

E7 REPEATER INTRODUCTION

1.01 The E7 repeater is a 48-volt, transistor device intended for use on nonloaded loops used for TWX and DATA-PHONE services. It is installed at the central office end of such loops, and is not intended for intermediate use. It improves the return loss of the loop by modifying the impedance seen from the central office end, and provides moderate gains at the higher voice frequencies to permit meeting return-loss and insertion-loss requirements, respectively.

1.02 The E7 has no counterpart in previous Western Electric negative-impedance repeaters although it does utilize the same housing and mounting-shelf arrangements as the E6 repeater. The E7 repeater, consisting of a negative-impedance converter, an adjustable network and an inequality ratio transformer, acts essentially as a series repeater at low voice frequencies and as a shunt repeater at high voice frequencies.

1.03 Because E7 repeaters must improve the impedance matches between non-loaded loops and nominal office impedance, 900 ohms and 2 uf in series, they are necessarily unsymmetrical devices. To couple the office to the loop, the E7 employs a transformer with taps on the loop winding. The converter is coupled to both office and loop by means of a fixed third winding. Cross-connections to the E7 must be made carefully to avoid connecting the loop to the office side and vice versa, with consequent failure of the line-up to produce expected results.

1.04 The E7 repeater is designed for use on nonloaded subscriber loops that meet the design rules listed below.

- (1) No more than 18 kft in length to the working station.
- (2) No more than 1200 ohms external loop resistance.
- (3) Straight and mixed gauge utilizing 26-gauge, 24-gauge and/or 22-gauge cable. (Only trivial amounts of 19-gauge or open wire).

(4) Bridged taps.

- (a) No loaded bridged taps.
 - (b) Total bridged tap (including nonworking end section) not to exceed 6 kft.
 - (c) No bridged taps within 600 ft. of the central office.
- (5) No more than 500 ft. of drop wire.

Variations within these rules are taken care of through adjustment of the network in the repeater.

1.05 For transmission purposes, an E7 repeater is not considered as an entity apart from its associated loop. It is designed so that, within the rules given above and with proper line-up, it will produce these minimum return-loss results for the repeatered loop as a whole:

FREQUENCY (cps)	RETURN LOSS (db)
1000	At least 14
2300	" " 10
3500	" " 4
300 — 3000	" " 8

These return losses are measured against a standard of 900 ohms in series with 2 uf.

1.06 Because the E7 is not designed to present a smooth termination at the central office end of the loop it may reduce the return loss at the station end of the loop. Application of the E7, therefore, is restricted to terminal subscriber loops where the circuit is not switched at the station end.

1.07 Through use of the E7, the losses of most nonloaded loops can be reduced to about 6 db up to 2300 cps, with little or no gain provided at 1000 cps or lower frequencies. Stability is maintained with adequate singing margin to take care of normal variations in loops and repeaters.

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1.08 The E7 is measured and adjusted after connection to the non-loaded loop to which it is assigned. The principal items of testing equipment required for adjustment are as follows: a 54B Test Stand, a 54C Return Loss Measuring Set and an adjustable-frequency oscillator.

1.09 All adjustments are made by means of a screwdriver, with the repeater in the test stand. Because of the wide variation among loops, prescription design based on loop-layout information can provide only approximate repeater network settings. Some readjustment based on measurement of return loss and stability is necessary in order that the repeated loop meet return-loss and insertion-loss objectives.

1.10 Once the repeater has been adjusted, variations with both time and temperature will be small. As the network components are carefully selected during manufacture of the repeater, one E7 can be replaced with another without repeating the whole line-up. Settings of the first repeater are simply duplicated on the second, and then touched up, if necessary.

1.11 The repeater causes little distortion of dial pulses and ringing signals.

1.12 The E7 is designed to pass supervisory direct current up to 150 ma. Nonloaded loops passing currents in excess of 120 ma will not normally require E7 treatment.