PUB 42209

PRELIMINARY

Bell System Voice Communications
TECHNICAL REFERENCE

Voice Connecting Arrangements

RDMZR
RDY

Interface Specification

June 1971

ENGINEERING DIRECTOR - CUSTOMER TELEPHONE SYSTEMS

PRELIMINARY

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.

This Technical Reference supersedes and replaces Bell System Voice Communications Technical Reference for Voice Connecting Arrangement RDM dated March 1970. The information for Voice Connecting Arrangement RDL also contained in that reference is still valid.

If further information is required, please contact:

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New York, New York 10007

TECHNICAL REFERENCE

VOICE CONNECTING ARRANGEMENTS RDMZR AND RDY

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PRELIMINARY

VOICE CONNECTING ARRANGEMENTS RDMZR AND RDY

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 voice transmitting and receiving terminal equipment and communications systems to Bell System telecommunications network. The tariffs also provide for the indirect (acoustic or inductive) connection of such equipment or systems. Both methods require compliance with network protection criteria given in the tariffs.

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

1.2 Application

Voice Connecting Arrangement RDMZR provides the means for automatically connecting customer-provided answer-only terminal equipment, typically telephone answering sets, to the telecommunications network via a loop to a local, foreign exchange, or WATS Central Office. An associated Telephone Company provided telephone set provides all of the other normal telephone station functions, e.g., dialing. This voice connecting arrangement is only offered for speech transmission and may not be used for data transmission.

Voice Connecting Arrangement RDMZR supersedes and replaces Voice Connecting Arrangement RDM which was described in Technical Reference, Voice Connecting Arrangements RDL/RDM dated March 1970. In addition to internal improvements in the voice connecting unit itself (e.g. lower insertion loss), the new arrangement gives the customer the option of

providing dc power to operate the voice connecting unit or of having the Telephone Company provide, by means of a low voltage ac transformer power to operate the voice connecting unit. Operation of the new arrangement has been simplified and as a result the number of leads required at the interface has been reduced (from 22 for RDM to 11 for RDMZR); this change permits the use of a 15 pin interface connector instead of the 25 pin interface connector used in Voice Connecting Arrangement RDM.

Voice Connecting Arrangement RDY has all of the features of Voice Connecting Arrangement RDMZR and, in addition, provides a volume-limited receive transmission path to be used with customer-provided recorders.

Voice Connecting Arrangement RDL, originally known as the Recorder Coupler, will continue to be made available for use with customer-provided equipment previously designed to that specification. It is expected that the new features available in Voice Connecting Arrangements RDMZR and RDY will encourage their use and that no new designs will be based on the Voice Connecting Arrangement RDL or RDM specifications.

Recording of two-way telephone conversations is not permitted with Voice Connecting Arrangements RDMZR and RDY; to record two-way conversations, Voice Connecting Arrangement RCZ must be used in order that the required "beep" tone can be transmitted to the distant party.

1.3 Ordering and Identification

The connection services described in this Technical Reference are identified by the Bell System as Voice Connecting Arrangement RDMZR and Voice Connecting Arrangement RDY. One voice connecting arrangement should be ordered for each telephone line which is to be connected to the

customer-provided equipment. The local Telephone Company business office or Marketing representative will provide information regarding availability and rates for these services. When ordering the customer should specify his power option.

2. DESCRIPTION

2.1 Functions

The major functions of these voice connecting arrangements are:

(a) To protect Telephone Company personnel and facilities from hazardous voltages which may be applied to the voice connecting arrangements.

(b) To provide longitudinal isolation.

(c) To limit abnormally high speech and signal levels to the telecommunications network.

(d) To provide speech transmission to and from the telecommunications network.

(e) To provide for network control signaling to the telecommunications network including on-hook, off-hook, etc.

(f) To provide for an indication of ringing signals from the telecommunications network.

(g) To provide (RDY only) for volume limited receive transmission from the telecommunications network.

2.2 Physical

Voice Connecting Arrangements RDMZR and RDY consist of printed circuit boards housed in an apparatus box measuring approximately 9 inches square and 3 inches deep and is intended for either shelf or wall mounting (Fig. 1). The arrangement weighs approximately 4 pounds, has a steel base and a molded plastic cover with a light olive gray finish.

A 15-pin female receptacle is provided at the bottom of the arrangement to connect the transmission, signaling, and power leads to the customer-provided equipment by means of a plug and cable to be furnished by the customer (see Figs. 2 and 3). Internal screw terminals are provided for the Telephone Company installer to make connections to the telephone line, a key by telephone system, associated telephone set, and power transformer (if provided).

2.3 Interface Leads

Voice Connecting Arrangement RDMZR provides at the interface connector: (1) a pair of leads for two-way speech transmission, (2) a pair of service alerting leads (ring sense), (3) a pair of service request leads (on) and off-hook), (4) three status leads, (5) an answer lead, (6) a disconnect lead, and (7) a pair of battery leads (Fig. 2 and 3).

Voice Connecting Arrangement RDY provides, in addition to all of the leads mentioned above, a pair of leads for volume-limited receive transmission.

These leads are described in more detail in the paragraphs below and in Section 4 and are extended from the connecting arrangement by means of a customer-provided cable terminated in a customer-provided plug, Cinch No. 231-15-61-133 equipped with a Hood No. 239-13-99-069 or equivalent. Connections should be made only to the leads specified below and in Figures 2 and 3.

Transmission (Leads CT and CR)

Leads CT and CR provide a two-way speech transmission path between the customer-provided equipment and the telecommunications network.

Service Alerting (Leads RU1 and RU2)

Leads RU1 and RU2 provide an isolated contact closure of approximately 1 second duration during the latter half of each 20 Hz ringing burst received from the telephone line to give a ring sense indication to the customer-provided equipment.

Service Request (Leads OH1 and OH2)

Leads OH1 and OH2 provide the means for the customer-provided equipment to cause line seizure and to trip ringing (off-hook) and, also, to release the line (on-hook).

Status (Leads TR1, TR2, and TR3)

Leads TR1, TR2, and TR3 provide isolated contacts to the customer-provided equipment to indicate the status of the connecting arrangement. During line seizure, contacts across leads TR1 and TR2 are closed and contacts across leads TR3 and TR2 are open; when the connecting arrangement is disconnected from the line, contacts across leads TR1 and TR2 are opened and contacts across leads TR3 and TR2 are closed.

Battery (Leads B1+ and B2-)

Leads B1+ and B2- provide a means for connection of a customer-provided dc power source for operating the connecting arrangement. The Telephone Company may (at the customer's option) provide a power source for the connecting arrangement. In this case, a low voltage, current-limited, ac transformer is plugged into a 60 Hz, 117 volt ac outlet provided by the customer. The transformer is connected to Telephone Company terminals in the connecting arrangement where ac power is converted to dc power. When the Telephone Company transformer is used, a customer-provided rechargeable battery may be

"floated" across leads B1+ and B2- to provide emergency power during failure of commercial ac power.

Answer (Leads ANS and B1+)

Lead ANS provides an alternate method to cause the connecting arrangement to seize the telephone line by momentarily (nominally 100 milliseconds) closing lead ANS to lead B1+ (as opposed to maintaining the closure across leads OH1 and OH2). Lead ANS may also be used to prevent the voice control disconnect circuit (if provided) from functioning during pauses in speech between the announce and record cycles of customer-provided equipment. However, closure of lead ANS to lead B1+ should not be maintained to the end of the call because it could result in a trouble condition on the telephone line (permanent signal from the Central Office).

Disconnect (Leads DIS and B2-)

Lead DIS provides an alternate method to cause the connecting arrangement to release the line by momentarily (nominally 100 milliseconds) closing lead DIS to lead B2- (provided that leads OH1 and OH2 are open).

In addition to the interface leads described above, Voice Connecting Arrangement RDY provides the following pair of leads.

AVL Receive (Leads AVL and GRD)

Leads AVL and GRD provide to the customer-provided equipment speech signals from the telephone line which are amplified with automatic volume limiting.

3. OPERATION

In the following paragraphs, the operation of Voice Connecting Arrangement RDMZR and RDY are described and reference is made to the circuits shown in the Block Diagram (Fig. 2). It is assumed that power is being supplied to the connecting arrangement.

3.1 Incoming Call from the Central Office

When a 20Hz ringing signal is detected on the telephone line by the RING DETECTOR circuit, leads RU1 and RU2 close for approximately one second during each ringing cycle (the typical Central Office ringing cycle in use in the Bell System is two seconds on and four seconds off) and relay PR operates. The customer-provided equipment may cause the connecting arrangement to seize the line and trip ringing by either closing lead OH1 to OH2 or by momentarily closing lead ANS to B1+. Two-way transmission is provided immediately upon line seizure. Relay TR operates, providing a closure between leads TR1 and TR2, and providing an open between leads TR3 and TR2 indicating that the connecting arrangement has seized the line. The operation of relay TR removes talking battery from the associated telephone set but permits monitoring, through the handset receiver of the incoming call by an attendant.

3.2 Outgoing Call to the Central Office

Outgoing calls to the Central Office are made using the associated telephone set in the normal manner.

3.3 Disconnect

The connecting arrangement will maintain the connection to the telephone line until the customer-provided equipment removes the closure between leads OH1 and OH2. When the ANS lead is used to answer the call (momentary closure to B1+) leads OH1 and OH2 must not be used; the connecting arrangement will maintain the connection to the telephone line

until one of the following actions take place to cause the connecting arrangement to disconnect:

(a) A momentary open is received from the Central Office or PBX switching equipment (where available*) and the calling party control (CPC) circuit in the connecting arrangement operates.

(b) The customer-provided equipment closes lead DIS to lead B2-.

(c) A voice control disconnect circuit in the connecting arrangement operates when syllabic signals are absent for approximately 13 seconds. This voice control disconnect circuit may be provided at the option of the Telephone Company when the signal from the Central Office described in (a) above is not available.

When using leads OH1 and OH2 to answer and disconnect the call, or when the automatic disconnect features described in (a) and (c) above do not fit the desired mode of operation of the customer-provided equipment, the customer-provided equipment shall have a time-out feature or some other means for terminating the call. Failure to provide a means for disconnect may result in trouble reports and maintenance visits for which the customer may be held liable.

* Generally, such signals are available only from No. 5 Crossbar, Step-by-Step, and Electronic Central Offices which serve slightly over half of the lines in the Bell System. This signal interval may vary from 15 to 250 seconds after the distant station goes on-hook.

4. SPECIFIC DESIGN CONSIDERATIONS

4.1 Transmission Path (Leads CT and CR)

4.11 Insertion Loss

The insertion loss of Voice Connecting Arrangements RDMZR and RDY through leads CT and CR is a nominal 3 dB at 250 Hz and 1 dB over the voice-frequency range of 300 to 3000 Hz. No voice signal amplification is provided for this transmission path.

4.12 Impedance

Voice Connecting Arrangements RDMZR and RDY provide about a one-to-one impedance transformation on the CT and CR leads. The impedance is a function of the voice connecting arrangement impedance and the impedance of the loop to the Central Office. For design purposes, the input impedance of these arrangements should be considered to be 600 ohms and, therefore, the impedance of the customer-provided equipment should be 600 ohms for optimum voice signal power transfer across the interface.

4.13 Bandwidth

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

4.14 Voice Signal Power Level

The tariffs state that the average power (in any 3-second interval) delivered at the Central Office should not exceed -12 dBm in order to prevent excessive noise and crosstalk from interfering with other services. The maximum

available power from a customer-provided 600 ohm source when averaged over any 3-second interval and measured at the CT and CR leads should not exceed -8 dBm. This limit has been set so that when the average loss of loops in the Bell System are considered (including the insertion loss of the voice connecting arrangement), the limit of -12 dBm at the local Central Office will be met.

Using measuring Method A (see Paragraph 4.15), in almost all cases, the speech power averaged over any 3-second interval, will not exceed -8 dBm if the maximum meter swing does not exceed 85 dBrn. With the additional damping of measuring Method B, the power averaged over any 3-second interval will not exceed -8 dBm if the maximum meter swing does not exceed 83 dBrn.

When these arrangements are used on foreign exchange or private line service, the local Telephone Company may specify lower levels.

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 criteria specified in Paragraph 4.14 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 settings on these meters should be as follows.

* 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.

Western Electric 3-Type Noise Measuring Set		Hewlett-Packard Transmission and Noise Measuring Set Model 3555B	
Control	Setting	Control	Setting
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)	3kHz 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.)

4.16 Signal Power Distribution

The telecommunications network incorporates tone signaling devices that are used for network control functions. These devices, which are connected at all times to the telephone circuit, are designed to be sensitive to 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 voice connecting arrangement at no time have energy solely in the 2450 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 26 dB below one milliwatt.

(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 Signal Limiting

A voice signal limiter is incorporated in the transmission path (lead CT and CR) to protect the Bell System telecommunications network from applications of abnormally high signal levels. This has no effect on normal voice signal levels. This limiter does not abrogate the customer's responsibility to meet the network protection criteria contained in the tariffs and in Section 4 of this Technical Reference.

4.19 AVL Receive (RDY only)

Voice Connecting Arrangement RDY provides (over leads AVL and GRD) a -5 dBm volume-limited output to the customer-provided equipment from speech signals on the telephone line. The high impedance bridging amplifier used to provide this feature has no effect on the received signal bandwidth and has an output impedance of 600 ohms.

4.2 DC Signaling Paths

4.21 Service Alerting (Leads RU1 and RU2)

Leads RU1 and RU2 provide an isolated contact closure of approximately a one second duration during the latter half of each 20 Hz ringing burst received from the telephone line. The normal ringing cycle from Bell System Central Offices is two seconds on and four seconds off; manually generated ringing from PBX operator positions may vary considerably. The isolated contacts across leads RU1 and RU2 are rated at 250 milliamperes. The maximum voltage which may be applied is 28 volts dc or 50 volts ac RMS.

4.22 Service Request (Leads OH1 and OH2)

Leads OH1 and OH2 provide the means for the customer-provided equipment to cause the connecting arrangement to seize and release the telephone line. Leads OH1 and OH2 must not be used when lead ANS (see paragraph 4.24 below) is used to answer the call. The customer-provided equipment may terminate leads OH1 and OH2 either with isolated metallic contacts or with transistor switches that should have a total closed circuit contact resistance including leads of 50 ohms maximum and an open circuit resistance of 500,000 ohms minimum. The open circuit voltage across leads OH1 and OH2 is 22 volts maximum and the short circuit current is 15 milliamperes maximum.

4.23 Status (Leads TR1, TR2, and TR3)

Leads TR1, TR2, and TR3 are isolated contacts which indicate to the customer-provided equipment the status of the connecting arrangement, e.g., it has seized the line or it has released the line. During line seizure (off-hook), contacts across leads TR1 and TR2 are closed and contacts across leads TR3 and TR2 are open. When the connecting arrangement is disconnected

from the line (on-hook), contacts across leads TR1 and TR2 are opened and contacts across leads TR3 and TR2 are closed. These contacts are rated at 250 milliamperes. The maximum voltage which may be applied is 28 volts dc or 50 volts RMS.

4.24 Answer (Leads ANS and B1+)

Lead ANS may be momentarily closed to lead B1+ by the customer-provided equipment so as to cause the connecting arrangement to seize the telephone line (provided that leads OH1 and OH2 are not used). When the Telephone Company-provided transformer is used to power the connecting arrangement, a current limited positive source is furnished on lead B1+. The open-circuit voltage between leads ANS and B1+ is 22 volts maximum and the short circuit current is 10 milliamperes maximum. The customer-provided equipment may momentarily terminate lead ANS to lead B1+ with isolated metallic contacts or transistor switches that should have a total closed circuit contact resistance including leads of 50 ohms maximum and an open circuit resistance of 500,000 ohms minimum.

4.25 Disconnect (Leads DIS and B2-)

Lead DIS may be momentarily closed to lead B2- by the customer-provided equipment so as to cause the connecting arrangement to release the telephone line. The open circuit voltage between leads DIS and B2- is 10 volts maximum and the short circuit current is 10 milliamperes maximum. The customer-provided equipment may momentarily terminate lead DIS to B2- with isolated metallic contacts or transistor switches that should have a total closed circuit contact resistance including leads of 50 ohms maximum and an open circuit resistance of 500,000 ohms minimum.

4.26 Battery (Leads B1+ and B2-)

Leads B1+ and B2- are used to permit the customer-provided equipment to supply dc power to the connecting arrangement as well as common leads for signaling as described in Paragraph 4.24 and 4.25 above. The customer-provided equipment should supply the following:

(a) Voltage : 21 ± 5 volts dc (ripple must fall within these limits)

(b) Operating Current: 140 milliamperes maximum

(c) Standby Current: 12 milliamperes maximum

(d) Initial Surge: 1 ampere

When the Telephone Company provided ac power transformer is being used to power the connecting arrangement, a customer-provided rechargeable battery (18 volts, 150-500 milliampere-hour) may be "floated" across leads B1+ and B2- to provide for emergency power. A charging current of 2.5 milliamperes is available to keep the battery charged under normal conditions.

4.3 Grounding

Voice Connecting Arrangements RDMZR and RDY are normally ungrounded and customer-provided signaling and power supply connections must be isolated from ground. It is expected that the customer's equipment will be grounded in accordance with applicable electrical codes such as the National Electrical Code.

5. GENERAL DESIGN CONSIDERATIONS

5.1 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 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 metallic and longitudinal surges.

The customer is responsible for providing protection, internal to his equipment and facilities, against foreign and hazardous voltages from his equipment and facilities being applied to the voice connecting arrangement.

5.2 Telecommunications Network Characteristics

5.21 End-to-End Electrical Loss

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

5.22 Nonlinearities

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

6. SERVICE AND MAINTENANCE CONSIDERATIONS

6.1 Responsibility of the Customer

The tariffs permitting connection of customer-provided terminal equipment or communications systems state that where long distance message telecommunications service is available under these tariffs for use in connection with terminal equipment or communications systems, provided by a customer, 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 does not endanger the safety of Telephone Company employees or the public; damage, require change in or alteration of, the equipment or systems or other facilities of the Telephone Company, interfere with the proper functioning of such equipment or systems or facilities, impair the operation of the telecommunications system of 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 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.

6.2 Responsibility of the Telephone Company

The tariffs permitting connection of terminal equipment and communications systems, provided by a customer, state that the Telephone Company shall not be responsible for the installation, operation or maintenance of said terminal equipment or communications systems. Long distance message 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 long distance message 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, or (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, 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 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) Description of the trouble

(e) 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 is liable to be charged for the service call.

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APPENDIX A

GLOSSARY

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

INTERFACE CONNECTOR - the Telephone Company-provided connecting point to which the customer brings and connects the mating plug and cable of his equipment to the voice connecting arrangement.

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

NETWORK CONTROL SIGNALING UNIT - denotes the terminal equipment furnished, installed, and maintained by the Telephone Company for the performance of network control signaling.

OFF-HOOK SUPERVISION - the conditioning of the SERVICE REQUEST leads by the customer-provided equipment which indicates a customer's telephone is answering or originating a call.

ON-HOOK SUPERVISION - the conditioning of the SERVICE REQUEST leads by the customer-provided equipment which indicates that the customer's telephone has disconnected or that the equipment is idle.

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 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 COUPLER - the part of Voice Connecting Arrangement RDMZR or RDY which connects the transmission path from the customer-provided equipment to the telecommunications network.

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

VOICE CONNECTING UNIT - that portion of the voice connecting arrangement including the voice coupler that 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.

PRELIMINARY

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.

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

*(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, Inc.
Commercial Relations
P. O. Box 1579
Newark, New Jersey 07102

PRELIMINARY

APPENDIX C

WHERE TO OBTAIN REFERENCE MATERIAL

1. Bell System Technical References

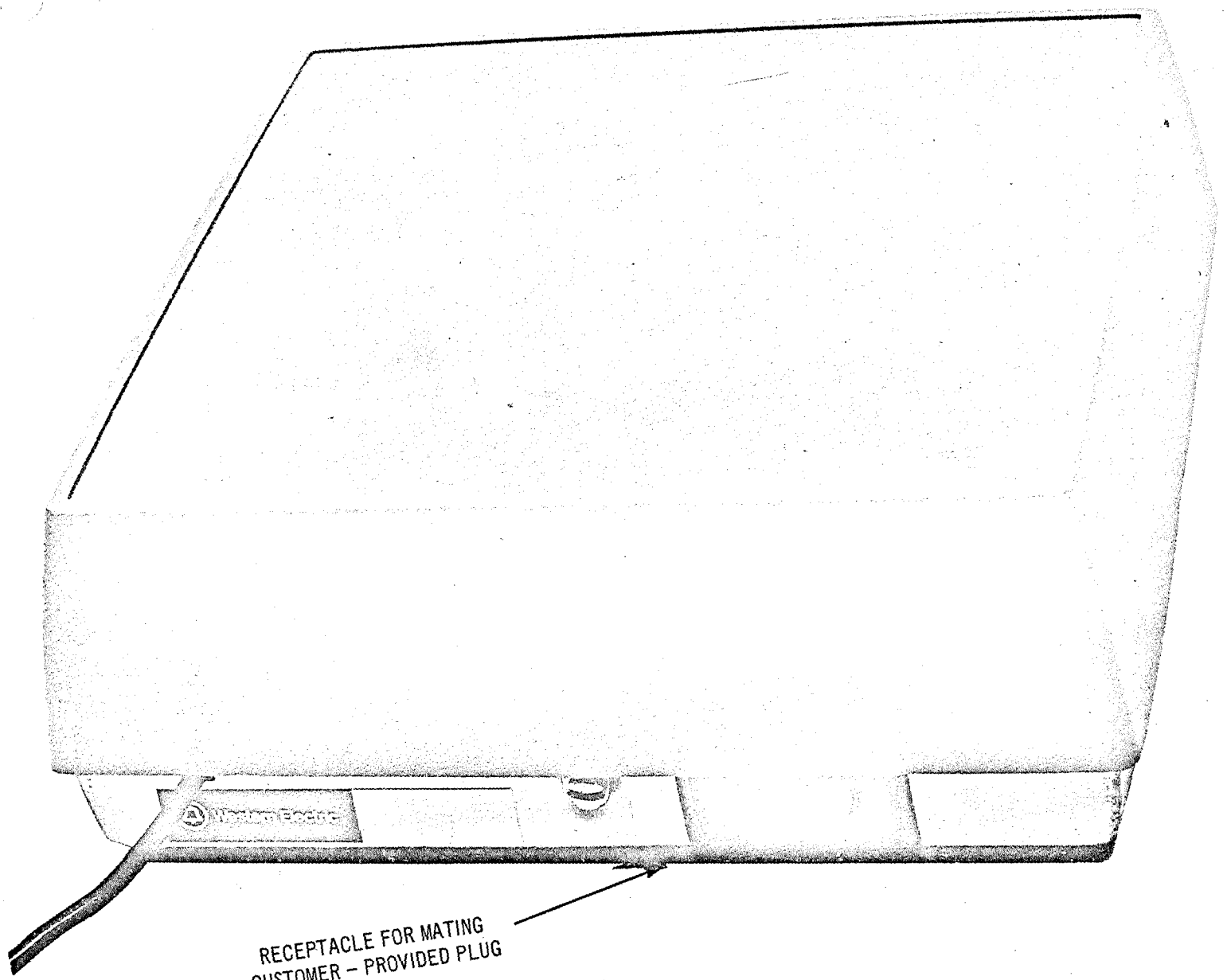
These references may be purchased by writing to:

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

2. Bell System Technical Journals (BSTJ)

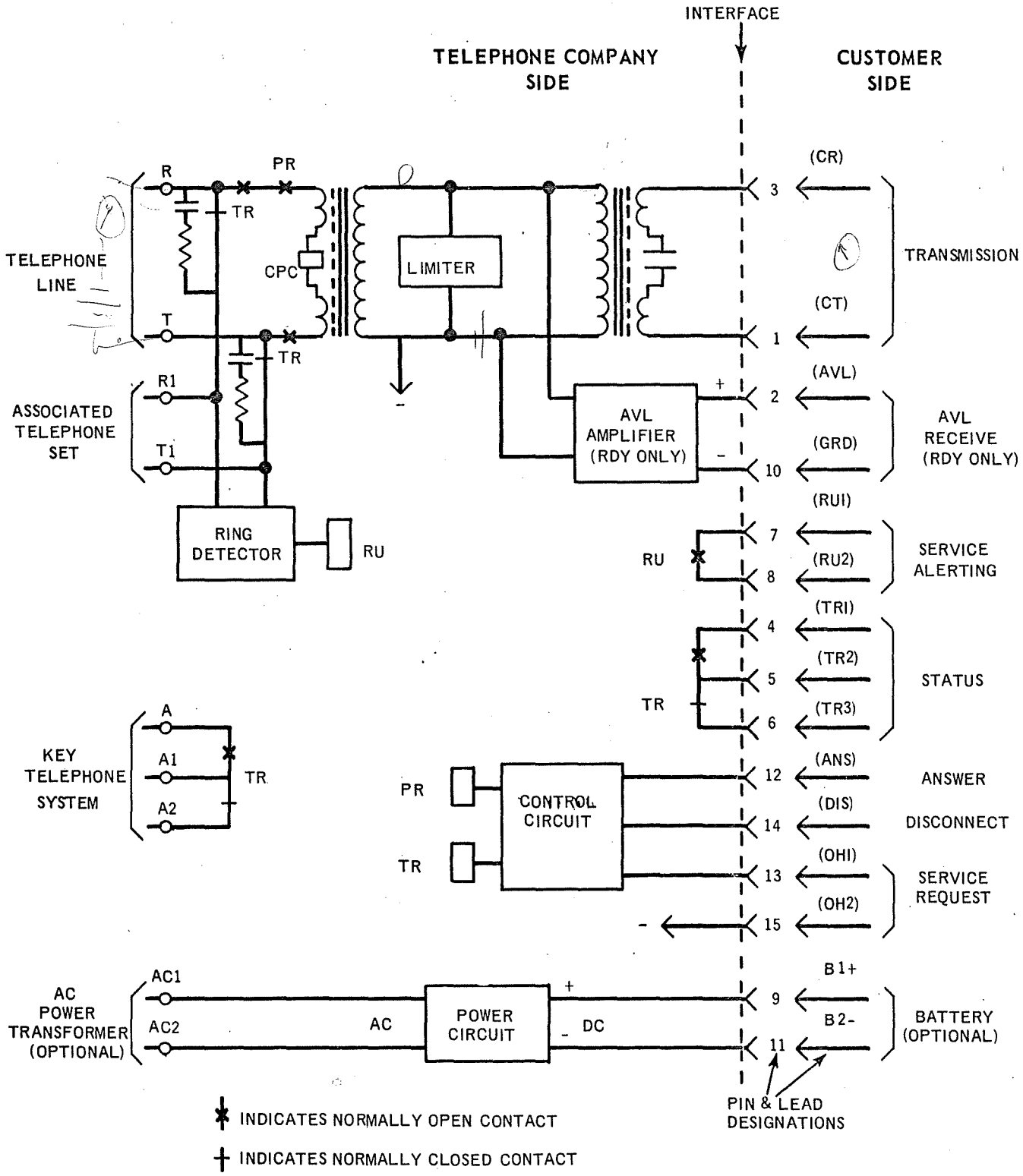
These journals may be purchased by writing to:

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

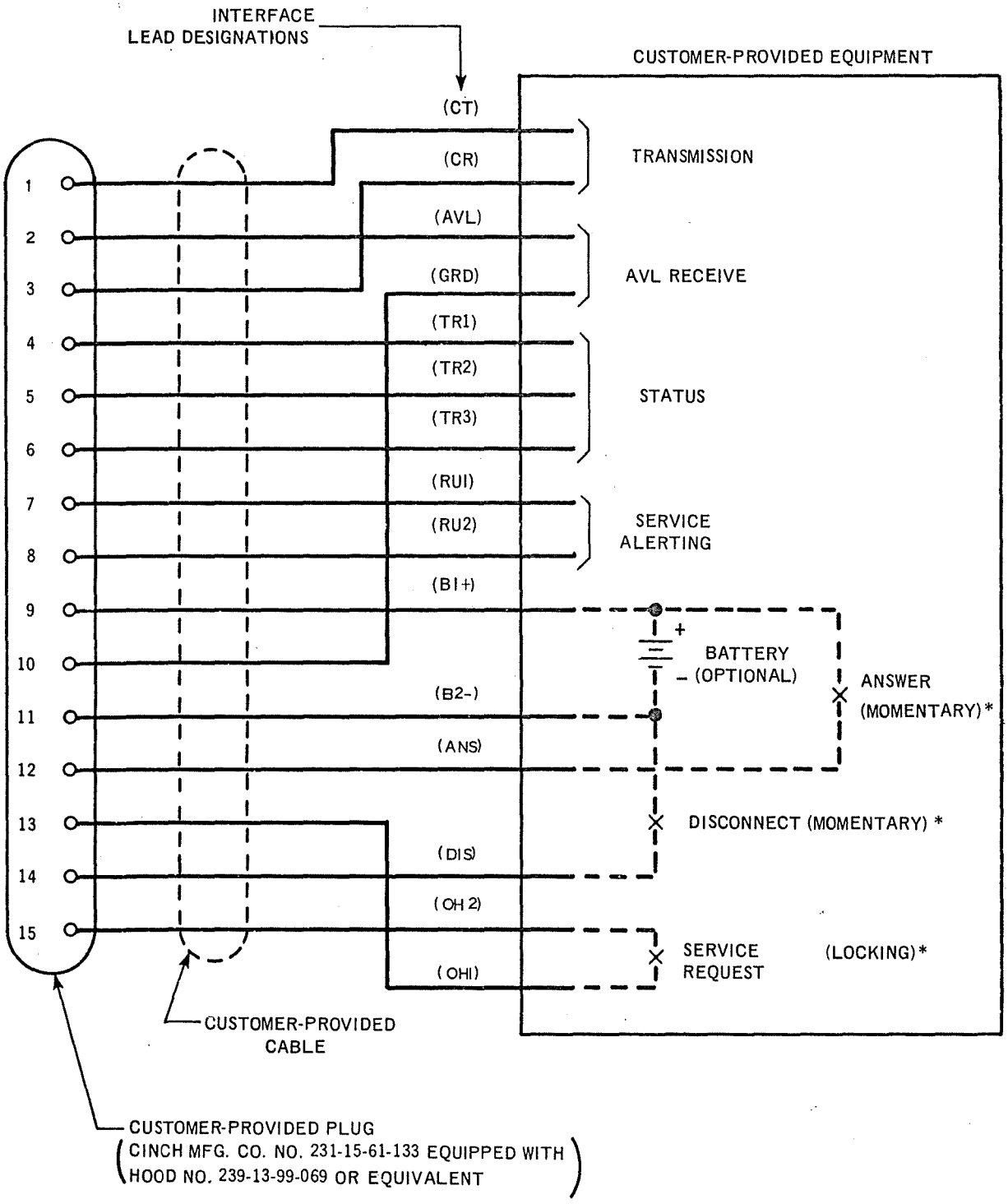


VOICE CONNECTING ARRANGEMENTS RDMZR AND RDY

FIG. 1



VOICE CONNECTING ARRANGEMENTS RDMZR AND RDY
BLOCK DIAGRAM
FIG. 2



* USE EITHER SERVICE REQUEST LEADS OR ANSWER AND DISCONNECT LEADS BUT NOT BOTH

VOICE CONNECTING ARRANGEMENT RDMZR AND RDY
TYPICAL CONNECTIONS TO BE PROVIDED BY THE CUSTOMER
FIG. 3