E1D 2600-CYCLE SINGLE-FREQUENCY SIGNALING AND 4-WIRE TERMINATING UNIT REVERSE BATTERY SUPERVISION TERMINATING OFFICE END COMMON SYSTEMS

1. GENERAL

1.01 The E1D single-frequency (SF) signaling unit is used at the terminating end of one-way automatic or dial trunks with loop reverse battery supervision and MF or nominal 10-pulse-per-second dial pulsing. It is suitable for exchange, tandem, and toll connecting trunks that use carrier channels for line facilities. DC signals (battery reversals) from the office (equipment) side are converted to 2600-cycle signals for transmission over the line facility to an SF unit at the distant terminal. Conversely, it receives 2600-cycle signals from the line facility (which are originated by the SF unit at the far end) and converts them to dc loop signals on the office side.

1.02 This unit transmits supervisory signals to, and receives supervisory signals and dial pulses from the carrier facility. When associated with an automatic trunk or a trunk using MF pulsing, the signaling unit is used only for supervision. Audible tone and flashing signals are passed without distortion over a maximum of three SF signaling links in tandem, providing none of these links transmit the flashing signals with an E1B or E2B unit. The E1D is primarily intended to be used with a type E1C at the originating end. Substitutions may be made for the E1C however, and are noted in 2.02. A 4-wire terminating circuit is included as an integral part of the E1D.

1.03 Present design does not provide for trunks that use any other kind of loop supervision, 20 pps dialing, revertive or PCI pulsing, 20-cycle or 130-volt ringing, or remote-control zone registration. In addition, it can not be used with CAMA crossbar tandem trunks which dial pulse against an off hook, or can be made busy from the terminating office.

2. APPLICATION

2.01 This unit will function with N-, O-, or ON-type carrier systems. Office transmission levels for the transmitter and receiver are −16 db and +7 db, respectively. Nominal signal tone (in the idle condition and also for supervisory flashes) is −20 dbm referred to zero transmission level.

2.02 Six leads are required to insert the transmitter-receiver between the office and line facility. These leads may be cabled to an intermediate distributing frame for cross connection. Fig. 1 shows a typical circuit layout with an E1D unit at the right terminal and a complementary E1C unit at the left terminal. It is expected that the E1D will normally be used with an E1C at the originating end, but the E1D will also function properly if an E1A, E1B, or E2B 2600-cycle unit is substituted for the E1C.

2.03 The 2-wire side of the 4-wire terminating circuit is designed to be used with a 900$_\omega$ and 2 MF impedance circuit. The 4-wire side matches 600$_\omega$ facilities. A group of four building-out capacitors is included across the compromise network in the terminating circuit, any combination of which may be wired in when required to balance the capacitance of the office cabling on the 2-wire side of the terminating circuit.

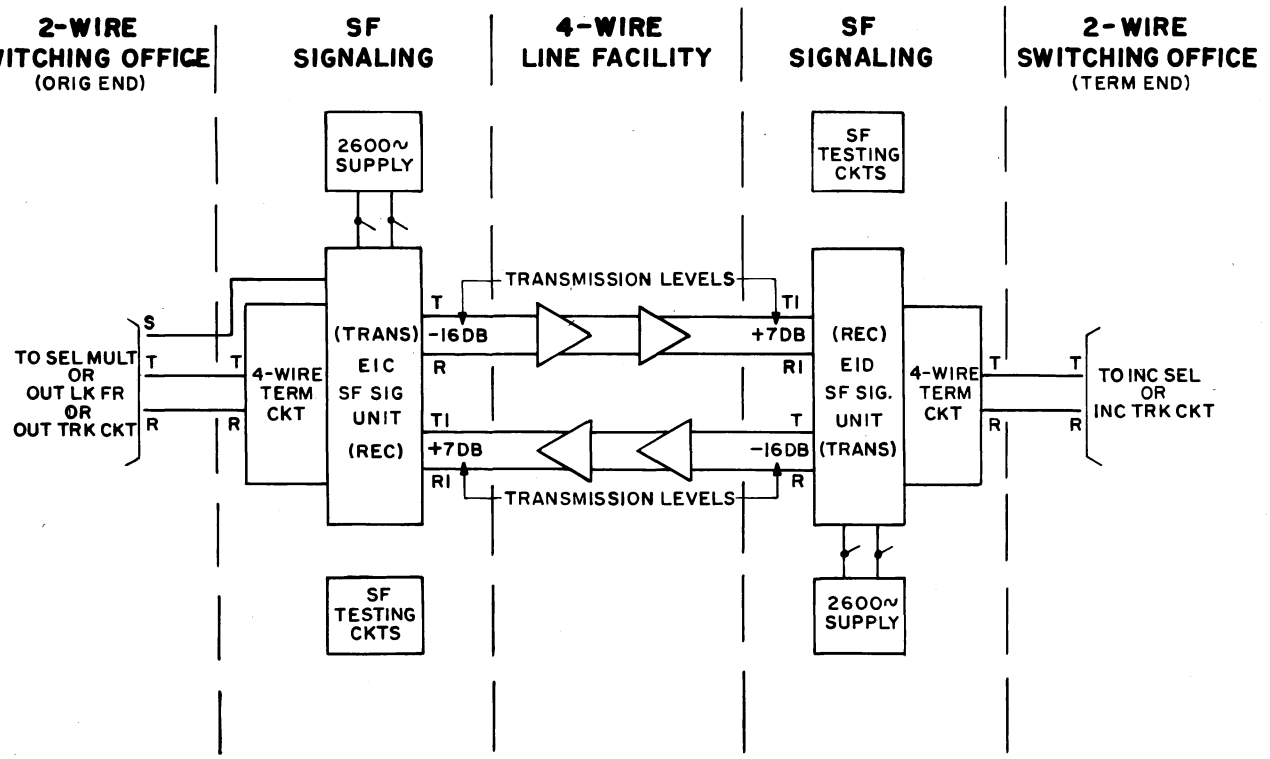

Fig. 1 – Circuit Layout Using E1D SF Signaling Unit

2.04 The maximum allowable frequency shift within the 4-wire facility is ±10 cycles and the transmission variation limits should be held within ±6 db at the signaling frequency.

2.05 This unit will function with −48-volt battery loop signaling office circuits which supply reverse battery supervision. Maximum external circuit loop resistance including selector or incoming trunk circuit relay windings within the pulsing loop is 950ω.

3. OPERATIONAL PRINCIPLES

3.01 A block diagram showing the basic elements of the E1D circuit appears in Fig. 2. The transmitter converts dc loop supervisory signals on the 2-wire T and R leads into SF tone pulses to the T and R line transmit leads. The CS relay operates and releases from battery reversals received from the 2-wire T and R leads, thereby alternately removing and applying SF tone to the line. Since only supervisory signals of a relatively slow pulse rate (usually not over 120 ipm) are transmitted to the originating end, no provision is made to increase the amplitude of these pulses over the level that is used for the idle condition.

3.02 To simplify the block diagram in Fig. 2, the voice amplifier is shown as part of the receiver although technically it is a separate circuit. The amplifier's primary function is to provide a high loss in a backward direction to prevent noise or speech originating in the office equipment from reaching the receiver (over the T1, R1 leads) and interfering with its operation. In addition, it makes up for the insertion loss of the receiver (approximately 1.0 db), and by means of its associated potentiometer allows the required trunk net loss to be established.

3.03 The receiver consists of (1) an amplifier-limiter input stage, (2) a signal and guard frequency detector plus separate half-wave rectifiers, (3) a 2-stage dc amplifier and pulse correcting circuit, (4) two relays (R, RG), and (5) two networks.

3.04 The amplifier-limiter stage receives ac signals from the line via a third winding on the input transformer. A potentiometer at the input of this stage permits setting the proper

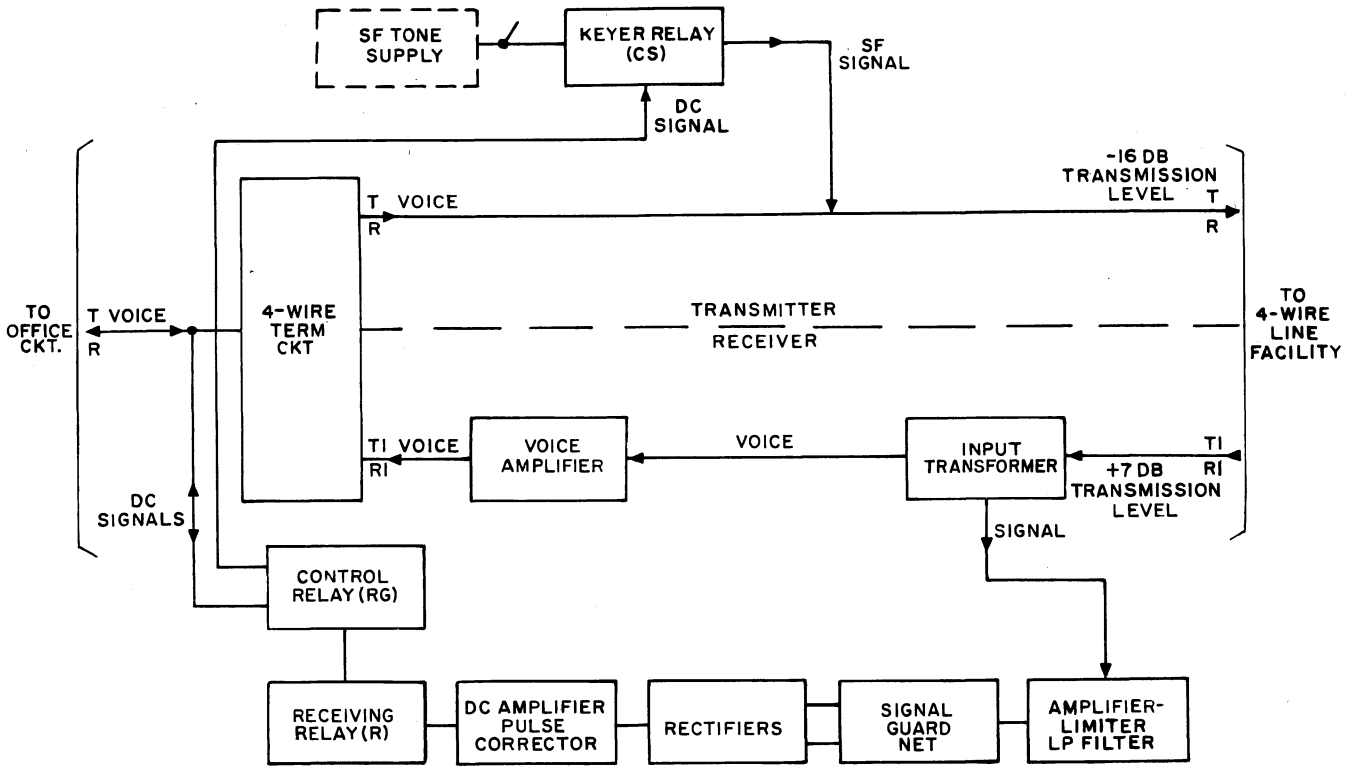

Fig. 2 – Basic Elements of E1D Circuit

receiver operate sensitivity of −29 dbm referred to zero transmission level. Since nominal signal power is −20 dbm (at 0TL), a 9-db operate margin is obtained. This compensates for variations in the sending power at the distant terminal, loss variations in the line facility, and sensitivity drift in the receiver itself. At low input levels, the amplifier-limiter produces maximum gain, while at higher input levels, limiting takes place and gain is reduced. An output transformer and capacitor arrangement forms a low-pass filter to sharply attenuate harmonics of the signal frequency that might be generated as a result of limiting. These harmonics, if not suppressed, would produce an excess amount of guard voltage which might prevent proper receiver operation, as described below.

3.05 The amplifier-limiter output voltages are then applied to the signal-guard detector where they are separated into signal and guard components. The signal network in this detector develops ac voltages proportional to incoming SF tone and/or signaling frequency appearing in speech. The guard network develops ac voltages proportional to all frequencies except SF tone and/or speech-simulated signaling frequency. These components are individually rectified, combined in opposing polarity, and are then fed to the dc amplifier for control of the receiving relay (R). The R relay in turn controls the RG relay. A pulse-correcting network is included in the dc amplifier circuitry. This correcting feature improves the characteristics of incoming SF pulses before they are applied to the 2-wire loop as dc signals.

3.06 The signal-guard relationship together with the time constants in the pulse corrector circuit determines the operate time of the receiver. A high signal-guard ratio produces fast operate time; low signal-guard ratio, a slow operate time. This ratio is established by the CS and RG relays which control the efficiency of the guard channel. When the trunk is idle (RG relay operated, CS relay released), the guard channel is at its lowest efficiency and the resultant signal-guard ratio is maximum. The receiver, there-

fore, should not be released falsely by line noise. In the talking condition (RG relay released, CS relay operated), the guard channel is at its maximum efficiency and the signal-guard ratio is then minimum. This protects the receiver from operating falsely on signal frequencies appearing in speech.

3.07 Contacts on the RG relay furnish dc loop signals to the office equipment on the 2-wire T and R leads. When the RG relay is operated, the loop is open. Release of the RG closes the loop.

4. MISCELLANEOUS

4.01 The E1D unit is 2 inches wide and 12 inches high. Ten units mounted side by side require the space taken by six 2- by 23-inch mounting plates. For 19-inch relay rack bays, eight units use approximately the same amount of space as seven 1-3/4- by 19-inch mounting plates. Fig. 3 is a view of the unit.

4.02 Typical relay rack bay arrangements for the E1D units are described and pictured in Section 987.200.20.

Fig. 3 – E1D SF Signaling Unit