grounding requirements for the customer-provided equipment are covered in Paragraph 4.3.

4. GENERAL DESIGN CONSIDERATIONS

4.1 Foreign and Surge Voltage Protection

Where telephone lines are exposed to foreign voltages by direct contact or induction (e.g., power line crosses or lightning), protective devices are installed at the Central Office and on the customer's premises which provide a path to ground for foreign voltages exceeding about 600 volts peak. Since the customer's equipment is connected to the telephone line through the voice connecting arrangement, it is protected

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from longitudinal surges by transformer isolation. Additional circuitry within the voice connecting arrangement limits the maximum metallic (i.e., transverse) surge between transmission leads due to foreign potential to less than 30 volts.

The customer is responsible for providing protection against foreign and hazardous voltages from his equipment and facilities being applied to the voice connecting arrangement. The surge potential on transmission leads at the interface shall be limited to 30 volts metallic.

#### 4.2 Voltage Limitations

The customer-provided equipment must not supply any dc voltages on leads CT1, CR1, and CT, CR toward the voice connecting arrangement. All ac voltages must comply with the provisions of Paragraphs 3.14 and 3.17. 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.

#### 4.3 Grounding

It is expected that the customer's equipment will be grounded in accordance with applicable electrical codes (NEC). 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 as the telephone protector or signal ground but not using the Telephone Company ground clamp. This lead shall not be fused.

#### 4.4 Private Line Network Characteristic

##### 4.41 End-to-End Electrical Loss

The nominal 1000 Hz loss of the private line facilities used in conjunction with Voice Connecting Arrangement C234W will be lined up to within  $\pm 1.0$  dB of the design given in Paragraph 3.15. However, additional variations of both a short and a long term nature should be expected. Short term variations will normally not exceed  $\pm 3$  dB. Long term variations, which will be corrected periodically by the Telephone Company during routine measurements, should not exceed  $\pm 4$  dB. Further discussion on this subject will be found in the Technical Reference "Private Line Interconnection - Voice Applications" (see Paragraph 3.15).

##### 4.42 Nonlinearities

Nonlinearities such as compression, clipping, and harmonic distortion can exist on the telecommunications network. Normally, these are low enough to be ignored. It is expected that harmonic distortions generated in the network will result in single tones which are more than 5% of the fundamental.

5. SERVICE AND MAINTENANCE CONSIDERATIONS

5.1 Responsibility of the Customer

The tariffs permitting direct electrical connection of customer-provided communications systems state that:

Where private line service is available under this Tariff for use in connection with terminal equipment or communications systems, provided by a customer, authorized user or joint user, 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, authorized user or joint user 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 Telephone Company's facilities or otherwise injure the public in its use of the Telephone Company's services. Upon notice from the Telephone Company that the equipment or systems provided by a customer, authorized user or joint user 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.

5.2 Responsibility of the Telephone Company

The tariffs permitting direct electrical connection of customer-provided communications systems state that:

The Telephone Company shall not be responsible for installation, operation or maintenance of any terminal equipment or communications systems provided by a customer, authorized user, or joint user. Private line service is not represented as adapted to the use of such equipment or systems and where such equipment or system is connected to Telephone Company facilities the responsibility of the Telephone Company shall be limited to the furnishing of facilities suitable for private line service and to the maintenance and operation of such facilities in a manner proper for such private line service. Subject to this responsibility the Telephone Company shall not be responsible for (i) the through transmission of signals generated by such equipment or system, or for the quality of or defects in, such transmission, or (ii) the reception of signals by such equipment or systems. The Telephone Company shall not be responsible to the customer or authorized user or joint user if changes in the criteria contained in the tariffs and Section 3 of this Technical Reference, or in any of the facilities, operations, or procedures of the Telephone Company render any facilities provided by a customer, authorized user or joint user obsolete or require modification or alteration of such equipment or system or otherwise affect its use or performance.

5.3 Trouble Reporting Procedure

When trouble is experienced with this service, the customer should perform the necessary testing at the interface to 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 into 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) Private line identification number
- (e) Description of the trouble
- (f) Customer's contact for additional information

The customer will be responsible for payment of a service charge for visits by the Telephone Company to the premises of the customer when the service difficulty or trouble report results from the use of equipment or facilities provided by the customer.

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GLOSSARY

CHANNEL - a path (or paths) for electrical communication, between two or more stations or Telephone Company offices. A channel may be furnished in such manner as the Telephone Company may elect. A channel may be derived from cable, radio or a combination thereof, and may consist of one or more physical facilities or routes.

COMMUNICATIONS SYSTEM - channels and other facilities which are capable, when not connected to private line service, of communications between customer-provided terminal equipment or Telephone Company stations.

CUSTOMER - 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 - devices or apparatus and their associated wiring, provided by a customer, authorized user or joint user 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.

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

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and to which the Telephone Company brings and connects leads from the voice connecting arrangement.

NETWORK CONTROL SIGNALING - the transmission of signals used in the telecommunications system to perform functions such as supervision (control, status, and charging signals), address signaling (e.g., 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 - the terminal equipment furnished, installed, and maintained by the Telephone Company for the performance of network control signaling.

PRIVATE LINE - the term "Private Line" denotes the channels, channel terminals, service terminals, channel arrangements and equipment furnished to a customer as a unit, that is, without intermediate interexchange channel switching arrangements.

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).

TELECOMMUNICATIONS NETWORK - the Bell System voice switching equipment, associated interconnecting facilities, and station equipment which provide Long Distance Message Telecommunication service.

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

TRANSMISSION LEVEL POINT (TLP) - a point in a transmission system at which the transmission level (expressed in dB) is defined as the nominal or design gain (or loss) at 1000 Hz referenced to an arbitrary point in the system called the 0 transmission level point (0 TLP). The 0 TLP (not to be confused with 0 dBm) is a point chosen for engineering convenience and is not an indication of signal power level.

VOICE COUPLER - the part of the voice connecting arrangement which connects the transmission path from the customer-provided equipment to the private line network.

VOICE CONNECTING ARRANGEMENT - equipment provided by the Telephone Company to accomplish the direct electrical connection of customer-provided facilities with the facilities of the Telephone Company, or the direct electrical connection of Telephone Company facilities.

VOICE CONNECTING UNIT - that portion of the voice connecting arrangement including the voice coupler which provides the interconnection function between the customer-provided equipment and the Telephone Company facilities.

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.

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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) Nasell, I., "The 1962 Survey of Noise and Loss on Toll Connections," BSTJ, Vol. 43, No. 2 (March 1964), p. 697.
- (c) Nasell, I., "Some Transmission Characteristics of Bell System Toll Connections," BSTJ, Vol. 47, No. 6 (July-August 1968), p. 1001.
- (d) Nasell, I.; Ellison, C. R.; and Homstrom, R., "The Transmission Performance of Bell System Intertoll Trunks," BSTJ, Vol. 47, No. 8 (October 1968), p. 1561.
- (e) Gresh, P. A., "Physical and Transmission Characteristics of Customer Loop Plant", BSTJ, Vol. 48, No. 10 (December 1969), p. 3337.
- (f) Alexander, A. A.; Gryb, R. M.; and Nast, D. N., "Capabilities of the Telephone Network for Data Transmission," BSTJ, Vol. 39, No. 3 (May 1960), p. 431.
- (g) Breen, C., and Dahlbom, C. A., "Signaling Systems for the Control of Telephone Switching," BSTJ, Vol. 39, No. 6 (November 1960), p. 1381.
- (h) Bodle, D. W., and Gresh, P. A., "Lightning Surges in Paired Telephone Cable Facilities," BSTJ, Vol. 40, No. 2 (March 1961), p. 547.

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

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

(k) "Notes on Transmission Engineering," by United States Independent Telephone Association, Washington, D.C.

\*(l) "Transmission Systems for Communications," by Bell Telephone Laboratories, Inc.

\*Available through Western Electric Company, Commercial Relations,  
153 Halsey Street, Newark, New Jersey 07102

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APPENDIX C

WHERE TO OBTAIN REFERENCE MATERIAL

1. Bell System Technical References

These references may be purchased by writing to:

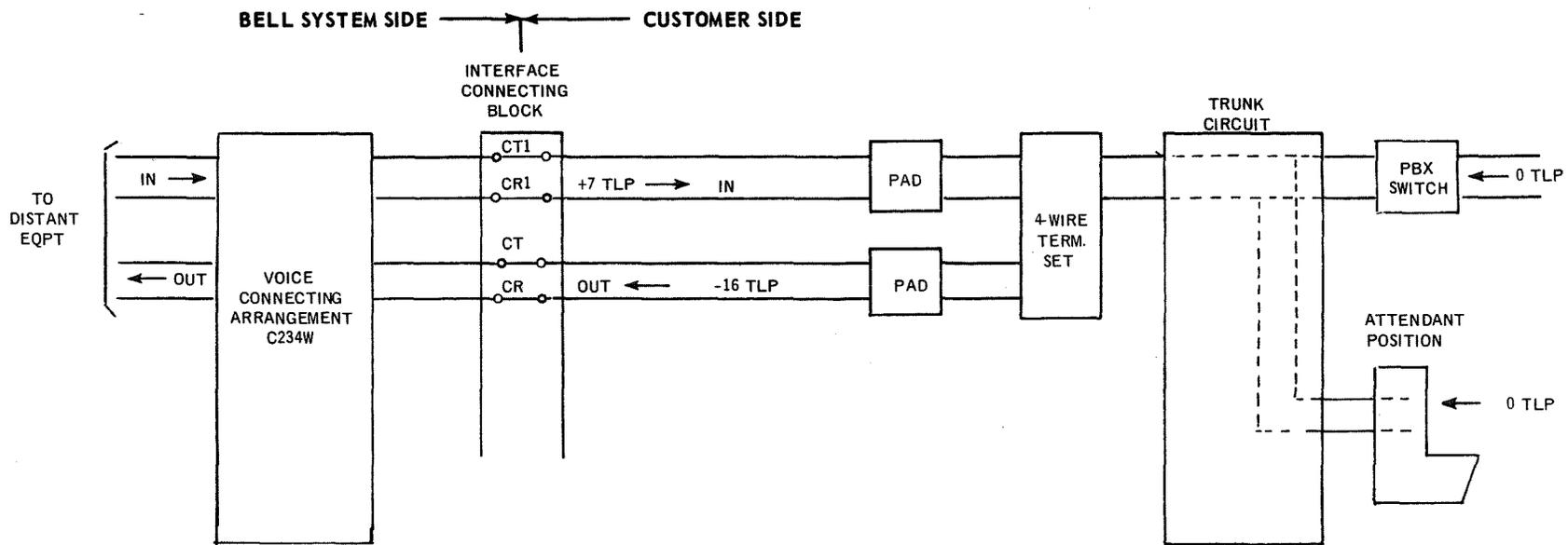
Western Electric Company, Inc.  
Commercial Relations  
P.O. Box 1579  
Newark, New Jersey 07102

2. Bell System Technical Journals (BSTJ)

These journals may be purchased by writing to:

Mr. F. J. Schwetje  
Bell Telephone Laboratories, Inc.  
Mountain Avenue, Room 3C115  
Murray Hill, New Jersey 07974

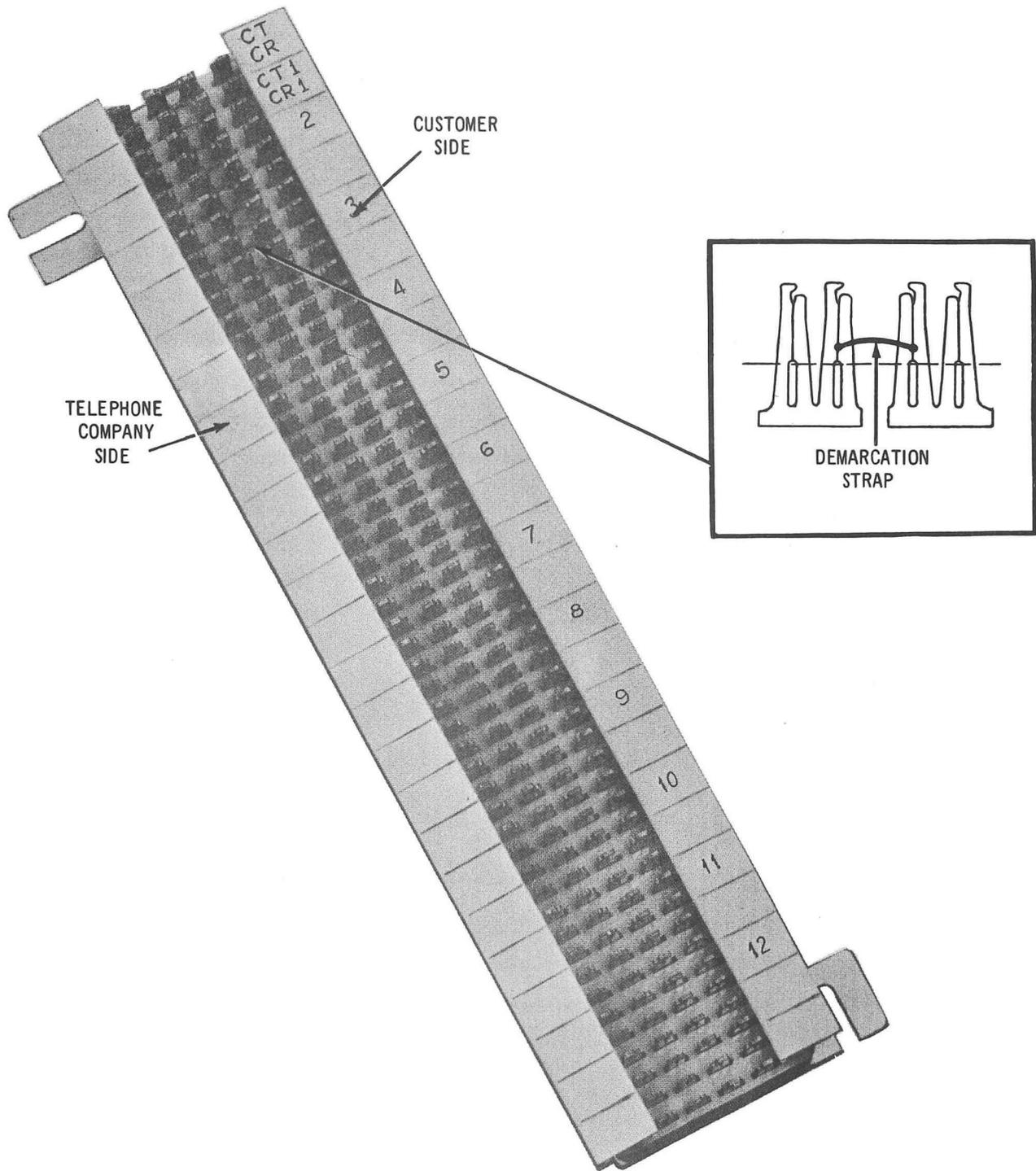




BLOCK DIAGRAM - VOICE CONNECTING ARRANGEMENT C234W  
FIG. 1

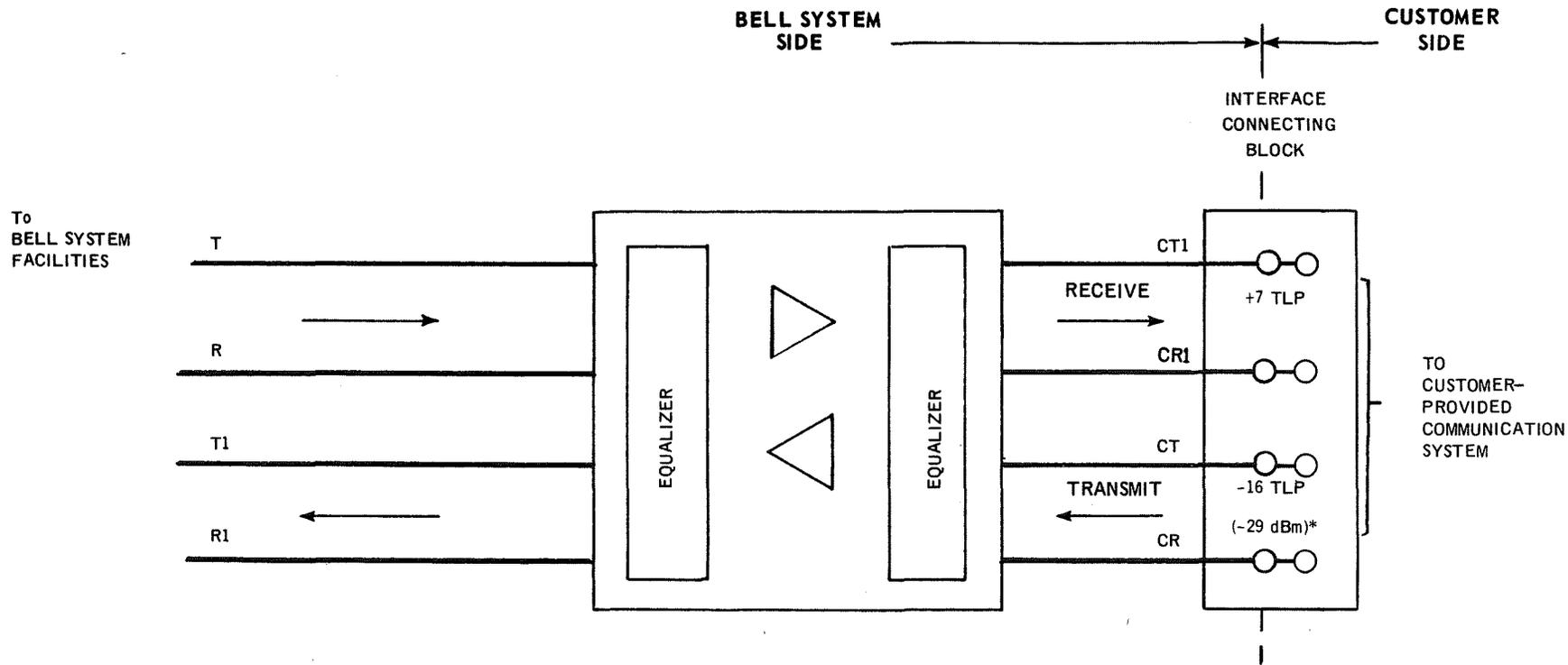
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TYPICAL INTERFACE CONNECTING BLOCK

FIG. 2



**SIMPLIFIED SCHEMATIC - VOICE CONNECTING ARRANGEMENT C234W**

**FIG. 3**

\* MAXIMUM 3 SECOND  
AVERAGE POWER  
FROM CUSTOMER

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