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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

B. Changes in Apparatus

B.1 Superseded

Superseded by

R1 through R4 Diodes
446F - App Fig 1

R1 through R4 Diodes
533F - App Fig 1

D,E,F Resistor 221A-
App Fig B

D,E,F Resistor
KS-20810 L1A-App Fig B

D. Description of Changes

- D.1 Diode code change due to component standardization program.
- D.2 Resistor code 221A rerated "Manufacture Discontinued"
replaced by KS-20810 L1A.

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DEPT 4161-FJL-LCJR

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CIRCUIT DESCRIPTION

CD-96555-01
ISSUE 4D
APPENDIX 3D
DWG ISSUE 16D

COMMON SYSTEMS
DIAL LONG LINES 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 CHANGES

- D.1 Rating of circuit changed from Manufacture Discontinued to AT&T Co. Standard.
- D.2 Drawing Distribution Code changed from 3N99 to 1N99.

BELL TELEPHONE LABORATORIES, INCORPORATED
DEPT 4132-LDS-RCC

CIRCUIT DESCRIPTION

CD-96555-01
ISSUE 4D
APPENDIX 2A
DWG ISSUE 15A

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 Changes

- D.1 Capacitor B is made part of ZJ option to provide a talking path when wet loop pulsing is required.
- D.2 Sheet 2 is changed to show repeat coil A, and sheet 2B is canceled.
- D.3 Note 105 is changed, Note 110 is omitted, and Note 111 is added.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 4132-GCC-RCC

COMMON SYSTEMS
DIAL LONG LINE CIRCUIT
10 OR 20 PPS REPEATING
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OR PBX MANUAL SELECTED TRUNKS
DIAL CENTRAL OFFICE OR PBX

CHANGES

D. Description of Changes

- D.1 The rating of circuit is changed from AT&TCo Standard to Mfr Disc. It is replaced by SD-1C359-01.
- D.2 CAD3 is modified to show ZL and ZK options.
- D.3 CAD8 is modified to always provide ground A to terminal punching 31 for relay R1.
- D.4 Reference to CAD1 which is rated Mfr Disc. is deleted from CAD11.
- D.5 The transmission path is shown in thick lines.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 4132-GCC-RCC

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

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to effectively increase 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.

1.02 By means of wiring options, the impedance of this circuit may be matched with the PBX and central office to which it is connected.

2. GENERAL DESCRIPTION OF OPERATION

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

2.02 Wet Loop Signaling: With the ZJ option, relay P closes 48-volt battery from this circuit over the ring side of the line, through the pulse repeating relay in the distance Long Line Circuit which has been modified for this service, and over the tip side of the line to ground in this circuit. This arrangement, which provides 48-volt battery for signaling between two Long Line Circuits instead of low-voltage battery from the PBX, gives considerable increase in loop and stability of pulsing. When the PBX has 48-volt battery, there is no advantage in using option ZJ.

2.03 72-Volt Operation: With the ZL option, 72-volt battery is provided to the DLL, which allows the station loop to be increased to 2800 ohms.

2.04 Ringing: When ringing current is received from the central office or PBX, relay R1 is operated connecting ringing current toward the station. Three different ringing arrangements are available by means of unit terminal strip wiring options:

- (a) Bypassed ringing.
- (b) ±105 volt repeated ringing with tripping during the silent period by operation of relay P.
- (c) 84 to 88 volts, 20 Hz, and superimposed with tripping during the ringing interval by operation of relay TP and during the silent interval by operation of relay P.

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 R1 operates; this connects fresh ringing current to the line when the Long Line Circuit is located in an intermediate central office or connects the line to the central office circuit when it is located in a terminating office to ring the PBX or the station. Generally, the circuit is arranged to relay the ringing. With option D, R1 operated also grounds the MS

lead to allow the ringing machine to start on a call-start basis.

1.02 Apparatus and wiring is provided in Fig. 1 to trip relayed ringing during the ringing interval. This feature is provided through the use of the TP relay, E capacitor, T wiring, and either U or S wiring. When these options are used and the subscriber answers during the ringing period, the TP relay operates and operates the central office tripping circuit, opens the winding circuit of relay R1 to release it, and short-circuits its own secondary winding to release the relay slowly. Capacitor E provides for bypassing the ringing around the winding of the TP relay to minimize any reduction in ringing range and to increase the slow-release time of the TP relay.

1.03 ±105 volt relayed ringing with tripping during the silent period only is available with P wiring.

1.04 When the 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, bypass ringing (option ZI) may be provided. In all cases, when the subscriber answers during the silent period, relay P operates and, through its contacts, operates the central office or PBX tripping circuit.

1.05 When relay R1 is operated, capacitors C1 and C2 are 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, capacitors C1 and C2 shunt the series bias resistance and charge 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 to prevent the front contact closure of relay P.

1.06 As described in 1.05, 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. CALL FROM DIAL STATION, PBX ATTENDANT, OR PBX STATION

2.01 Call Originated by Dial Station: When the receiver is removed from the switch-hook 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.

2.02 Calls Originated by PBX Attendant: 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.

2.03 Calls Originated by Station in the PBX: 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 Line Circuit.

3. PROTECTION

3.01 Resistance Lamp Protection: 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 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.

3.02 Diodes R1, R2, R3, and R4 are protected in part by an A varistor, which dissipates transients generated while dialing is in progress. To protect the diodes against ringing transients, the ringing plant must be equipped with surge protection equipment similar to SD-81278-01.

4. TESTING

4.01 Testing Polarized Relay P: Resistance lamp A is provided with an electron base so that it can be removed from the socket to provide a point where the test set can be connected for the testing and readjusting of relay P. The test set may be connected to the tube socket by using a 332A plug. 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. 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.

4.02 Testing R1 Relay: Polarity of test leads must be observed when adjusting the R1 relay due to the presence of the 420B diode bridge in parallel with the relay winding.

1.03 Tripping Range (Option S or U)

Maximum External
Circuit Loop

SECTION III - REFERENCE DATA

Ringling plant
having 44- to 52-volt
superimposed battery 3000 ohms

1. WORKING LIMITS

1.01 Dialing

Ringling plant
having 36- to 40-volt
superimposed battery 2400 ohms

10 PPS 20 PPS

Maximum conductor
loop resistance 3000 ohms 2000 ohms

See SD-96555-01, Sheet 3, for additional range data for single-circuit operation.

1.02 Supervision

1.04 See Table A. The data in Table A refers to DTWX lines only.

20 PPS

Maximum external
circuit loop 3100 ohms

1.05 This circuit is compatible for use with 28V4 repeaters in accordance with restrictions as detailed in the V4 repeater, signaling compatibility schematic, SD-99421-03.

Minimum insulation
resistance 30,000 ohms

TABLE A

Minimum	EIS to Dial Long Line	Dial Long Line	Dial Long Line to Station
Central Office Battery Voltage	Maximum Conductor Loop Resistance	Maximum External Circuit Loop Resistance	Makeup of Facilities
45 Volts	50 Ohms	2500 Ohms	19GA or Finer
45 Volts	500 Ohms	1800 Ohms	19GA or Finer
45 Volts	500 Ohms	2000 Ohms	22GA or Finer
48 Volts	50 Ohms	2800 Ohms	19GA or Finer
48 Volts	500 Ohms	1800 Ohms	19GA or Finer
48 Volts	500 Ohms	2400 Ohms	22GA or Finer

Notes

1. These are maximum hot weather resistance values.
2. Resistance limitations are based on dial speeds of 9 to 11 pps and minimum insulation resistance of 30,000 ohms.
3. These ranges assume a station dial that generates pulses with a percent break in the range of 58 to 64. The new 8C and 7L dials employed in the 689 and 691 attendant sets, respectively, meet this requirement.
4. Dial long line unit SD-96555-01 must be equipped with a 120C- or 120T-type coil, 2-uF capacitor, and option Y.
5. Repeater effects should be included as outlined in PEL 6914.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

<u>Designation</u>	<u>Meaning</u>
P	To respond to seizure and dialing by station.
R1	To apply ringing current toward station.
TP	To trip relayed superimposed ringing when station answers during the ringing interval.

2.02 Capacitors

<u>Designation</u>	<u>Meaning</u>
C1, C2	To neutralize discharge of line when R1 relay releases, thus preventing false operation of P relay.
D	To block dc component of machine ringing from R1 relay winding.
E	To bypass ac ringing around TP relay winding.

2.03 Lamp

<u>Designation</u>	<u>Meaning</u>
A (Resistance)	To limit current through winding of relay P during trouble conditions.

2.04 Resistors

<u>Designation</u>	<u>Meaning</u>
B, D, E, F	To provide bias for relay P as compensation for reactive effects of long cable loops.

2.05 Varistor

A	To protect diodes from transient peak voltages occurring during dialing
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3. FUNCTIONS

3.01 Provides 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 Provides means for repeating dial pulses (10 pps or 20 pps) on attendant-dialed calls to a central office.

3.03 Provides transmitter battery supply to the station.

3.04 Relays switchhook supervision.

3.05 Arranges for relayed or bypassed ringing.

3.06 Arranges to trip ringing during the ringing interval.

3.07 Provides for 600:900-, 900:600-, 600:600- or 900:900-ohm termination to station or office.

3.08 Provides for wet loop signaling.

3.09 Provides for 72-volt operation to increase range.

4. CONNECTING CIRCUITS

- (a) Standard Subscriber Set.
- (b) Dial Subscriber 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) Auxiliary Long Line Circuit - SD-1E043-01.
- (g) 24V4 Telephone Repeater Circuit - SD-97047-01 (typical).

5. MANUFACTURING TESTING REQUIREMENTS

None.

SECTION IV - REASONS FOR REISSUE

B. Changes in Apparatus

<u>Superseded</u>	<u>Superseded by</u>
Transformer A Type 120C	Transformer A Type 120T
Resistance Lamp 14A Type	Resistance lamp 14B Type

D. Description of Changes

D.1 Option ZJ is added to provide wet loop signaling.

D.2 Option ZK is added to provide a record option for 48-volt and option ZL for 72-volt operation.

D.3 Option ZM is provided for 14A resistance lamp and option ZN for 14B resistance lamp to limit loop current.

D.4 Information Notes 102 and 104 are modified.

D.5 Information Notes 110 and 301 are added.

D.6 ZS is assigned as an apparatus option to the 120C transformer and rated Mfr Disc.

D.7 Options ZU, ZT, and ZV are assigned to 120T transformer and rated AT&TCo Standard

to provide 900:900-, 600:600-, 600:900-, or 900:600-ohm termination at PBX or office to improve transmission capabilities.

D.8 CAD 8 is modified to show option ZE and ZF straps are optional.

D.9 CAD 10 is added

D.9 CAD 10 is added.

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DEPT 4132-GCC-RCC