45-, 55- AND 75-BAUD PRIVATE LINE CHANNELS

INTERFACE SPECIFICATION

1. GENERAL

PURPOSE

1.01 The purpose of this specification is to define the interface between the Private Line Channels designated 45-Baud, 55-Baud, and 75-Baud, and a Customer Provided Terminal (CPT).

DESCRIPTION OF CHANNEL

1.02 These Private Line Channels are capable of transmitting direct-current, two state ("mark-space," "binary") signals at their rated speeds for teletypewriter, data, metering, supervisory control, and miscellaneous signaling purposes. The following Table A summarizes the signaling capabilities of the 45-, 55- and 75-Baud Private Line Channels.

The 45-, 55- and 75-Baud services are different in nature than the familiar voiceband private line or the DDD network in that they consist of alternating or direct current terminal loops interconnected by networks of narrow band tandem link transmission facilities.

These channels are furnished for one-way operation on a two-wire basis, and for half-duplex (two-way, non-simultaneous) and for full-duplex (two-way, simultaneous) operation on a four-wire basis at the interface. Metallic continuity, end-to-end, however, is not a requirement of these channels and will generally not be available.

VARIATIONS FROM STANDARD ARRANGEMENTS

1.03 Where Customer Provided Terminal (CPT) equipment is not compatible with these channel interface specifications, or requires additional service features, special negotiations must be made with the local Telephone Company representatives. In some cases it may be determined that a different tariff would apply, special arrangement charges are appropriate, or a special contract with the Telephone Company is required. An example of such a special arrangement might be the bi-polar voltage interface that is described in the Electronics Industries Association specification RS-232-B.

2. DESCRIPTION OF INTERFACE

PHYSICAL

2.01 Normally a terminal block having 6-32 screws will be provided by the Telephone Company to serve as an interface between the 45-, 55- or 75-Baud Channel and the CPT. Figure 1 shows typical send-only, receive-only, half-duplex and full-duplex interface arrangements.

The channel side of the interface terminal block will appear as one or two pairs of wires connecting to the serving telephone office or to transmission equipment supplied by the Telephone Company and located on the customer's premises. The need for, and type of, transmission equipment will be

TABLE A

PRIVATE LINE CHANNEL DESIGNATION	MAXIMUM PERMISSIBLE BAUD RATE	MINIMUM SIGNALING ELEMENT LENGTH
45 Baud	45.55 Bauds	21.95 milliseconds
55 Baud	56.85 Bauds	17.59 milliseconds
75 Baud	75.00 Bauds	13.33 milliseconds

determined by the Telephone Company. Space for this equipment shall be provided by the customer.

The CPT side of the interface should consist of one pair of wires connected to the input of the CPT and one pair connected to the output of the CPT as shown in Figure 1.

> ***Note:*** Where a large number of channels are to be terminated at a single location, the physical aspects of the interface may vary due to space and maintenance considerations. Therefore, it is strongly recommended that these be discussed with the Telephone Company representatives well in advance of installation.

POWER REQUIREMENTS

2.02 In systems where the Telephone Company provides transmission equipment at the interface, the customer must provide a source of continuous 117-volt, 60-Hz ac power from a non-switched outlet. The equipment supplied by the Telephone Company will work properly over a voltage range of 105 to 129 volts and a frequency deviation of ± 0.45 Hz. The power receptacle provided must accept a U-bladeground type plug and supply a valid ground to the ground pin. The power consumption will not exceed 70 watts per channel. Where transmission equipment is not provided, the customer does not need to provide any power for the 45-, 55- or 75-Baud Channel.

ENVIRONMENT

2.03 In systems where the Telephone Company provides transmission equipment at the interface, the ambient temperature should be in the range of 40° to 120°F and the relative humidity should be in the range of 20 percent to 95 percent.

3. ELECTRICAL CHARACTERISTICS OF INTERFACE

CHANNEL SIGNALS

3.01 The signals at the interface will be either 20 ± 1-milliamperes or 62.5 ± 2.5-milliamperes neutral signals (current—no current) as determined by the Telephone Company. Therefore, it is suggested that CPT equipment using these channels be designed to work with either level of marking current; either directly or by a wiring option.

The value of dc voltage selected by the Telephone Company to supply the current will vary depending on local conditions and the type of transmission equipment used. The tip (T) or ring (R) side of the send data (SD) or receive data (RD) terminals may have a potential of 0 up to 135 volts dc to ground (positive or negative). From 24 volts up to 270 volts dc may exist across the SD terminals when the CPT send contact is open (station sending a space signal). Polarity is such that current flow through the CPT is from ring to tip, i.e., the ring side is positive with respect to tip.

Identification of the interface terminals will be furnished by the Telephone Company who will also make the dc current adjustments.

INPUT OF THE CUSTOMER PROVIDED TERMINAL

3.02 The input (receive side) of the CPT should appear to the channel as a circuit having a fixed resistance of less than 150 ohms and an inductance of less than 0.5 Henry. (Non-inductive impedances are preferred as they cause less CPT send contact deterioration.) The receiving circuitry should be isolated from ground (leakage > 1.0 megohm) and should not impress foreign voltages in excess of 1/2 volt on the telephone facilities.

OUTPUT OF THE CUSTOMER PROVIDED TERMINAL

3.03 The output (send side) from the CPT should appear as a set of contacts or their electrical equivalent (isolated from ground) capable of repeatedly making and breaking a nominal 62.5 milliamperes at up to 270 volts dc. When the contacts are "open," the resistance across the contacts should be at least one megohm and when closed, the contact resistance should be less than five ohms. Any device used to monitor the output of the CPT should insert less than 150 ohms and less than 0.5 Henry inductance in series with the send contacts. (Relays having dry reed contacts have not proven satisfactory for this application.) If mechanical or mercury wetted contacts are used, it is recommended that a spark suppression network be provided in the CPT as shown in Figure 1 to reduce electrical circuit noise and prevent excessive contact erosion. Nominal values of the spark suppression circuit components should be a resistance of 470 to 1000 ohms in series with a capacitance of 0.1 microfarad.

4. TRANSMISSION CHARACTERISTICS OF CHANNEL

CHANNEL DISTORTION—DEFINITION

4.01 The 45-, 55- and 75-Baud Channels are normally lined-up and maintained by the Telephone Company using "start-stop" telegraph characters as a source of test signals. These characters will generally be transmitted at the highest rated speed of the channel ordered. The exception to this is where the configuration of a channel requires a regenerative repeater (see Paragraph 4.02) and thus must be tested using a precise speed and code format. The received signals will be measured in terms of "telegraph distortion."

The start-stop character used is composed of several elements: a single-unit "start" element which is a space; five, single-unit information elements, which may be mark or space; and a "stop" element which is a mark, and is one unit or longer in length. A typical 5-level character is illustrated in Figure 2.

Telegraph distortion is the measure of the maximum displacement of any mark-to-space or any space-to-mark transition from its ideal instant. The reference point used when measuring telegraph distortion is the initial mark-to-space transition of each character which occurs at the beginning of each "start" element. The slicing level for all measurements is at the 50% point on the rising or falling current waveforms.

Referring to Figure 2, transitions measured at the slicing level should occur at integral multiplex of t_e for no distortion. If a transition occurs at time Δ t earlier or later than this time, the distortion is:

$$\text{Percent Distortion} = \frac{\Delta t}{t_e} \times 100$$

For example, refer to Figure 2 and examine the distortion of information element No. 3 which is in the space condition. Assume the nominal element length t_e = 20 milliseconds and that Δt_2 = 2 milliseconds and that Δt_3 = 4 milliseconds.

$$\text{Peak Distortion Per Character} = \frac{\Delta t \text{ max.}}{t_e} \times 100 = 20\%$$

Thus, although the element is 30 percent shorter than its nominal length, its telegraph distortion by definition is 20 percent.

CHANNEL DISTORTION

4.02 The amount of inherent channel distortion encountered on 45-, 55- and 75-Baud channels is a function of the channel length and its complexity (number of transmission links in tandem between any two stations). If the CPT character code format and Baud rate is any one of those listed in Table B, the Telephone Company may place a regenerative repeater in the channel to insure that it will perform as specified in paragraph 4.03. For this reason, the Telephone Company will generally ask for the speed and code format used by the CPT. However, if the CPT uses the channel for transmitting other codes, variable length bits or character, or if the CPT uses it alternately at different signal rates and/or different character code formats, standard regenerative repeaters can not be provided and the inherent distortion of the channel is not specified.

TABLE B

COMMON DATA CHARACTER FORMATS

Start-Stop	
Start Element	— Unity length
	— Always "Space"
Information Elements	— 5, 6, 7, or 8 per character
	— Unity length
	— "Mark" or "Space"
Stop Element	— Unity or greater in length
	— Always "Mark"
Synchronous	
All Elements	— Unity length
	— "Mark" or "Space"

TABLE B (Cont'd)

COMMON DATA RATES

(0-75 Bauds)

45.55 Bauds

50.00 Bauds

56.85 Bauds

61.12 Bauds

66.67 Bauds

74.23 Bauds

75.00 Bauds

PERFORMANCE OBJECTIVES

4.03 The long term objectives of 45-, 55-, or 75-Baud channels is to have an average performance of 1 error in 105 bits transmitted. The CPT should deliver no more than 8% telegraph distortion at the interface and should be capable of processing received data signals at the interface with up to 35% telegraph distortion. CPT's unable to meet these requirements may expect that special engineering and possible associated charges may be incurred.

TURN AROUND TIME—HALF DUPLEX OPERATION

4.04 The near-end or local turn around time of a half duplex 45-, 55- or 75-Baud channel (the required time interval for any Telephone Company supplied local transmission equipment to condition itself to reverse the direction of transmission) is essentially zero. However, the CPT should not be arranged to reverse its direction of transmission until it has received the entire nominal length "stop" pulse of the last received character in a message.

The far-end or distant turn around time of a half duplex channel (the time interval consisting of the two-way propogation time of the channel, delay through regenerative repeaters and directional control circuit operation in the transmission equipment) may be as high as 500 milliseconds. However, if far-end turn around time is critical to the CPT operating procedure, it is recommended that the specific case be discussed with the local Telephone Company representatives.

CHANNEL FAILURE INDICATION

4.05 No separate leads are brought out at the interface to indicate when a channel failure or interruption occurs. If the channel goes into a steady spacing condition (no current on the receive data leads), this indicates a channel failure and the CPT equipment may use this signal condition as a channel failure indication, if so desired. However, certain channel failure conditions may not cause steady spacing to occur on the receive data (RD) leads.

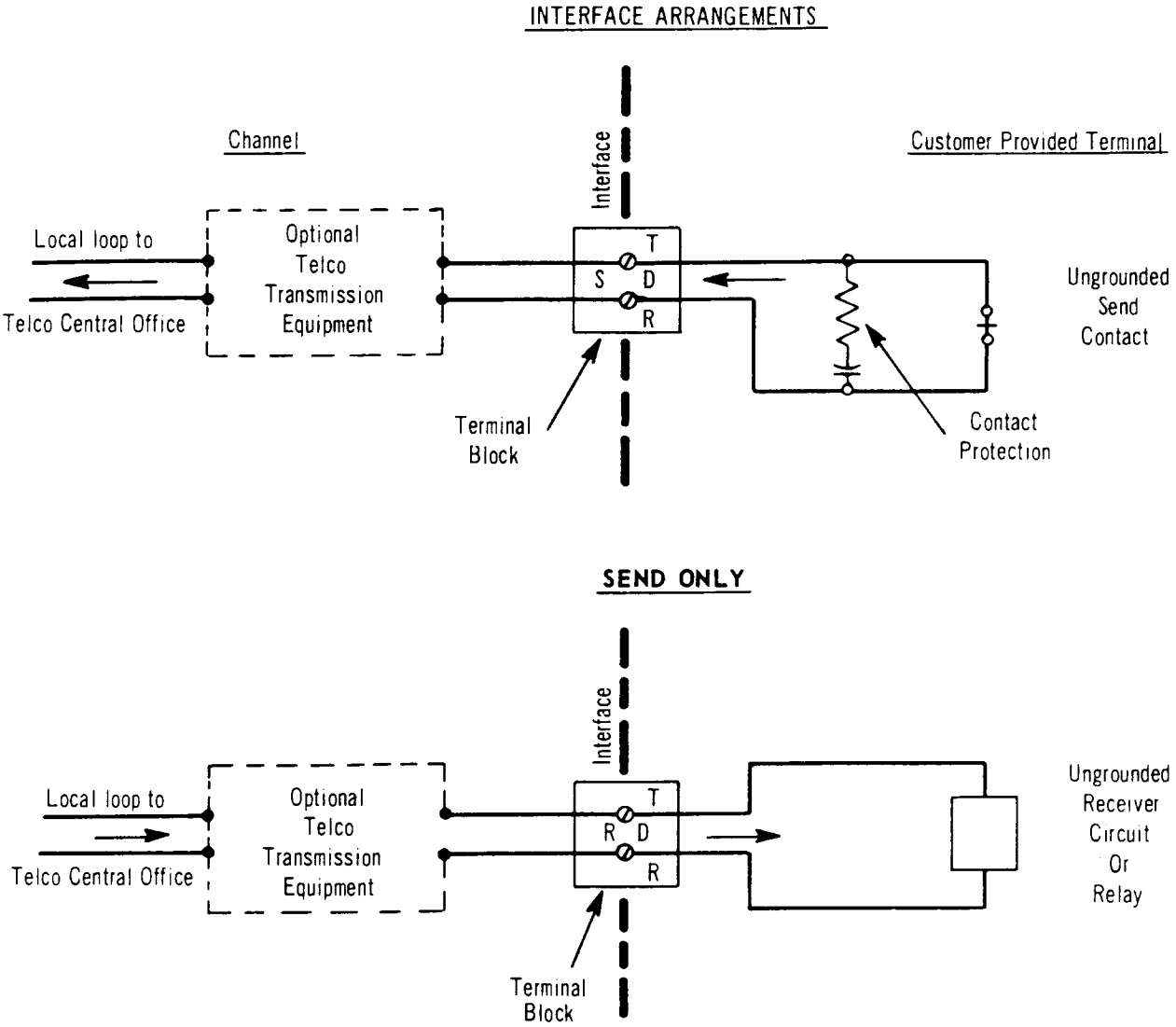


Fig. 1—Receive Only (Con't on Next Page)

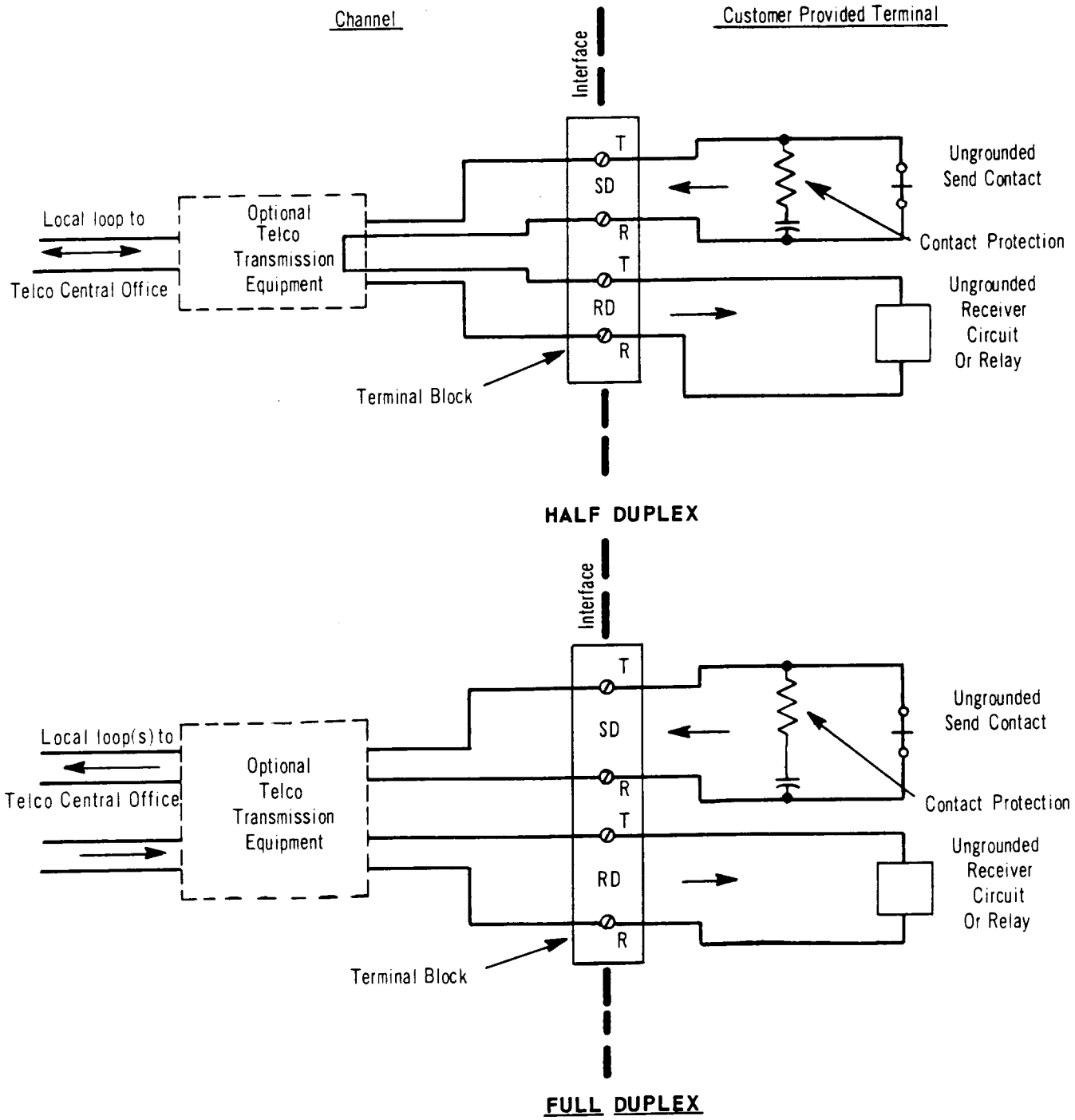
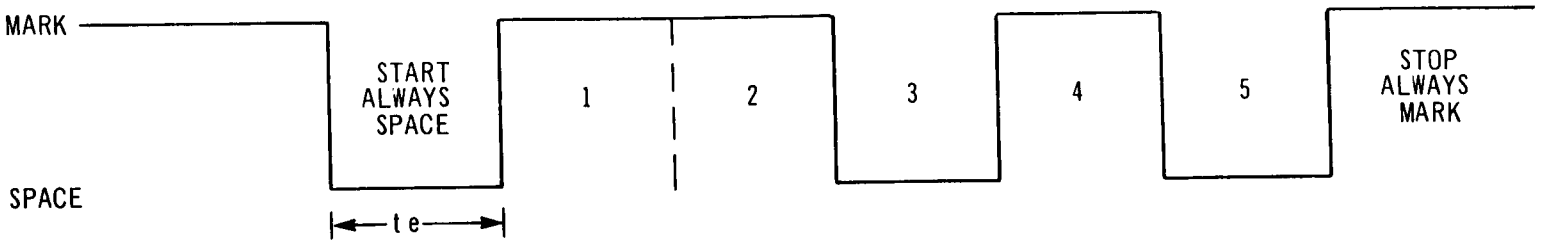


Fig. 1—(Continued)



IDEAL FIVE LEVEL
TELEGRAPH START-STOP SIGNAL

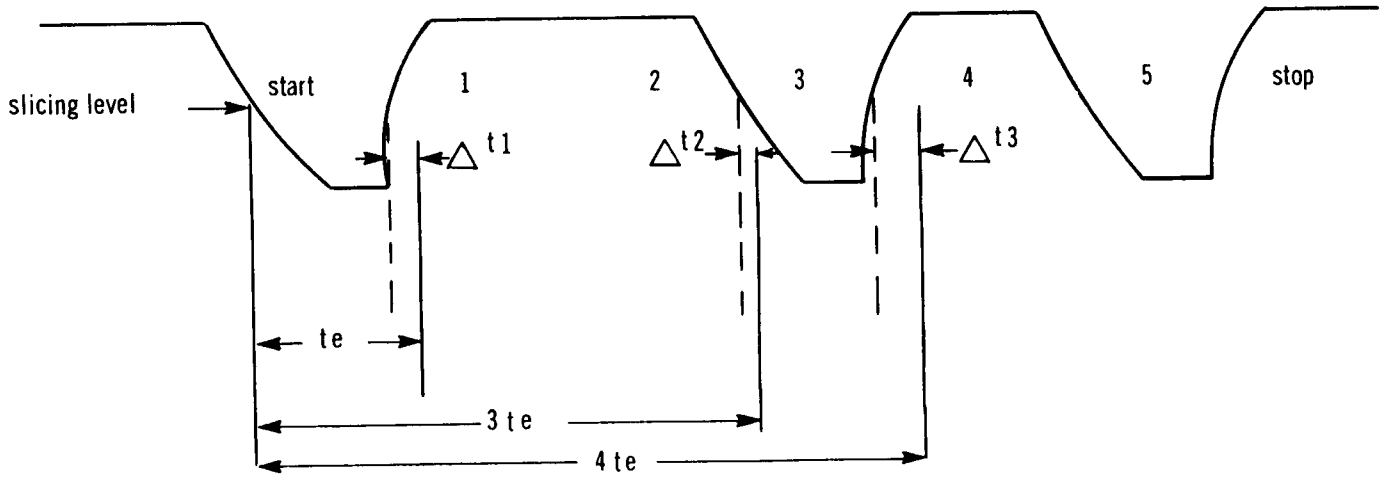


Fig. 2—Distorted Five Level Telegraph Start-Stop Signal