STATION SYSTEMS
KEY TELEPHONE SYSTEM NO. 1A
LINE AND SIGNALING CIRCUIT
WITH STRIP MOUNTED EQUIPMENT

0. CHANGES

0.1 CHANGED AND ADDED FUNCTIONS

None.

0.2 CHANGES IN APPARATUS

Added:

317A Varistor, Figs. 1 and 3

Superseded:	Superseded by:
1A Thermistor	8A Thermistor, Figs. 1 and 3

0.3 CHANGES IN CIRCUIT REQUIREMENTS (Not Associated with 0.2 Above)

None.

0.4 DESCRIPTION OF CIRCUIT CHANGES

(a) The (S) 317A varistor, option "ZF," is added to Figs. 1 and 3 to protect the (R) varistor, the (R1) varistor combination, Fig. 7, and the (T) and (R) thermistors from transients.

(b) Option "ZG" is designated for the (T) and (R) 1A thermistors in Figs. 1 and 3, which are superseded by 8A thermistors, option "ZH," in accordance with present Western Electric Company manufacture. The purpose of this change is to prevent short circuits caused by the metal ends of the 1A thermistors.

(c) In Figs. 51A and 51C the "LG" lead is removed from terminal 13 and connected to terminal 15, and a strap is added between terminals 13 and 15. The purpose of this change is to make these figures consistent with other cross-connection drawings.

1. PURPOSE OF CIRCUIT

This circuit provides a means for signaling a subscriber station on a line from a central office or PBX, for holding that line, and for lighting the (LINE AND BUSY) or telephone set lamps whenever that line is busy in connection with stations of the 1A key telephone system. It also provides tie lines, a station line, an intercommunicating circuit, and the common circuits necessary for the proper functioning of the lines for the 1A key telephone system.

2. WORKING LIMITS

The working limits will be shown on the range chart.

3. FUNCTIONS

3.1 ON CENTRAL OFFICE OR PBX LINES

(a) Flashes the (LINE AND BUSY) or telephone set lamps on incoming calls.

(b) Operates the audible signal on incoming calls.

(c) Lights the (LINE AND BUSY) or telephone set lamps steady when a station answers or originates a call.

(d) Provides for holding the line by means of a locked-in relay.

(e) Provides for removing the hold condition on the line when the line is again picked up at any station or when the line is momentarily opened at the central office or PBX.

(f) Starts the flashing circuit functioning on an incoming call.

(g) Releases, after an interval of approximately 30 seconds, locked-in relays which have operated on incoming calls while the system was unattended. This extinguishes line lamps on abandoned calls.

(h) Extinguishes the (LINE AND BUSY) or telephone set lamps when the station disconnects.

(i) Prevents the (LINE AND BUSY) lamps lighting falsely on disconnections.

(j) Provides for cutting off other stations.

(k) Provides for preventing a station from being cut off after it has been connected to the line.

( ) Provides for cutting off a station after it has been connected to a line.

3.2 ON AUTOMATIC TIE LINES

(a) Flashes the (LINE AND BUSY) or telephone set lamps on incoming calls.

(b) Operates the audible signal on incoming calls.

(c) Lights the (LINE AND BUSY) or telephone set lamps steady when the station answers or originates a call.

(d) Starts the flashing circuit functioning on incoming calls.

(e) Extinguishes the (LINE AND BUSY) or telephone set lamps after the stations at both ends disconnect.

3.3 ON RINGDOWN TIE LINES

(a) Flashes the (LINE AND BUSY) or telephone set lamps on incoming calls.

(b) Operates the audible signal on incoming calls.

(c) Lights the (LINE AND BUSY) or telephone set lamps steady when the station answers or originates a call.

(d) Starts the flashing circuit functioning on an incoming call.

(e) Extinguishes (LINE AND BUSY) or telephone set lamps when the station disconnects.

(f) Prevents the (LINE AND BUSY) or telephone set lamps lighting falsely on disconnections.

(g) Releases, after an interval of approximately 30 seconds, locked-in relays which have operated on incoming calls while the system was unattended. This extinguishes the line lamps on abandoned calls.

3.4 ON STATION LINES

(a) Flashes the (LINE AND BUSY) or telephone set lamps on incoming calls.

(b) Operates the audible signal on incoming calls.

(c) Lights the (LINE AND BUSY) or telephone set lamps steady when the station answers or originates a call.

(d) Starts the flashing circuit functioning on an incoming call.

(e) Extinguishes the (LINE AND BUSY) or telephone set lamps after the stations at both ends disconnect.

(f) Provides for intercommunication between stations.

4. CONNECTING CIRCUITS

When this circuit is listed in the key sheet, the connecting information thereon is to be followed. The following are typical connecting circuits:

(a) Standard line circuits in dial or manual central offices.

(b) Standard PBX line circuits.

(c) Similar type tie line circuits at distant end.

(d) Rectifiers J86205A, List 1 and List 2.

(e) Continuous ringing supply.

(f) Standard subscriber station sets.

(g) Telephone sets of the 1A key telephone system - SD-69096-01, SD-69128-01, SD-69129-01, SD-69132-01, SD-69133-01, SD-69185-01, SD-69187-01, SD-69188-01, and SD-69197-01.

(h) Attendant's telephone circuit - SD-69196-01.

(i) No. 101G power plant, list 4 or list 6.

5. DESCRIPTION OF OPERATION

5.01 LINE CIRCUIT (FIG. 1)

5.01.1 Incoming Call

5.01.11 Signaling

When ringing current is applied to the line on an incoming call, the (R) relay will operate, current passing through the

secondary winding to ground through the (R1) relay and the (R1) varistor combination, Fig. 7. The (S) 317A varistor protects the (R) varistor, the (R1) varistor combination, and the (T) and (R) thermistors from transients. The (R) relay will lock operated on its primary winding under control of the battery cutoff key, Fig. 9, or the (TO) relay, Fig. 17. The (R1) relay causes the audible signal to operate on each ringing period. The (R) relay also starts the flashing circuit, Fig. 6, functioning which causes the (LINE AND BUSY) or telephone set lamps to flash, and closes the circuit through the heater winding of the (TO) relay, Fig. 17, if that figure is used.

5.01.111 Operation of (R) Relay When Its Locking Circuit Is Opened at the Battery Cutoff Key (Fig. 9)

When the battery cutoff key is operated, ground is removed from the "LK" lead which prevents the (R) relay from locking operated. Under this condition the (R) relay will operate and remain operated only while ringing current is applied to the line.

5.01.112 Purpose of (T) and (R) Thermistors and the (R) Varistor

The (T) and (R) thermistors are used to prevent a false operation of the (R) relay on reversal of current which may occur on disconnections. Also, they prevent the false operation of the (R) relay on dial pulses. The thermistors are thermal devices which ordinarily have a resistance in the order of 50,000 ohms. When the ringing voltage is applied to the line, it causes current to flow through one of the thermistors according to which side of the line ringing current is impressed. Generally, this is on the ring side. This causes the resistance of the thermistor to change in approximately 1/2 second from 50,000 ohms to about 3,000 ohms. The path for the current through the thermistors is through varistor (R), relay (R), and (R1) relay, and the (R1) varistor combination to ground, Fig. 7. Only 1/2 the ringing cycle passes through varistor (R). The other half is blocked and will pass through relay (R). When the thermistor resistance drops to about 3,000 ohms, sufficient current flows on the 1/2 cycle through relay (R) to cause it to operate.

5.01.12 Answering

When the station answers by operating the associated pickup key in the key telephone set or separately mounted key and removing the handset from its mounting, the (L) and (L1) relays will operate. The (L) relay performs no function at this time. The

(L1) relay operates the (SR) relay which opens the lockup circuit of the (R) relay, lights the (LINE AND BUSY) or telephone set lamps steady, and operates the (TO) relay, Fig. 17, which opens the heater winding circuit of that relay. When the automatic cut-off circuit, Fig. 25, is used, the (SR) relay operates directly from that circuit or the automatic cutoff control circuit, Fig. 22. The (L1) relay does not operate in this case.

5.01.13 Disconnection

When the station disconnects, the (L) and (L1) relays release. The (L1) relay released, releases the (SR) relay which extinguishes the (LINE AND BUSY) or telephone set lamps and releases the (TO) relay restoring the circuit to normal.

5.01.2 Outgoing Call

5.01.21 Line Pickup

When the associated pickup key is operated and the handset is removed from its mounting, the (L), (L1), (SR), and (TO) relays will operate, the (SR) relay lighting the (LINE AND BUSY) or telephone set lamps steady.

5.01.22 Dialing

When the dial pulses are passing through the (L1) relay, it may vibrate following the pulses. The (SR) relay, however, is a slow-release relay and will hold operated keeping the (LINE AND BUSY) or telephone set lamps lighted steady.

5.01.23 Disconnection

Disconnection on outgoing calls is the same as for incoming calls as covered in 5.01.13.

5.01.3 Holding

5.01.31 Establishing a Hold Condition

Incoming and outgoing calls can be held by the operation of the hold key in the key telephone set or separately mounted key. The hold key, when operated, opens the operating path of the (L) relay, releasing it, closes a circuit for operating the (H) relay through its primary winding in series with the central office or PBX loop and the station set. When the (H) relay operates, its holding tertiary winding will be connected across the line in series with its noninductive quaternary winding and in parallel with its primary winding. When the hold key is released, the operated pickup key will release, and the operating primary winding circuit of the (H) relay will be opened. The (H) relay is held operated by its tertiary winding, and the key telephone set will be disconnected from the line. The secondary winding of the (H) relay and the "B" lead are used to balance the line which prevents crosstalk interference.

Under the hold condition the (L1) relay and the (SR) relay remain operated keeping the (LINE AND BUSY) or telephone set lamps lighted and the (TO) relay, Fig. 17, operated.

5.01.32 Release of Holding Bridge When the Call Is Again Picked Up

When the call is again picked up at any station, the (L) relay will operate which shorts the holding tertiary winding of the (H) relay releasing this relay. This removes the holding bridge from across the line.

5.01.33 Release of Holding Bridge from the Central Office or PBX

In case the hold circuit is not removed by a station picking up the call, the hold condition can be released from the central office or PBX by opening the line momentarily which releases the (H), (L1), (SR), and (TO) relays restoring the circuit to normal.

5.02 AUTOMATIC TIE LINE CIRCUIT (FIG. 2)

5.02.1 Incoming Call

5.02.11 Signaling

When a call is originated at the distant end, battery and ground coming in over the line will operate the (L) relay which operates the (L1) relay. The (L1) relay starts the flashing circuit functioning, flashing the (LINE AND BUSY) or telephone set lamps, and operates the (R1) relay of Fig. 7 to provide a steady audible signal.

5.02.12 Answering

When the station answers by operating the associated pickup key and removing the handset from its mounting, the (TB) relay operates which releases the (L1) relay, operates the (CO) relay, and operates the (TO) relay, Fig. 17. The operation of the (CO) relay lights the (LINE AND BUSY) or telephone set lamps steady and locks up under control of the (L) relay. The (L1) relay released, silences the audible signal and stops the flashing circuit functioning.

5.02.13 Disconnection

If the party at the distant end disconnects first, the (L) relay will not release as it is held operated from battery and ground on

the contact of the (TB) relay. When the local station disconnects, the (TB) relay releases, releasing the (L), (CO), and (TO) relays and removing battery and ground from the ring and tip of the line, respectively. The (CO) relay, released, extinguishes the (LINE AND BUSY) or telephone set lamps restoring the circuit to normal. If the local station disconnects first, the (TB) relay will release, removing battery and ground from the line, releasing the (TO) relay and opening the operating path for the (CO) relay. The (L) and (CO) relays do not release at this time since the (L) relay is held from battery and ground from the distant end. When the party at the distant end disconnects, the (L) relay releases which releases the (CO) relay. The release of the (CO) relay extinguishes the (LINE AND BUSY) or telephone set lamps restoring the circuit to normal.

5.02.2 Outgoing Call

5.02.21 Origination

An outgoing call is originated by operating the associated pick-up key and removing the handset from its mounting. This operates the (TB) relay which in turn operates the (CO) and (L) relays. The (CO) relay lights the (LINE AND BUSY) or telephone set lamps steady, and the (L) relay closes the holding circuit to the (CO) relay. The (TB) relay also operates the (TO) relay, Fig. 17, and connects battery and ground to the ring and tip of the line, respectively, which signals the party at the distant end. When the party at the distant end answers, no change takes place in this circuit.

5.02.22 Disconnection

Disconnection on outgoing calls is the same as for incoming calls as covered in 5.02.13.

5.02.3 Holding

Incoming or outgoing calls are held by the operation of the hold key. This causes the (TB) relay to release which releases the (TO) relay, removes battery and ground from the line, and opens the operating path for the (CO) relay but does not release the (L) and (CO) relays as these are held under control of the distant end. If the party, at the distant end disconnects while the circuit is being held, the (L) and (CO) relays will release and the (LINE AND BUSY) or telephone set lamps will be extinguished.

5.03 RINGDOWN TIE LINE (FIG. 3)

5.03.1 Incoming Call

5.03.11 Signaling

When ringing current is applied to the line on an incoming call, the (R) relay will operate which will operate the (R1) relay of Fig. 3 which locks to ground at the battery cutoff circuit, Fig. 9, or

the (TO) relay, Fig. 17. The (S) 317A varistor protects the (R) varistor and the (R) thermistor from transients. The (R) relay, when operated, also operates the (R1) relay of Fig. 7 which operates the audible signal on each ringing period. The (R1) relay of Fig. 3 starts the flashing circuit functioning which flashes the (LINE AND BUSY) or telephone set lamps and closes the circuit through the heater winding of the (TO) relay, Fig. 17, if used.

The (R) varistor and (R) thermistor are used to prevent false operation of the (R) relay on disconnections and function in a manner similar to that described in 5.01.112.

5.03.12 Answering

When the station answers by operating the associated pickup key and removing the handset from its mounting, the (TB) relay operates. The (TB) relay lights the (LINE AND BUSY) or telephone set lamps steady, releases the (R1) relay of Fig. 3, connects the talking circuit of the key telephone set to the line, and operates the (TO) relay, Fig. 17, which opens the heater winding circuit of that relay. The(R1) relay of Fig. 3 released stops the flashing circuit functioning.

5.03.13 Disconnection

When the station disconnects, the (TB) relay is released which extinguishes the (LINE AND BUSY) or telephone set lamps restoring the circuit to normal.

5.03.2 Outgoing Call

5.03.21 Origination

An outgoing call is originated by operating the associated pickup key and removing the handset from its mounting. This operates the (TB) relay which lights the (LINE AND BUSY) or telephone set lamps, connects the talking circuit of the key telephone set to the line, and operates the (TO) relay, Fig. 17. The station will then signal the distant end by operating the signal key, which will operate the (RO) relay, connecting ringing current to the line. No change takes place in the circuit when the distant station answers.

5.03.22 Disconnection

Disconnection on outgoing calls is the same as for incoming calls as covered in 5.03.13.

5.03.3 Holding

The holding feature is not provided with this circuit.

5.04 STATION LINE CIRCUIT (FIG. 4)

5.04.1 Incoming Call

5.04.11 Signaling

When a call is originated at the station, the (L) relay will operate which operates the (L1) relay. The (L1) relay starts the flashing circuit functioning flashing (LINE AND BUSY) or telephone set lamps and operates the (R1) relay of Fig. 7 to operate the audible signal steadily.

5.04.12 Answering

When the attendant answers by operating the associated pick-up key and removing the handset from its mounting, the (TB) relay operates which releases the (L1) relay, operates the (CO) relay which lights the (LINE AND BUSY) or telephone set lamps steady, and operates the (TO) relay, Fig. 17. The (CO) relay locks to the front contact of the (L) relay. The (L1) relay, released, silences the audible signal and stops the flashing circuit functioning.

5.04.13 Disconnection

When the party at the station disconnects, the (L) relay releases. When the attendant disconnects, the (TB) relay is released, releasing the (TO) relay, Fig. 17. The last party to disconnect releases the (CO) relay which extinguishes (LINE AND BUSY) or telephone set lamps restoring the circuit to normal.

5.04.2 Outgoing Call

5.04.21 Origination

An outgoing call is originated by operating the associated pick-up key and removing the handset from its mounting. This operates the (TB) relay which operates the (CO) relay to light the (LINE AND BUSY) or telephone set lamps and operates the (TO) relay, Fig. 17. The station will then signal the called station by operating the signal key which will operate the (RO) relay connecting ringing current to the line. When the called station answers, the (L) relay operates which locks the (CO) relay operated.

5.04.22 Disconnection

Disconnection on outgoing calls is the same as for incoming calls as covered in 5.04.13.

5.04.3 Holding

The holding feature is not provided with this circuit.

5.05 INTERCOMMUNICATING CIRCUIT (FIG. 5)

An intercommunicating line circuit is used to provide battery supply for the station transmitters. Whenever this circuit is in use, the (BF) relay will be operated which will operate the (TO) relay, Fig. 17, and light the busy lamps.

5.06 FLASHING CIRCUIT (FIG. 6)

On an incoming call on any line, ground will be connected to the "A" lead which operates the (B) relay. This causes the lamp leads to light the (LINE AND BUSY) or telephone set lamps of the called line and operates the (A) relay. The (A) relay releases the (B) relay. These relays will again reoperate and release until the call is answered. This flashes the (LINE AND BUSY) or telephone set lamps in the line circuits to indicate incoming calls.

5.07 AUDIBLE SIGNAL CONTROL CIRCUIT (FIG. 7)

Relay (R1) is operated by incoming ringing from the "ST" lead of the line circuit, Fig. 1, through the full wave rectifier (R1) to ground or by dc from the private line circuits. The audible signal follows incoming ringing to the line circuit, Fig. 1, and ringdown tie line, Fig. 3, with some delay due to the heating time of the thermistor of the line circuit. It operates steadily on the other private line circuits.

5.08 BATTERY CUTOFF

5.08.1 Manual (Fig. 9)

The operation of the battery cutoff key opens the locking circuit for the (R) relay, Fig. 1, and the (R1) relay, Fig. 3, which prevents these relays locking operated and the (LINE AND BUSY) or telephone set lamps remaining lighted on an abandoned call.

5.08.2 Automatic Time-Out Circuit (Fig. 17)

The purpose of the (TO) relay is to release locked-in relays on abandoned calls when the system is unattended. On all incoming calls of Figs. 1 and 3, a circuit is closed through the heater winding of the (TO) relay. If the call is not answered, the thermometall contacts will open after an interval of approximately 30 seconds. This will release the (R) relays, Fig. 1 and the

(R1) relays, Fig. 3, which in turn will extinguish the (LINE AND BUSY) or telephone set lamps. When the system is attended, the (TO) relay operates whenever a line is in use. This opens the operating circuit of the heater winding of the (TO) relay which prevents the releasing of the locked-in relays while the system is occupied.

5.09 INTERCOMMUNICATING SIGNALS CIRCUIT (FIG. 10)

The buzzers of the 1A key telephone system are arranged for both code and selective signaling. If both code and selective signaling are required for any buzzer at an installation, the (S) relay is provided. When the (S) relay is provided, signaling keys in the key telephone sets arranged for code signaling will operate the (S) relay which in turn will operate all the buzzers that are to be operated by code. For selective signaling, the signaling key when operated will operate the buzzers directly. Any buzzer may be connected for both code and selective signaling. If the (S) relay is not provided, the buzzer will operate either on a code or selective basis directly from the signaling keys.

5.10 AUTOMATIC CUTOFF (FIGS. 22 AND 25 OR 21 AND 25)

5.10.1 Station Cuts Off Other Stations ("J" and "K" Wiring)

When a call is answered or originated at such a station, the (L2) relay operates, operating the (CT) relay. The operating circuit for the (L2) relay is through the back contacts of the (CO) relay, Fig. 22. The (CT) relay closes the "T", "R", "B", and "H" leads through to the station and operates the (CO) relay. The (CO) relay opens the "T" and "R" leads to all stations which are arranged for automatic cutoff and operates the (SR) relay, Fig. 1.

5.10.2 Stations Cannot Cut Off Other Stations and Cannot Be Cut Off When Connected to the Line ("J" and "L" Wiring)

When a call is answered or originated at such a station, the (L2) relay operates operating the (CT) relay. The (CO) relay, Fig. 22, does not operate; therefore, other stations can originate calls. The (CT) relay closes the "T", "R", "H" and "B" leads through to the station so that should another station originate a call which would operate the (CO) relay, Fig. 22, the station which was first connected to the line would not be cut off. The (CT) relay, by means of "L" wiring, operates the (SR) relay, Fig. 1.

5.10.3 Stations Cannot Cut Off Other Stations but Can Be Cut Off When Connected to the Line ("L" Wiring Fig. 25 or "H" and "L" Wiring Fig. 21)

When a call is answered or originated at such a station, the (L2) relay operates, operating the (CT) relay. For Fig. 25: The (CT) relay, by means of the "L" wiring, operates the (SR) relay in Fig. 1. The (CO) relay, Fig. 22, does not operate. Should another

station which operates the (CO) relay come on the line, the station which was first connected to the line would be cut off. The operation of the (CO) relay would open the tip and ring leads to the first station since "J" wiring is omitted. This releases the (L2) relay. For Fig. 21: The (CT) relay, by means of "H" and "L" wiring through back contacts of the (CO) relay of the 26A key telephone unit, operates the (SR) relay in Fig. 1. Should another station originate a call which operates the (CO) relay of Fig. 22, the station which was first connected to the line would be cut off. The operation of the (CO) relay would open the operating circuit for the (CT) relay releasing it. This releases the (L2) relay.

5.10.4 Operation of (SR) Relay (Fig. 1)

When a noncutoff station answers or originates a call, the (L1) relay, Fig. 1, operates the (SR) relay, Fig. 1. The (L1) relay does not operate on calls answered or originated by cutoff stations.

5.11 NOISE SUPPRESSION CIRCUIT (FIG. 23 OR 24)

The 500MF condenser in Figs. 23 and 24 is used to suppress noise interference in the battery supply leads.

5.12 POWER SUPPLY

5.12.1 Battery Supply Information

Sheets 0107 to 0110 provides battery and ac supply feeder information and method of fusing local, building, and 48-volt central office battery.

Formula No. 1 shows the method for computing the feeder resistance to maintain a minimum voltage of 14 volts at the station equipment when the load is maximum and the voltage of the central office or building battery is minimum.

Table 1 shows the minimum and maximum voltages of the central office and building batteries and the feeder voltage drops to maintain 14 volts at the station system. Table 2 shows the current through the relays, buzzers, and lamps at maximum load when the voltage is 14 volts.

Figs. 101, 102, 103, 104, 105, 106, and 107 show the method of fusing for central office or building batteries. When a local battery is used, the fuses are located at the battery. When 48-volt central office battery is used, the feeder and circuit fuses must be 1-1/3 amperes each.

Formula No. 3 provides information for computing the maximum current which may be supplied to the system when the voltage at the central office or building battery is maximum. The current in a 2-ampere fuse under maximum load and voltage condition is limited to 1.6 amperes and a 1-1/3-ampere fuse is limited to 1 ampere to provide an adequate life for the fuse since fuses deteriorate rapidly if they carry current close to their rated capacity. If local and building battery feeder is more than 14 ohms and 48-volt central office battery feeder is more than 38 ohms, fuses should not be used at the station end. The reason for this is that should the resistance be more and the wiring at the station end become grounded, the fuses would not operate even if the battery voltage is maximum.

Sheet 0108 covers the method for computing the charging rate, the battery feeder resistance, and the fusing when local batteries are used at a 1A key telephone system. When a local battery is used, the fuses are to be located at the battery.

The battery charging current is computed by Formula No. 4 and is based on 6 busy hours per day which should be satisfactory for most installations especially those located in business establishments operating 8 hours a day. If definite busy-hours-per-day information is available, then the available values should be substituted for the Fig. 6 in the formula. The busy-hours-per-day value is obtained by dividing the total daily calls by the total calls in the busiest hour. The 1.25 value in the second part of the formula provides for a 25 per cent allowance to take care of battery losses.

5.12.2 Power Supply for Signal Lamps

5.12.21 AC Power Supply for Lamps and Buzzers (Figs. 18 and 19)

Fig. 18 provides the ac-power supply for B2 lamps shown in Fig. 15 when lamp indicators are used. It also provides the ac supply for the buzzers.

Fig. 19 provides the ac supply for the lamps in key telephone sets where a voltage of 7 to 11 volts is required at the lamps. When this supply is used at installations also having some lamps in lamp indicators, these lamps must be G2 lamps per option "ZE" or 51A lamps per option "S."

5.12.22 Lamp Resistance Circuit (Fig. 20)

Fig. 20 is required where a dc-power supply is used for the lamps in key telephone sets. (This dc-power supply is used only when an ac supply is not available.) A resistance is used in series with each lamp so that the voltage will not exceed 11 volts.

When three or more stations are located near each other the "L" and "LG" leads for these stations from Fig. 20 may be connected together, and common "L" and "LG" leads may be run

from the apparatus box to these stations, provided the total resistance of the common "L" and "LG" leads does not exceed 10 ohms divided by the number of stations in the group.

5.12.23 Lamp Supply Information

When B2 lamps mounted in lamp indicators are used in an installation and power is supplied from a battery, one set of feeders between the battery and the apparatus cabinet may supply both the lamps and relays. When the lamps in the key telephone sets are used and power is supplied from a battery, one set of feeders is required for lamps only and one set of feeders for the relays.

Formula 2 (Sheet 0107) shows the method for computing the feeder resistance from a local battery, a building battery, or a 48-volt central office battery to maintain a minimum voltage of 7 volts at the lamps when the load is maximum and the voltage of the battery is minimum.

Formula 5 (Sheet 0107) shows the method for computing the maximum resistance of the wires between the transformer and the apparatus cabinet to maintain a minimum voltage of 7 at the lamps when the load is maximum.

Formula 6 (Sheet 0107) shows the method of computing the maximum load on the 18-volt dc terminals of the J86205A rectifier.

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