

PRELIMINARY

**Bell System Voice Communications
TECHNICAL REFERENCE**

**Protective
Connecting
Arrangement**

**STP
C2F**

**Interface
Specification**

**MARCH
1977**

ENGINEERING DIRECTOR – CUSTOMER EQUIPMENT SYSTEMS



PRELIMINARY

NOTICE

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This Technical Reference supersedes and replaces Bell System Voice Communications Technical Reference for Voice Connecting Arrangement STP dated May, 1973.

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TECHNICAL REFERENCE

PROTECTIVE CONNECTING ARRANGEMENTS STP AND C2F

TABLE OF CONTENTS

	Page
1. GENERAL	1
1.1 Introduction	1
1.2 Application	1
1.3 Power Outage Provisions	2
1.4 Ordering and Identification	2
2. DESCRIPTION	2
2.1 Functions	2
2.2 Physical	3
2.3 Interface Leads	3
3. OPERATION	4
3.1 Incoming Call From the Central Office	4
3.2 Outgoing Call To the Central Office	5
3.3 Disconnect	5
3.4 Power Failure	5
4. SPECIFIC DESIGN CONSIDERATIONS	5
4.1 Transmission Path	5
4.2 Signaling Paths	10
4.3 Ringing Leads	11
4.4 Battery Leads	12
5. GENERAL DESIGN CONSIDERATIONS	12
5.1 Foreign and Surge Voltage Protection	12
5.2 Telecommunications Network Characteristics	13
5.3 Grounding	13
6. SERVICE RESPONSIBILITIES	14
6.1 Responsibility of the Manufacturer	14
6.2 Responsibility of the Customer	14
6.3 Responsibility of the Telephone Company	15
7. MAINTENANCE OF SERVICE	16

APPENDIX A - GLOSSARY

APPENDIX B - REFERENCES

LIST OF FIGURES

- Fig. 1 Photograph - Protective Connecting Arrangements STP and C2F
- Fig. 2 Typical Interface Connecting Block
- Fig. 3 Block Diagram and Typical Connections to be Provided by the Customer - Protective Connecting Arrangements STP and C2F
- Fig. 4 Dial Pulse Characteristics

PRELIMINARY

PROTECTIVE CONNECTING ARRANGEMENTS STP AND C2F

1. GENERAL

1.1 Introduction

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

1.2 Application

Protective Connecting Arrangement STP provides a means for automatically connecting customer-provided voice terminal equipment (typically a key telephone system) to the telecommunications network via a central office local exchange, foreign exchange, WATS line or PBX station line which terminates on the customer's premises.

Protective Connecting Arrangement C2F provides a means for connecting customer-provided facilities to Bell System PBX and Centrex line terminals at the customer's premises.

Neither of these protective connecting arrangements is intended for data transmission.

Both STP and C2F provide local talk battery (24 volts for STP, 48 volts for C2F), locally generated 20 Hz or 30 Hz ringing, a 2-wire voice transmission interface, and permit dial service using customer-provided dc dial pulse or dual tone address signaling (where the customer has subscribed to Bell System TOUCH-TONE® service). These arrangements are used on a bridged ringer basis. A maximum of two high impedance ringers may be used.

PRELIMINARY

- 2 -

The local power and ringing supply required to operate Protective Connecting Arrangements STP and C2F may be furnished by either the Telephone Company or by the customer.

1.3 Power Outage Provisions

Protective Connecting Arrangements STP and C2F are normally powered by a Telephone Company-provided power supply which operates from commercial power. Connecting arrangement power outage protection can be provided by a Telephone Company battery backup system, a customer-provided power supply and battery backup system using Protective Connecting Arrangement VCP, or simply a Telephone Company-provided telephone bridged on the line ahead of the coupler. These options are described in detail in Technical Reference Notice PUB 42607.

1.4 Ordering and Identification

The protective connection services described in this Technical Reference are identified by the Bell System as Uniform Service Order Codes (USOC) STP and C2F. One Protective Connecting Arrangement STP should be ordered for each telephone line to which customer-provided equipment is to be connected or one Protective Connecting Arrangement C2F should be ordered for each Bell System PBX or Centrex line terminal to which a customer-provided facility is to be connected. The local Telephone Company business office or marketing representative will provide information regarding availability and rates for these services. When ordering service, the customer should specify whether provision is to be made for any of the power outage protection methods described in Paragraph 1.3.

2. DESCRIPTION

2.1 Functions

The major functions of these protective connecting arrangements are:

- (a) To prevent the introduction to the telecommunications network of hazardous voltages which could cause harm to Telephone Company personnel and/or facilities.
- (b) To provide isolation against longitudinal imbalance.
- (c) To limit abnormally high speech and tone address signal levels from the customer-provided equipment.

PRELIMINARY

- 3 -

- (d) To provide speech transmission to and from the tele-communications network.
- (e) To provide for network control signaling to the tele-communications network, including dc dial pulses, tone address signals, on-hook and off-hook.
- (f) To provide for ringing signals.
- (g) To provide local dc battery for talking and signaling.

2.2 Physical

Protective Connecting Arrangements STP and C2F consist of one 8 inch, 80 pin printed circuit board per line equipped (see Fig. 1) and a mounting arrangement. The size of the initial installation and the expected growth will be the determining factors in selecting the mounting arrangement.

2.3 Interface Leads

Two leads per circuit are normally provided from Protective Connecting Arrangements STP and C2F to the Interface Connecting Block (see Fig. 3). Two additional leads are provided at the power protector VCP for connection to customer-provided dc power when the customer elects to provide power to the connecting arrangement. Two other leads may be provided in a special plug if the customer also desires to provide his own ringing power supply. Additional information pertaining to these leads is discussed in Sections 3 and 4.

The leads and their functions are as follows:

<u>Lead Designation</u>	<u>Function</u>
CT, CR)	Transmission, loop supervision, dialing
CR-Sig.) CR-Grd.)	Ringing (optional) power input
-V Grd.)	Battery (optional) power input

Only the CT and CR leads from these protective connecting arrangements 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 or facilities. The customer must provide and install his conductors and make the necessary connections of his equipment to the protective connecting arrangement at this block.

A typical Interface Connecting Block is shown in Figure 2. This "quick connect", "66" type 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 bridging clips between the second and third terminal rows 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 or facilities and then be replaced to restore the circuit to service.

When indicating a closure, the customer-provided equipment or facilities must be such that the maximum external conductor loop resistance across the CT and CR leads measured at the block shall not exceed 200 ohms for Protective Connecting Arrangement STP and 1300 ohms for Protective Connecting Arrangement C2F. These figures assume a 200 ohm station set. The minimum loop plus station set resistance is 100 ohms.

3. OPERATION

3.1 Incoming Call from the Central Office

When ringing on the line is detected by the ringing detector circuit in the protective connecting arrangement, a ringing relay operates in unison with each incoming ringing signal. With each operation of the ringing relay, local ringing voltage is applied to the CT and CR leads to signal the customer-provided equipment. When the customer-provided equipment goes off hook to answer the call, the resistive termination is recognized as a signal to disconnect the ringing detector circuit, trip the ringing signal from the central office, PBX or Centrex, and cut through the transmission path to the CT and CR leads.

PRELIMINARY

- 5 -

3.2 Outgoing Call to the Central Office

When the customer-provided station goes off-hook closing the loop to CT and CR, a relay operates and closes through the transmission path to the T and R leads to the serving central office, PBX or Centrex. When dial tone is received, the customer dials the desired number. The operated relay will release and operate in unison with the dial pulses. The relay repeats the dial pulses on the T and R leads to the central office, PBX or Centrex and remains operated after dialing is complete. When tone address signaling is used, the relay remains operated and the signals are transmitted through the transformer in the protective connecting arrangement.

3.3 Disconnect

When the customer's station goes on-hook, the customer-provided equipment shall remove the resistive termination (remove loop closure) across CT and CR causing the operated relays to release, thus requesting a release of the line. Distant party disconnects are detected or indicated by the protective connecting arrangement only when the serving central office provides such indication by momentarily opening the tip and ring battery supply. (Both disconnects and other opens on the T and R leads are repeated on leads CT and CR.)

3.4 Power Failure

Standby power is not normally provided by the Telephone Company unless specifically ordered by the customer (special rates apply for standby power). During failure of commercial power sources, all functions of the connecting arrangement will be inoperative unless standby power is provided by the Telephone Company or the customer. If desired, a Telephone company-provided telephone can be bridged to the line ahead of the protective connecting arrangement.

4. SPECIFIC DESIGN CONSIDERATIONS

4.1 Transmission Path (Leads CT and CR)

4.11 Insertion Loss

The insertion loss of Protective Connecting Arrangements STP and C2F is nominally 1 dB over the voice-frequency range of 300 to 3000 Hz. No voice signal amplification is provided.

4.12 Impedance

Protective Connecting Arrangements STP and C2F provide approximately a one-to-one impedance transformation from the line to CT and CR. The input impedance is, therefore, primarily a function of the impedance of the station loop. For design purposes, the input impedance of these arrangements should be considered to be 600 ohms.

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 protective connecting arrangements do not limit this bandwidth.

4.14 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. To meet this specification, the maximum available power from a customer-provided source 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 -8 dBm. This limit has been set so that when the average loss of loops in the Bell System is considered (including the insertion loss of the protective connecting arrangements), the limit of -12 dBm at the local central office will be met.

Using measuring Method A (see Paragraph 4.15), the power averaged over any 3-second interval will, in almost all cases, 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.

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 in Paragraph 4.14 are being met.

PRELIMINARY

- 7 -

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 ensure a proper measurement technique, the control 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)	3KHz 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 their associated trunk or line, 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.

*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.

PRELIMINARY

- 8 -

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 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 not exceed 26 dB below one milliwatt (18 dB below the signal level specified in Paragraph 4.14).
- (b) The power in the band from 4005 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

When TOUCH-TONE® service has been ordered by the customer, Protective Connecting Arrangements STP and C2F permit customer-provided tone address signals to be transmitted to a central office TOUCH-TONE receiver for the purpose of network address signaling. The signaling code for the Bell System TOUCH-TONE signaling system provides for 12 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 combination are not harmonically related. The frequency pairs assigned for the signaling are as follows:

PRELIMINARY

- 9 -

		<u>Nominal High 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>	*	0	#	Spare

In order for the central office receiver to properly register the digits, the tone address signals shall meet the following requirements (measured by the customer into a 600 ohm test termination on the CT and CR leads at the interface):

1. Signal Levels

Nominal level per frequency: -6 to -4 dBm

(Minimum level) Low Group: -10 dBm
(per frequency) High Group: -8 dBm

Max. difference in levels between frequencies: 4 dB

Max. level per frequency pair: +2 dBm

2. Frequency Deviation

Tone frequencies should be within +1.5 percent of their nominal values.

3. 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.

4. Voice Suppression

Voice energy from the telephone transmitter or other source should be suppressed at least 45 dB during tone signal transmission (e.g., the transmitter should be muted). In the case of automatic dialing, the suppression should be maintained continuously until pulsing is completed.

5. 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.

PRELIMINARY

- 10 -

6. Pulsing Rate

Minimum duration of
two-frequency tone signal: 50 ms

Minimum interdigital time: 45 ms

Minimum cycle time (period): 100 ms

7. Tone Leak

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

8. Transient Voltages

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

4.19 Signal Limiting

A voice signal limiter is incorporated in the transmission path of the protective connecting arrangements to protect the Bell System telecommunications network from applications of abnormally high signal levels. This has no effect on normal voice or normal 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 Signaling Paths

4.21 DC Signals on CT and CR

CT and CR provide battery and ground for loop signaling which is similar to "conventional" loop signaling on a switching system line circuit. In order to operate properly, equipment connected to Protective Connecting Arrangement STP or C2F must have dc resistance characteristics within the following limits:

Off-Hook:

STP - 400 ohms maximum station plus cable resistance.

CTF - 1500 ohms maximum station plus cable resistance.

STP and C2F - 100 ohms minimum station plus cable resistance.

PRELIMINARY

- 11 -

On-Hook:

STP and C2F - minimum leakage resistance from CT to CR
is 100,000 ohms.

To calculate dc loop currents, the dc source impedance of Protective Connecting Arrangements STP and C2F can be assumed to be 250 ohms in series with each side of the battery supply.

The dc dial pulses shall be generated on the CT and CR leads 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 (see Fig. 4). The percent break shall be a minimum of 58 percent and a maximum of 64 percent. The minimum interdigital timing shall be 600 milliseconds.

4.22 AC Signals on CT and CR

In addition to the voice and tone signals covered in Section 4.1, ringing is also applied to CT and CR. The ringing signal is usually supplied by the Telephone Company and will be either 90 \pm 15 volts @20 Hz or 125 \pm 5 volts @30 Hz. If ringing is supplied by the customer-provided equipment, it should be in the range of 90 to 105 volts @20 \pm 2 Hz or 110 to 125 volts @30 \pm 3 Hz. In either case, the ringing is applied to the CR lead by a circuit which clamps the ringing signal at the talk battery voltage. With clamped ringing the positive excursions of the AC voltage never go more positive than -DC talking battery volts (-24v or -48v) with respect to ground. The negative excursions of the AC voltage can reach -370 volts peak value with respect to ground. Clamped ringing is also described in PUB 47002. Ringing is tripped by meeting the off-hook conditions specified in Section 4.21.

4.3 Ringng Leads (Leads CR-Sig. and CR-Grd.)

Leads CR-Sig. and CR-Grd. provide for a connection of an optional customer-provided ringing supply which should have the same voltage and frequency characteristics as the Telephone Company supply described above. The ringing signal, which must be furnished by a grounded ringing supply, is clamped to -24 volt or -48 volts dc dependent on power supply used. The Telephone Company interface is a special plug selected to preclude inadvertently plugging it into a commercial power source. The customer-provided ringing supply must be terminated in a

PRELIMINARY

- 12 -

Socket, No. S-302-CCT, Cinch Mfg. Co. or equivalent (Fig. 3). The socket should be located within six feet of the Telephone Company Apparatus Cabinet. It is not intended that more than two conventional high impedance ringers will be used with each Protective Connecting Arrangement STP or C2F.

4.4 Battery Leads (Leads -V and Grd.)

Leads -V and Grd. provide for connection of an optional customer-provided dc power source to provide power to the connecting arrangement through an appropriate protective device furnished by the Telephone Company. If the customer elects to furnish -24 volt dc power to Protective Connecting Arrangement STP, he must also order Protective Connecting Arrangement VCP24. If he elects to furnish -48 volt dc power to Protective Connecting Arrangement C2F, he must also order Protective Connecting Arrangement VCP48. (See Fig. 3 for connections.) The power requirements are as follows:

- (a) Voltage: 20-26 volts or 45-52 volts dc (ripple must fall within these limits) quiet (talk) battery.
- (b) Operating Current: 0.046 amperes at -20 volts dc (maximum)
0.193 amperes at -45 volts dc (maximum)
0.045 amperes at -24 volts dc (typically)
0.055 amperes at -48 volts dc (typically)

The Telephone Company (at the customer's option) may provide a power source for these connecting arrangements (STP: -24 volts dc and C2F: -48 volts dc). When power is supplied by the Telephone Company, the associated -24 or -48 volt rectifier power supply requires a grounded outlet connection to a non-switched, customer-furnished, nominal 117 \pm 12 volt, 60 \pm 1 Hz source, fused at 15 amperes.

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. These devices 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 protective connecting arrangements.

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 inter-office 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, phase shift, and harmonic distortions 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.

5.3 Grounding

It is expected that the customer's equipment, if powered from commercial power, will be grounded in accordance with applicable electrical codes, e.g., National Electrical Code (NEC) and should be bonded to the ground electrode to which the telephone protector is grounded but not using the telephone ground clamp. 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.

6. SERVICE RESPONSIBILITIES

6.1 Responsibility of the Manufacturer

The manufacturer of the customer-provided equipment or facilities is responsible for the following:

- (a) Informing the purchaser as to which protective connecting arrangement his equipment has been designed to work with.
- (b) Advising the purchaser to order this protective connecting arrangement by code STP or C2F from the Telephone Company.
- (c) Providing information to the purchaser that specifies installation, operational, routine maintenance, and repair procedures which, if properly employed by the purchaser, will assure compliance with this Technical Reference and the tariffs.
- (d) All patent or other liability arising out of the use, offering or distribution of such equipment by or to them.

6.2 Responsibility of the Customer

The tariffs regulating the connection of customer-provided terminal equipment or communications systems through connecting arrangements to the telecommunications network state that 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 systems 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 as shall be necessary to remove or prevent such hazard or interference.

The customer desiring to use customer-provided equipment is responsible for the following:

- (a) Informing the Telephone Company of his intention to use such a device and ordering the protective connecting arrangement by code STP or C2F.
- (b) Connecting the equipment to the interface connecting block.
- (c) Assuring that the equipment in use continues to comply with all the requirements of the applicable tariffs and this Technical Reference.
- (d) Following the installation, operational, routine maintenance, and repair procedures specified by the manufacturer.
- (e) Removing the device from use if the customer detects that it is defective or if the Telephone Company notifies the customer that the equipment is causing a hazard or interference as specified above.

6.3 Responsibility of the Telephone Company

The Telephone Company shall not be responsible for the installation, operation or maintenance of any customer-provided terminal equipment. Long distance message telecommunications service is not represented as adapted to the use of customer-provided equipment and where such equipment is connected to Telephone Company facilities, the responsibility of the Telephone Company shall be limited to the furnishing of facilities suitable for telecommunications service and to the maintenance and operation of such facilities in a manner proper for such telecommunications 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 for the quality of, or defects in, such transmission, (ii) the reception of signals by customer-provided equipment, 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,

PRELIMINARY

- 16 -

operations or procedures of the Telephone Company render any customer-provided equipment obsolete or require modification or alteration of such equipment or otherwise affect its use or performance.

7. MAINTENANCE OF SERVICE

Maintenance of equipment supplied by the Telephone Company shall be done only by the Telephone Company.

When trouble is experienced with this service, the customer should disconnect the equipment to determine whether the service impairment is located in the customer-provided equipment or facilities or in the equipment provided by the Telephone Company. If the customer-provided equipment is determined to be defective, the customer shall immediately discontinue its use until such time as the customer has it repaired. If the tests indicate that the trouble is in the Telephone Company-provided equipment, a trouble report should be promptly referred to the Telephone Company's "Repair Service" whose number 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) Uniform Service Order Code (USOC) STP or C2F
- (f) Customer's contact for additional information

The customer shall be responsible for the payment of a maintenance of service charge for visits by the Telephone Company to the customer's premises where the service difficulty or trouble report results from the use of customer-provided equipment.

PRELIMINARY

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.

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.

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 and to which the Telephone Company brings and connects leads from the protective 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.

PRELIMINARY

Appendix A - 2

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.)

OFF-HOOK SUPERVISION - the conditioning of the interface leads by the customer-provided equipment which indicates that it is answering or originating a call.

ON-HOOK SUPERVISION - the conditioning of the interface leads by the customer-provided equipment which indicates that it has disconnected and is idle.

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.

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 A - 3

PROTECTIVE CONNECTING ARRANGEMENT - protective equipment provided by the Telephone Company to accomplish the electrical connection of customer-provided equipment with the telecommunications network. It is designed to transmit speech signals as contrasted to one designed to transmit data signals.

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).

TALKING BATTERY - direct current supply typically used to energize carbon transmitters in telephone sets.

TELECOMMUNICATIONS NETWORK - 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.

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) 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 Data Communications Technical Reference - PUB 41007 - 1969-1970 Switched Telecommunications Network Connection Survey (Reprints of Bell System Technical Journal articles) - April 1971.
- *** (f) "Principles of Electricity Applied to Telephone and Telegraph Work," by American Telephone and Telegraph Company, New York, New York.
- *** (g) "Switching Systems," by American Telephone and Telegraph Company, New York, New York.
- (h) "Notes on Transmission Engineering," by United States Independent Telephone Association, Washington, D.C.
- *** (i) "Transmission System for Communications," by Bell Telephone Laboratories, Inc.
- *** (j) "Notes on Distance Dialing - 1975," by American Telephone and Telegraph Company, New York, New York.

PRELIMINARY

Appendix B - 2

*These journals may be purchased by writing to:

Bell Telephone Laboratories, Inc.
Circulation Supervisor
Mountain Avenue, Room 3C109
Murray Hill, New Jersey 07974

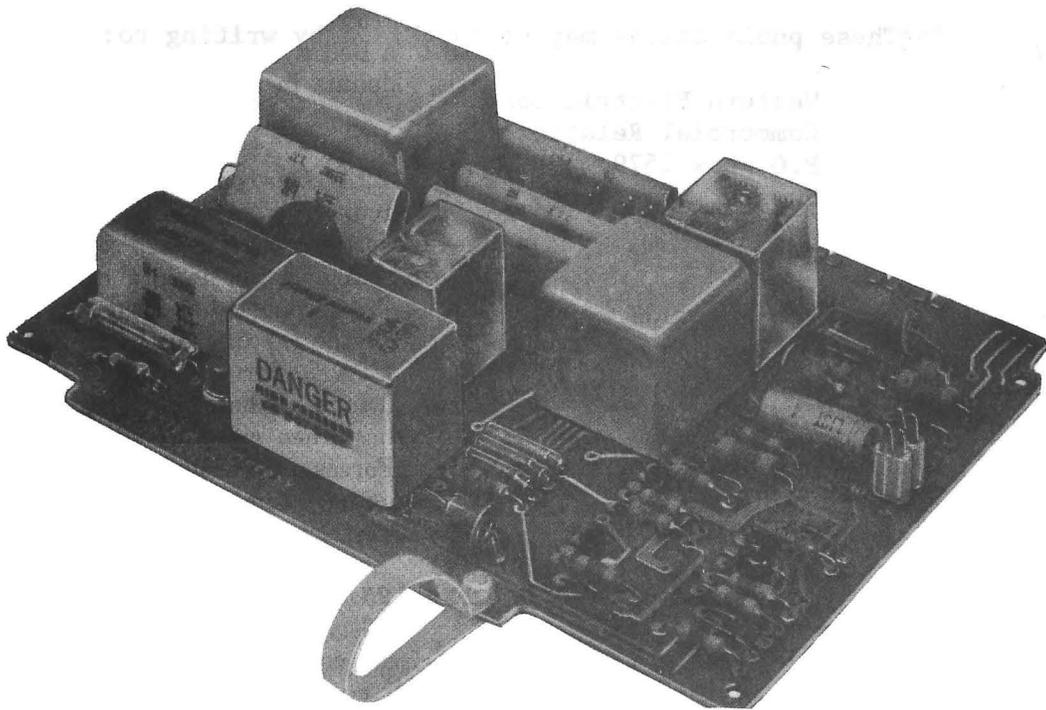
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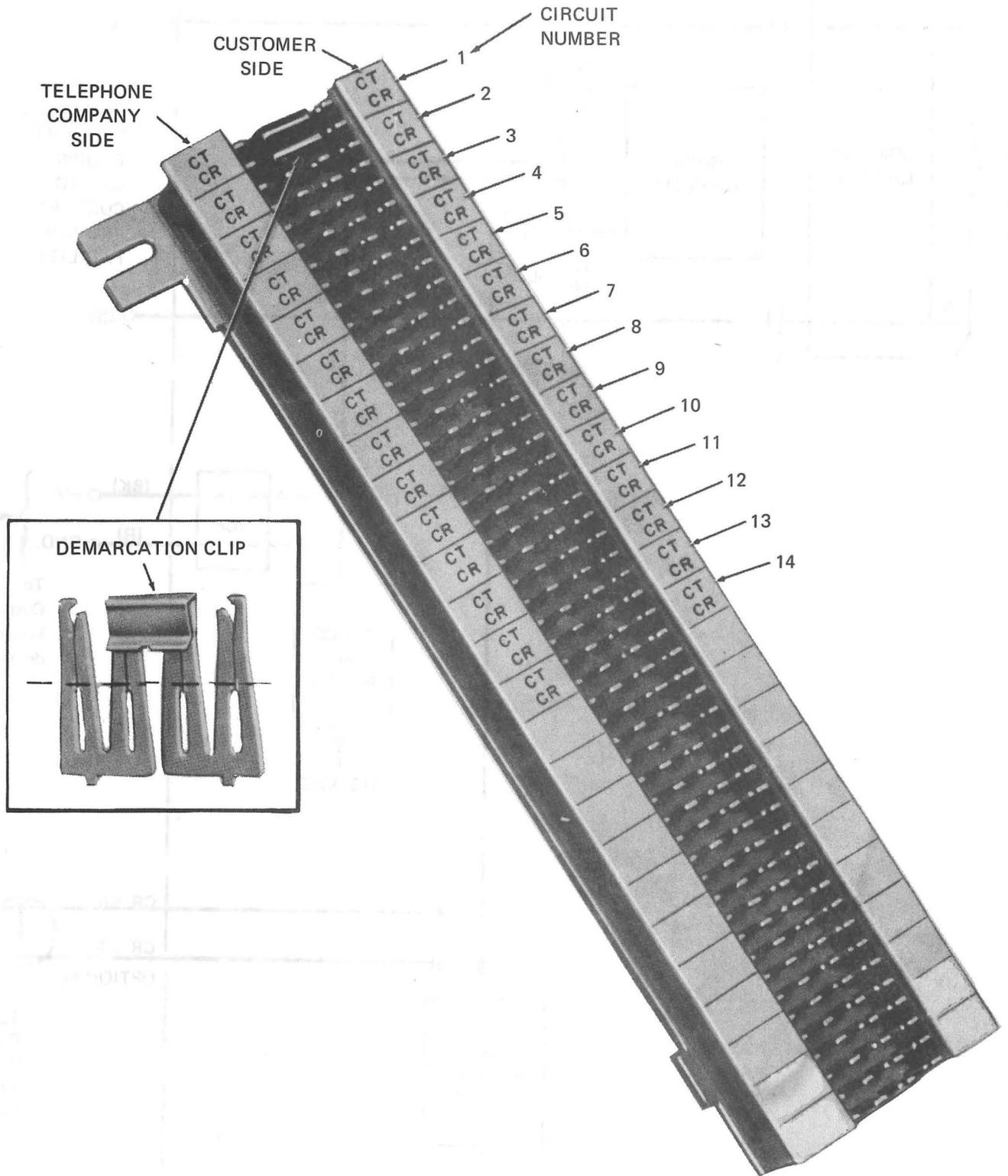
Western Electric Company, Inc.
Commercial Relations
P.O. Box 1579
Newark, New Jersey 07102

PRELIMINARY



PROTECTIVE CONNECTING ARRANGEMENTS STP AND C2F
FIG. 1

PRELIMINARY

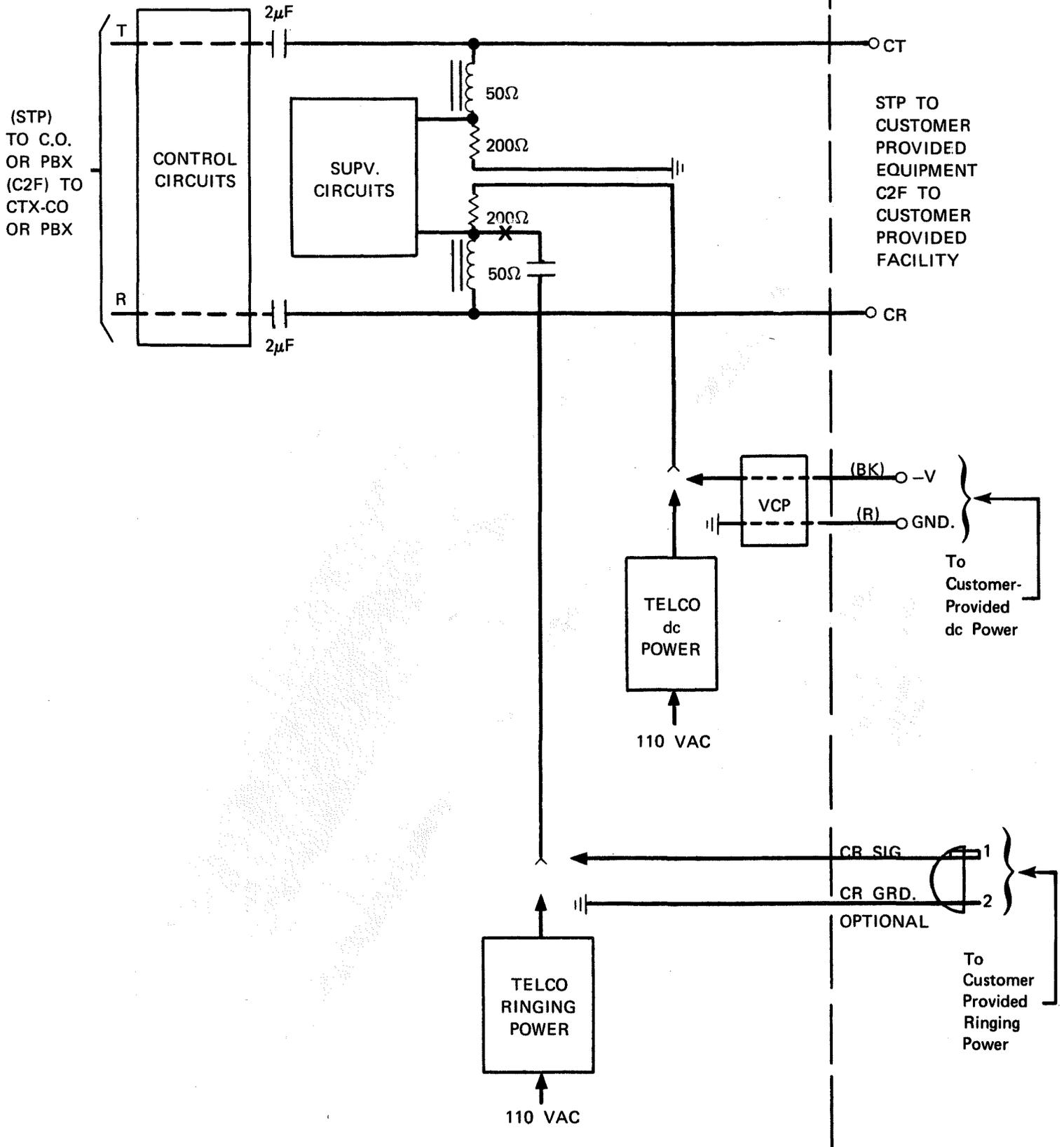


TYPICAL INTERFACE CONNECTING BLOCK
FIG. 2

PRELIMINARY

TELEPHONE COMPANY SIDE

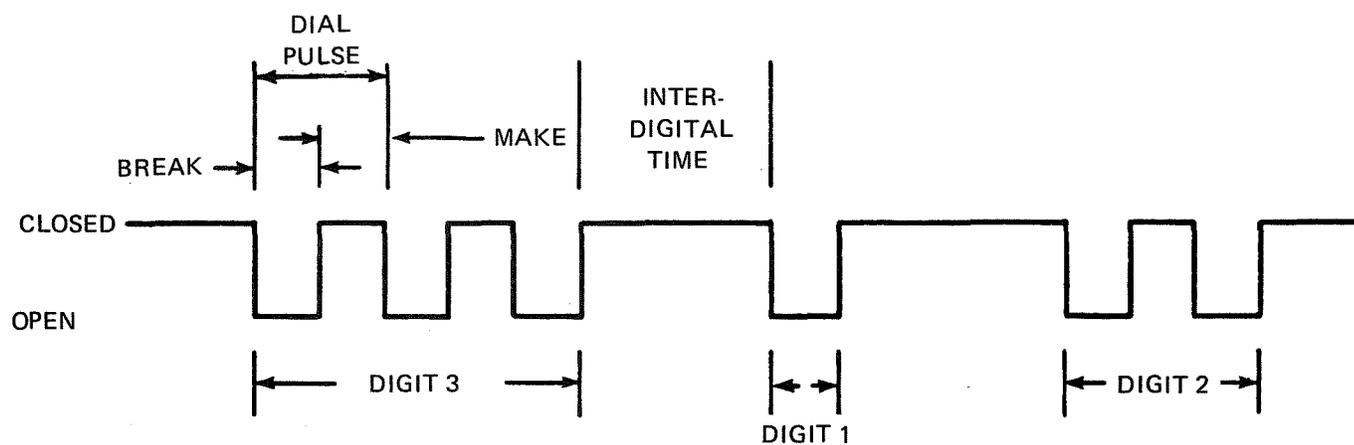
CUSTOMER'S SIDE



BLOCK DIAGRAM – PROTECTIVE CONNECTING ARRANGEMENTS STP AND C2F
FIG. 3

PRELIMINARY

TYPICAL PATTERN OF DIAL PULSES EXPECTED
FROM CUSTOMER-PROVIDED EQUIPMENT OVER
LEADS CT AND CR (e.g., WHEN DIALING NUMBER 312)



DIAL PULSE RATE: 8-11 PULSES PER SECOND (10 NOMINAL)
PERCENT BREAK: 58-64 PERCENT OF TOTAL MAKE-PLUS-BREAK INTERVAL (61% NOMINAL)
INTERDIGITAL TIME: 600 MILLISECONDS MINIMUM

PROTECTIVE CONNECTING ARRANGEMENTS STP AND C2F
DIAL PULSE CHARACTERISTICS
FIG. 4