COMMON SYSTEMS
DIAL LONG LINE CIRCUIT
10 OR 20 PPS REPEATING
FOR SUBSCRIBER LINES, PBX STATION LINES
OR PBX MANUAL SELECTED TRUNKS
DIAL CENTRAL OFFICE OR PBX

CHANGES

D. Description of Circuit Changes

D.1 ZN option is provided as a record option for 48V operation, and ZP option is added to provide for 72V operation to increase the range.

D.2 ZQ option is provided as a record option to rate 14A resistance lamp as Mfr Disc. and ZR option is added as Standard replacing ZQ option to provide 14B resistance lamp to limit loop current.

D.3 Notes 101, 102, 106, and Figures and Option Table are modified.

D.4 Equipment Note 207 is added.

D.5 Rating of circuit is changed from AT&TCo Standard to Mfr Disc.

D.6 This action is initiated as part of a program to reduce the number of D11 circuits which have little or no demand.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 4132-GCC-RCC

50

COMMON SYSTEMS
DIAL LONG LINE CIRCUIT
10 OR 20 PPS REPEATING
FOR SUBSCRIBER LINES, PBX STATION LINES
OR PBX MANUAL SELECTED TRUNKS
DIAL CENTRAL OFFICE OR PBX

TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 To increase effectively the maximum loop resistance over which dialing supervision, and ringing signals may be properly transmitted and received between a central office or PBX and a station, or between a central office and a PBX.

2. GENERAL METHOD OF OPERATION

2.01 This circuit receives dial pulse and supervisory signals from the station end and repeats them, by means of the sensitive P relay, toward the central office or PBX.

RINGING

2.02 When ringing current is received from the central office or PBX, relay R is operated causing the operation of relay R1. Relay R1 connects ringing current toward the station.

2.03 Three different ringing arrangements are available as follows:

(a) Bypassed ringing.

(b) A ±105 volt repeated ringing with tripping during the silent period by operation of relay P.

(c) An 84- to 68-volt 20 cycle ac and superimposed dc ringing with tripping during the ringing interval by operation of relay TP and during the silent interval by operation of relay P.

It should be noted that arrangement (c) requires the use of applique unit J99236F and circuit option ZE.

SECTION II - DETAILED DESCRIPTION

1. CALLS FROM THE CENTRAL OFFICE OR PBX

1.01 When the line terminal associated with this circuit in the central office or dial-type PBX is seized, or when the plug is inserted in the station line jack of the PBX station line circuit and ringing current is applied to the line, relay R operates. Relay R operated closes the circuit to relay R1 which, with M or ZE option, connects fresh ringing current to the line to ring the PBX or the station. With M option, ringing may only be tripped during the silent period. With ZE option, ringing can be tripped during both the ringing and the silent period. When option ZE is provided and the subscriber answers during the ringing period, relay TP operates, operating the central office tripping circuit, short circuiting capacitor D and relay R which releases, and short circuiting its own secondary winding to aid in making this relay slow release. Capacitor E provides for bypassing ringing around the winding of relay TP to minimize any reduction in ringing range and to increase the slow-release time of relay TP. Relay R released in turn releases relay R1 which completes the

operating circuit of relay P. Relay P operated maintains the loop to the central office when relay TP releases. When this circuit is used for a long subscriber line, or when the combination of PBX trunk loop and station loop is within the tripping range of the office, N option with bypass ringing may be provided in the case of the long subscriber line to provide party line ringing if required, and to provide tripping during the ringing period.

1.02 This circuit uses a 239- or 280-type relay with a permanent electrical bias which insures proper repetition of the high speed dial pulses. The biasing winding is also effective in the ringing condition.

1.03 When relay R1 is operated, capacitor C is charged to 48 volts. When ringing stops and relay R1 releases, the voltage stored on the line toward the station or PBX, together with that on the capacitor in series with the ringer and the ringing bridge, discharges into the line windings of relay P, tending to operate it. Under this condition, capacitor C shunts the series bias resistance and charges through the biasing winding to approximately 48 volts in a direction opposite to the charge which it held when relay R1 was operated. The effect of this charging current in the secondary winding is to oppose the rise in current in the primary windings and prevent the front contact closure of relay P.

1.04 Relay R is connected through the back contact of relay P to avoid changing the charge on capacitor D while the attendant or station is dialing. This prevents false operation of relay R.

1.05 As described above, provision is made at the end of the ringing period to prevent the false operation of relay P when ringing current is disconnected from the line by the release of relay R1. Under extreme conditions, relay P may operate momentarily, but the interval of its closure is not sufficient to operate the tripping relay in the central office ringing circuit.

2. CALLS FROM DIAL STATION, PBX ATTENDANT, OR PBX STATION

CALLS ORIGINATED BY THE STATION

2.01 When the receiver is removed from the switchhook at the station, relay P operates and closes the loop toward the central office. When dial tone is heard, the station dials in the usual manner. Relay P follows the dial pulses, repeating them to the central office.

CALLS ORIGINATED BY PBX ATTENDANT

2.02 When the attendant inserts the plug of the cord into the PBX trunk jack which is associated with this equipment, relay P operates and closes the loop toward the central office. When dial tone is heard, the attendant dials in the usual manner and relay P follows the dial pulses, repeating them to the central office. The attendant may dial with either a 10- or 20-PPS dial.

CALLS ORIGINATED AT PBX STATION

2.03 When this circuit is used as a long line circuit on an extension from a dial or manual PBX to a regular subscriber telephone, the operation of the circuit is the same as when used as a central office long trunk circuit.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Dialing

	10 PPS	20 PPS
Maximum Conductor Loop Resistance	3000 ohms	2000 ohms

1.02 Supervision

Maximum External Circuit Loop	3100 ohms
Minimum Insulation Resistance	30,000 ohms

1.03 Tripping Range (ZE Option)

	Maximum External Circuit Loop
Ringing Plant Having 44-to 52-Volt Superimposing Battery	3000 ohms
Ringing Plant Having 36-to 40-Volt Superimposing Battery	2400 ohms

1.04 For interconnecting information, see compatibility application schematic, SD-99421-01, for the transmission system to which connections are to be made.

1.05 Relay P Biasing Applications -Selection to be Made Unless Otherwise Noted (See Note 1.04)

Type of Office	Application	Bias Resistor
SXS	Single Circuit	10,000 ohms
	Tandem Circuits	5,000 ohms

Type of Office	Application	Bias Resistor
Panel, Crossbar, or ESS	Single Circuit	10,000 ohms
	Tandem Circuit	10,000 ohms or 16,500 ohms for loops exceeding 5000 ohms

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
P	Responds to seizure and dialing by station.
R1	Applies ringing current toward station.
TP	Trips relayed superimposed ringing when station answers during the ringing interval.
R	Responds to ringing and causes operation of relay R1.

2.02 Lamp

Designation	Meaning
Resistance Lamp A	Limits current through windings of relay P during trouble conditions.

2.03 Resistors

Designation	Meaning
A	Compensating resistance to prevent saturation of CO relay.
B	Provides bias for relay P as compensation for reactive effects of long cable loops.

2.04 Capacitors

Designation	Meaning
B	Transmission bypass
E	Bypasses ac ringing around relay TP winding.
C1,C2	Neutralizes discharge of line when relay R1 releases, thus preventing false operation of relay P.
D	Blocks dc component of machine ringing from relay R winding.

3. FUNCTIONS

3.01 To provide for repeating dial pulses (10 PPS) on station dialed calls through a manual PBX or the manual section of a dial PBX into a central office.

3.02 To provide means for repeating dial pulses (10 or 20 PPS) on attendant dialed calls to a central office.

3.03 To provide transmitter battery supply to the station.

3.04 To relay switchhook supervision.

3.05 To arrange for relayed or bypassed ringing.

3.06 To trip ringing during the ringing interval.

4. CONNECTING CIRCUITS

(a) Standard Subscribers Set.

(b) Dial Subscribers Line Circuit - SD-32133-01 (typical).

(c) PBX Station Line Circuit - SD-66715-01 (typical).

(d) Long Line Circuit - SD-96034-01 (typical).

(e) Central Office Trunk Circuit - SD-66617-01 (typical).

(f) 4-Wire Term Set - SD-97136-01.

(g) Auxiliary Long Line Circuit - SD-1E043-01 (TOUCH-TONE® Calling).

5. PROTECTION

RESISTANCE LAMP PROTECTION

5.01 Resistance lamp A has a high-enough resistance to be self-protecting against the office voltage. However, under certain line conditions on lines which may be exposed to electrical disturbances, voltages may be impressed upon the lamp which would cause its filament to burn out. The use of Fig. 2 provides shunts around the lamp filaments to prevent the voltage from rising above the capability of the lamp. Normally the resistance of the varistor is so high as to have no effect upon the circuit operation, but when the voltage rises above 50 volts the resistance drops to a very low value, which holds the voltage below a value which would tend to burn out the filaments of the lamp.

6. TESTING

TESTING THE POLARIZED P RELAY

6.01 Resistance lamp A is provided with a electron-tube base so that it can be removed from the socket to provide a point where the test set can be connected for testing and readjusting relay P. The test set may be connected to the tube socket by using a 332A tool.

6.02 With relay P connected in the circuit and resistance lamp A removed from the socket, all shunts on the operating windings of relay P are removed, with the exception of varistor A when it is equipped with Fig. 2 and the secondary winding of relay R1. The resistance of varistor A under the test condition is so high as to have no effect upon the meter reading and no appreciable effect upon the amount of current flowing through the P1 winding of relay P. The shunt of the secondary winding of relay R1 on relay P has a slight effect when current is applied in the direction with the reversal key normal in the test set. This is compensated for in the value indicated under the test condition. When the reversal key is operated, this shunt is removed and there is a different reading in the test set, but this does not affect the capability of the relay in the circuit and this change in current should be disregarded.

SECTION IV - REASONS FOR REISSUE

B. Changes In Apparatus

B.1

Superseded	Superseded By
Resistor B 106A - 5000 ohms - ZF option	Resistor B 221A - 4990 ohms - ZG option
Resistor B 106A - 10,000 ohms - ZF option	Resistor B 221A - 10,000 ohms - ZG option

D. Description of Changes

D.1 This circuit is compatible for use with 24V4 repeaters in accordance with restrictions detailed in the V4 repeater signaling compatibility schematic, SD-99421-01. In Fig. 1 the following circuit changes reflect this usage:

(a) ZH and ZI option designations are added to the T and R leads.

(b) ZJ option designation is added at the A capacitor.

D.2 For certain applications of V4 signaling systems it has been found that longitudinal voltages, arising from the simplexing of cable pairs, can be converted to metallic noise. This noise can be adequately rejected by connecting this circuit between the A/B and SX/SX1 leads of the 4-wire terminating set. In Fig. 1 the following circuit changes are made to reflect this modification:

(a) ZL and ZM options wiring to the 4-wire terminating circuit is added.

(b) ZK option wiring straps are added at the A repeat coil.

This circuit arrangement provides for an improved return loss because the repeat coil is removed from the transmission path. This arrangement also improves the stability of the transmission circuits because the loop is not opened during dialing or when the dial long line circuit is idle. The pulsing capability of this circuit is unaffected under this usage.

D.3 Circuit Note 110 and Information Note 302 are added.

D.4 The apparatus codes for the B resistors are changed per ZF and ZG options to effect a circuit cost reduction.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5333-WFH-FLS