

## STATION WIRING PLAN CONNECTIONS—LIMITATIONS

### 1. GENERAL

1.01 This section covers line and station, ringer and line signal, conductor loop resistance and other limitations for station wiring plans. It is reissued to include improved limits for conductor loop resistances of plans with holding features.

1.02 Exceptions to the limitations given herein may be authorized on service orders.

### 2. LINE AND STATION LIMITATIONS

2.01 Standard numbered station wiring plans shall not be used on either party lines or on magneto lines except when authorized by local instructions.

2.02 In general, the arrangement of wiring plan stations should be such that not more than five stations can be connected at one time to the same central office or P.B.X. line and not more than six stations including CR stations to the intercommunicating line at one time. These limits have been followed so as to reduce the possibility of poor transmission being experienced due to the use of a line simultaneously by several stations for listening-in or conference purposes and also to reduce the possibility of interference, particularly with dial pulsing on dial lines. Where the service order and attachments thereto call for station arrangements which would exceed these limitations, some notation to that effect may be made on the order. If no such notation is made it should be explained to the subscriber that transmission is impaired in proportion to the number of stations used simultaneously on one line, and also that interference is more likely where numerous stations may be connected to the same line. Where it is contemplated that not more than two stations will be used simultaneously on one line and where the use of the telephone is such that little interference is anticipated, the limit of five or six stations may be exceeded.

2.03 Unless holding is provided at least one station should be provided for each central office or P.B.X. line associated with a wiring plan.

2.04 The number of line circuits which may be connected to the keys used in the plans ranges from one to five.

2.05 Any arrangement of stations and wiring plans may be connected to the same line circuits, provided that limitations in 2.02 as well as ringer and line signal limitations are not exceeded. Where local practices restrict the combination of certain wiring plans, these should, of course, be observed.

2.06 Line (L or LX) stations are optional and may be bridged directly to the central office or P.B.X. circuits associated with all plans except Plans 107 and 108. With the latter plans, line stations are not provided.

2.07 Where wiring plans provide holding features, the L or LX stations should be connected to the central office or P.B.X. line at the station (key) side of the holding relay equipment so that any locked-in holding relay will release when the bridged station answers an incoming call.

2.08 Where a 3 or 4-wire talking circuit is extended from an induction coil of a subscriber set to a desk stand or hand telephone set, be guided by limitations included in the section entitled "Main and Extension Stations—Connection and Wiring Limitations."

2.09 Drawings in related connections sections may show connections between keys and line circuits or equipment cabinets made outside of the keys. These connections may be made at key terminals, at intermediate connecting blocks or in some cases, in subscriber sets provided that the circuit operation remains unchanged and that the holding leads are wired as specified in the sections covering the installation of wiring plans. In general, related connection

drawings indicate the use of anti-sidetone equipment but sidetone equipment may also be employed if the requirements included herein are met.

2.10 Where automatic cut-off features are provided, apparatus unit equipment is required for each central office or P.B.X. line having the automatic cut-off (secrecy feature).

### 3. RINGER AND LINE SIGNAL LIMITATIONS

3.01 Ringers and line signals used with wiring plans are subject to the same connection limitations as are ringers and line signals used at regular stations. In addition the limitations given below apply.

3.02 The arrangements shall be such that at least one ringer or signal is connected to the central office or P.B.X. line at all times. Exception to this requirement may be made at P.B.X. stations in special cases where for one reason or another a ringer or other signal is not needed by the subscriber.

3.03 At key stations arranged to pick up more than one line where both an induction coil and a ringer are required, use separate subscriber sets for the ringer and the induction coil (except where the ringer and telephone circuit are in the subscriber set housing the relay equipment). The extension ringers can then be located where the sounding of its signal will be most satisfactory. If crosstalk is experienced at existing installations, it may be due to the use of subscriber sets utilizing both a ringer and an induction coil. In such cases, follow instructions covered in the section entitled "Station Wiring Plans—Maintenance."

3.04 On lines arranged for automatic cut-off (Plans 107 and 108) all ringers shall be in separate sets from the subscriber sets used for talking.

3.05 For crosstalk reasons, ringers connected in series shall not be used with wiring plans unless the wiring to the series ringer does not parallel talking circuit wires or is run outside the cable carrying the talking circuits.

### 4. CONDUCTOR LOOP RESISTANCE AND RELATED LIMITATIONS

#### Relay Holding Circuit

4.01 The maximum loop resistance of a central office line or P.B.X. line associated with a wiring plan having holding features should be such that (with the holding bridge across line) not less than .013 amperes will flow through the supervisory relay in the holding circuit when the receiver or hand set is removed from the mounting at the most remote station.

4.02 This limits the maximum conductor loop resistance (assuming a maximum conductor loop resistance between the relay equipment and any station of 30 ohms) from the central office to the relay equipment to 460 ohms in manual and panel dial districts and to 590 ohms in step-by-step dial districts. These resistance limits may be somewhat increased in districts where the central office equipment has been modified so as to permit extended ranges.

4.03 Corresponding conductor loop limits between the central office and the relay equipment when wiring plans are associated with P.B.X. extension lines are indicated in the table which follows.

Type of P.B.X.	Conduc. Loop Res. Between P.B.X. and Relay Equipment	Combined Conduc. Loop Res. Between Manual or Panel Dial Central Off. and P.B.X. and Between P.B.X. and Relay Equip.	Combined Conduc. Loop Res. Between Step-by-Step Dial Central Off. and P.B.X. and Between P.B.X. and Relay Equip.
604C	340 $\omega$	445 $\omega$	580 $\omega$
605A	*275 $\omega$	275 $\omega$	275 $\omega$
605A	**240 $\omega$	275 $\omega$	275 $\omega$
606A	†375 $\omega$	375 $\omega$	—
606A	††550 $\omega$	—	550 $\omega$
701A	***250 $\omega$	250 $\omega$	250 $\omega$
701A	****240 $\omega$	275 $\omega$	275 $\omega$
702A	†375 $\omega$	375 $\omega$	—
702A	**525 $\omega$	—	525 $\omega$
710C	310 $\omega$	300 $\omega$	310 $\omega$
711A	240 $\omega$	430 $\omega$	565 $\omega$
740 A, B & C	240 $\omega$	430 $\omega$	565 $\omega$

0, 550SC, 551A, 551B, 551D, 600C or 700C type P.B.X.'s require long line equipment.

\* When used with regular manual station line circuits.

\*\* When used with station line circuits arranged for conversion for dial use.

\*\*\* When used with manual station line circuits without connector multiple.

\*\*\*\* When used with manual station line circuits with connector multiple.

† Manual or panel dial districts.

†† Step-by-step dial districts.

4.04 Where the limits specified in 4.02 and 4.03 are exceeded, long line equipment should be provided. In determining resistance limits, minimum battery voltages, maximum station resistances, etc. are assumed. While the use of long line equipment is generally recommended when limits specified in 4.03 are exceeded if extension loops are short and other circuit conditions are favorable the long line set may be omitted.

4.05 The orders covering the installation of a wiring plan with holding features should specify whether long line equipment is to be used. Should a check be desired to determine whether or not long line equipment is required the following test of current flow through the supervisory relay in the holding circuit may be made:

(a) Open the ring side of the line at the "R" key terminal in the subscriber set or apparatus cabinet. Connect a 35 type test set or equivalent in series with the wire removed and the "R" key terminal in the apparatus cabinet with the test set arranged for a metallic test, namely "M".

(b) Then call the test deskman from the station, requesting the P.B.X. attendant if station is an extension from a P.B.X. to leave the connection undisturbed until she receives a disconnect signal. Request the test deskman to operate his holding key and to return to the connection within a short time. (If requested, inform test deskman of test being made.) Leave the receiver or hand set off the mounting at the station.

(c) Now block the holding relay operated at the apparatus cabinet and with all resistances in the test set out of the circuit (resistance slides at the extreme left) the meter in the set should show a reading of not less than .013 amperes. Now adjust resistance slides in the test set so that the meter shows a reading of .012 amperes. With this setting the supervisory relay should operate satisfactorily. The latter test will assure some margin for operation of the supervisory relay should tests be made when central office battery is at peak voltage. Should the first reading be less than .013 amperes, the indication of the test is that long line equipment is required. If the relay fails to operate on .012 amperes, it should be readjusted.

(d) At completion of test, disconnect test set, reconnect ring side of line, remove blocking from holding relay and recall test deskman, advising him of completion of test.

### Battery Supply

4.06 If a wiring plan is associated with a P.B.X. where the P.B.X. battery is supplied over direct feeders from the central office additional direct feeders are required for the wiring plan unless the additional battery requirements will warrant the provision of a storage battery charged locally or over floater feeders from the central office.

4.07 For plans requiring a separate battery supply for intercommunication only, the maximum conductor resistance of the feeder from the central office to the wiring plan shall not exceed 250 ohms from a 24-volt central office battery, 430 ohms from a 36-volt battery and 650 ohms from a 48-volt battery.

4.08 A maximum of four 7E bells or six 7E buzzers in parallel may be operated from the central office battery feed used to supply current for intercommunication provided that a minimum of 14 volts is maintained at the station, and that the resistance of the wiring loop through the buzzers and key does not exceed 25 ohms. Where six bells are required the resistance of the buzzer wiring loop shall not exceed 20 ohms.

4.09 Where local battery is used to supply current, the minimum for any plan shall not be less than 14 volts. If dry cells are used connect 15 cells in series. Where local battery is used for talking and signaling six 7E bells or 7E buzzers may be operated over a 25 ohm wiring loop.

4.10 Where the battery feed line used for intercommunication is also used for signaling between stations, condenser per KS-8056 shall be connected across the battery feed pair as close as practicable to the buzzer arrangement. Where, however, a local battery is provided for the installation and separate leads from the battery are run for intercommunication and for the buzzer arrangement, condenser KS-8056 is not required.

4.11 Wires to buzzer keys and buzzers which parallel talking wires or are run in the cable carrying pairs shall be paired as indicated in the drawings in the section entitled "Station Wiring Plans—Buzzer and Key Equipment Power Unit Connections."

4.12 In those cases where the battery feed is capable of supplying sufficient current for talking on the intercommunicating line but there will not be sufficient current for operating the buzzers, or where buzzer signaling circuits only are required, three 22-1/2-volt dry B batteries per KS-6572 connected in parallel may be used to supply the buzzer current. With this arrangement six 7E bells or buzzers may be operated over a wiring loop not exceeding 25 ohms.

4.13 In locations where 110-volt-60 cycle a.c. power is available, the use of a transformer such as the Jefferson Electric Company Transformer No. 231-998 or equivalent may be preferable to the use of B batteries for the purpose stated in 4.11. The 7E buzzer will operate satisfactorily when the 60 cycle output of this transformer is connected to its a.c. terminals. For the 7E bell, connect the alternating current to the d.c. terminals for satisfactory operation. The above transformer will operate 12 7E buzzers or bells.

4.14 Where a.c. power is within limits of 105-125 volts and generally free from interruptions, the key equipment power unit J86205A or equivalent may be used instead of a local storage battery.

4.15 A maximum of six 7E buzzers or bells may be operated from a common buzzer key.