

**BELL SYSTEM PRACTICES**  
**Station Installation and Maintenance**

**SECTION C53.158**  
**Issue 1, June, 1953**  
**AT&T Co Standard**

## **1A1 KEY TELEPHONE SYSTEM**

### **INSTALLATION**

#### **1. GENERAL**

1.01 This section covers the installation of the 1A1 key telephone system. The service and operating features of this system are described in Section C53.156 and the apparatus and supplies required for its installation and maintenance are listed in Section C53.157.

#### **2. SERVICE ORDER AND WORK SHEETS**

2.01 The service order issued for each installation, addition and rearrangement will list the service that is to be provided and usually an attached work sheet will show the operating features for each station and will give information as to the type of apparatus required at each new station.

#### **3. LOCATING AND MOUNTING**

3.01 **The key telephone sets** should be installed on desks or tables on the same basis as other combined sets, hand telephone sets or desk stands and the same requirements apply as regards their location. They should be connected to the station wiring by means of 42- or 44- or 47-type connecting blocks, the installation of which is covered in Division C30. Key telephone set cords should not be exposed to moisture. It may be necessary to fasten the cord near the connecting block with a cable clamp to keep the cord off of the floor. When installing key telephone sets with illuminated key buttons avoid as far as possible locations where extremely high illumination may exist, particularly direct sunlight.

3.02 **Equipment cabinets** when used to house the key telephone units of the 1A1 system should be located and mounted as covered in Section C53.507.

3.03 The 6-plate apparatus cabinet per ED-95021-01 was designed primarily for housing the 1A1 key telephone units, however, these units may be mounted in any of the

larger metal apparatus cabinets or in relay racks that are drilled for 2" mounting plates on 1" centers, by use of mounting bars P-37A502 (for 23") and P-37A823 (for 19"). The 6-plate cabinet, when used, should have at least 10" clearance from a wall or immovable furniture on the right of the cabinet and at least 36" clearance to the front of the cabinet to permit opening the gate.

3.04 Table 1 lists the space requirements for the various key telephone units of the 1A1 key telephone system.

3.05 **The 105B apparatus box** when used to house the individual key telephone units should ordinarily be placed in closets or other inconspicuous locations if they are available and are accessible for maintenance purposes.

3.06 If the apparatus box is mounted on a wall it should be located just above the baseboard, or at baseboard height above the floor. **These boxes should not be installed on desks or other furniture if other satisfactory locations are available.** Where appearance considerations are such that the attachment of numerous apparatus boxes to walls may not be desirable, give consideration to the use of equipment mounted in key equipment cabinets.

3.07 The backboard for mounting the 105B boxes should be used under the following conditions:

(a) Where fasteners for the apparatus box would come into contact with metal or damp surfaces. This is to avoid grounding the apparatus boxes and the frames of relays, etc., contained therein.

(b) On all masonry surfaces.

(c) On all surfaces that are uneven.

3.08 The fasteners for the apparatus box are the same as those specified for subscriber sets, and the fasteners for the backboards are the same as those specified for wooden backboards used with subscriber sets except that four fasteners should be used with backboards that mount more than one apparatus box. Backboards may be mounted either vertically or horizontally on a wall, however, the vertical mounting position is preferred wherever appearance, wiring and other considerations will permit.

3.09 **The apparatus units** are fastened in the apparatus boxes with the two machine screws furnished with each unit.



**CABINET CAPACITY**

	<b>Horizontal Space Holes per Row</b>	<b>Number 7" Vertical Width Rows</b>	<b>Excess Vertical Space- inches</b>
6-Plate per ED-95021-01	48	2	0
11-Plate per ED-91195-01***	49	2	5-1/4"***
18-Plate per ED-91180-01*** G10 or G11	49	4	3-1/2"***

Notes — \* Angle bracket mounting assembly P-39A687 for 7" vertical row will mount one 3-1/2" vertical width KTU plus one 1-3/4" unit or three 1-3/4" vertical width KTU's.

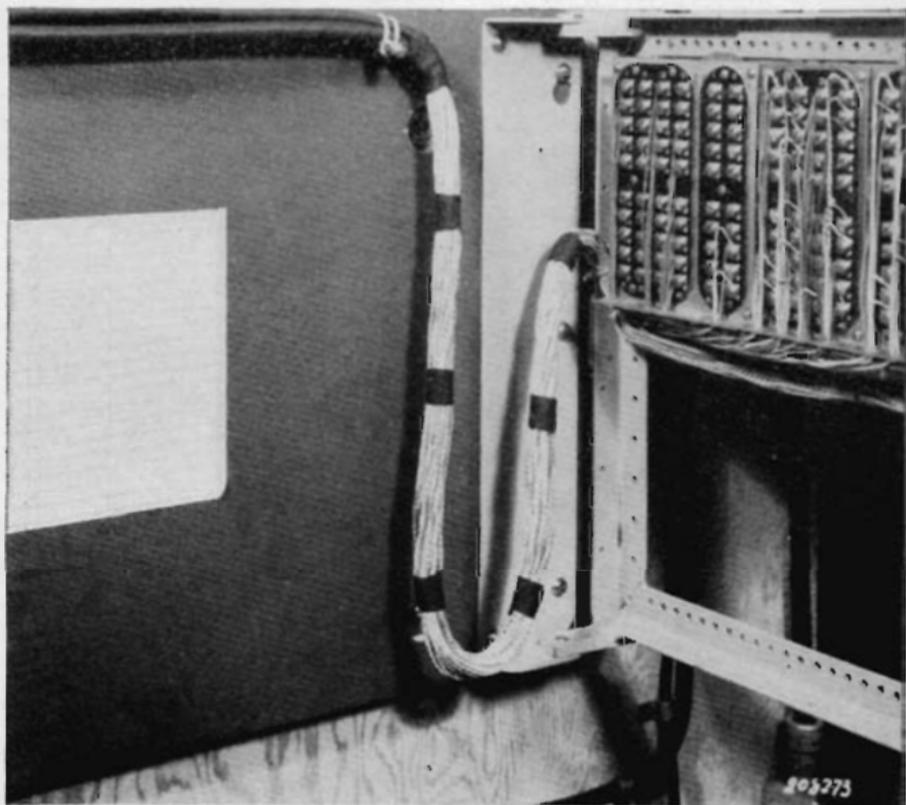
\*\* Space may be used for mounting 3-1/2" or 1-3/4" vertical width KTU's on bars per ED-69143-01, G1.

\*\*\* Using mounting bars.

**4. WIRING**

4.01 Wire or cable shall be selected, placed and fastened in accordance with the sections in Division C20.

4.02 Cable wiring to apparatus cabinet should be run in and dressed for good appearance. The forming of cables in a typical single cabinet 1A1 installation is shown in Fig. 1. The cable may be taped as shown or tied at several points to hold the shape of the form.



**Fig. 1**

4.03 SD-69217-01 showing a schematic of the circuit and the terminations for a typical installation of the principal features of the 1A1 system is provided to aid in trouble analysis. Information covering the cross-connections between the various key telephone units making up the 1A1 key telephone system is given in SD-69199-01 and SD-69203-01.

4.04 Terminals are provided for terminating six or less (3 per screw terminal) outgoing cables on the key telephone units of the 1A1 system. However, it may be advisable to terminate only one cable on the key telephone units and run this cable to connecting blocks in a distribution terminal at which point cables to the station equipment are also terminated.

4.05 44-type connecting blocks, apparatus boxes equipped with 8-type key telephone units or GA, GB or GC-type cable terminals with 30 or similar type connecting blocks may be used as bridging terminals to permit flexibility in cable distribution. At a main station or other bridging point the con-

necting block arrangement should provide a sufficient number of terminals to accommodate all the conductors in the incoming cable.

- 4.06 Wiring to desks and tables should follow recommended procedures in accordance with existing practices.
- 4.07 The mounting cord terminations for the various codes of key telephone sets applicable to the 1A1 systems are shown in SD-69206-01.

## 5. POWER SUPPLY

5.01 The power supply to be used with the 1A1 key telephone system is determined in accordance with instructions covering power supply arrangements for key telephone systems using current drain and fusing requirements given in SD-69199-01 and SD-69203-01. The basic voltages required are:

- Relays — 14-28 volts d-c
- Lamps — 10 volts a-c or 14-50 volts d-c
- Ringers — 105 volts 20 cps
- Buzzers — 16-20 volts a-c 18-28 volts d-c

5.02 The 201A key telephone unit which provides for seven fuses and six multiple ground connections may be assembled in the apparatus cabinet when required.

## 6. LINE STATIONS AND RINGER LIMITATIONS

- 6.01 The 1A1 key telephone system should not be installed on party or magneto lines.
- 6.02 Where visual signals are provided, not more than 12 signal lamp appearances should be associated with any one line.
- 6.03 Unless holding is provided, at least one station for each central office line should be provided.
- 6.04 Conductor loop resistance limits for key telephone systems will be included on range charts for the central office or P.B.X. with which a system is associated.
- 6.05 Where a hand telephone set is connected to a subscriber set, follow wiring limitations in section covering "Main and Extension Stations."
- 6.06 Bridged stations used in the 1A1 system **must** be arranged for "A" lead control and can be connected **only** to the **station side** of the key telephone unit line circuit. Ringer and line signals used with the 1A1 system are subject

to the same connection limitations as ringers and line signals used at regular stations. In connection with this, the ringing bridge of the central office or P.B.X. line circuit unit shall be considered the equivalent of one low impedance ringing bridge. Accordingly not more than two additional high impedance ringer bridges or the equivalent may be connected on the station side of the line circuit key telephone unit.

6.07 At least one ringer or equivalent ringing bridge should be connected to the central office line at all times. On P.B.X. stations, a ringer or equivalent ringing bridge need not be connected if the subscriber has no need for the facility.

6.08 At stations having separately mounted keys arranged to pick up more than one line, use either separate subscriber sets for ringer and induction coil or subscriber sets having shielded induction coils and capacitors arranged to limit crosstalk. Reference SD-69207-01.

6.09 Where telephone sets with illuminated key buttons are used, the voltage impressed on the lamps should be limited to approximately 10 volts and should not be less than 7 volts. Where 110-125 volt a-c power supply is available, a 101G power plant or a 393-type transformer is used to supply power for lamps. When battery power is supplied, resistors should be connected in the lamp leads in accordance with Note 1.03 of SD-69203-01 to limit the voltage at the lamps. Where signal lamps are operated from a-c supply, the conductor loop resistance between the apparatus cabinet and signal lamps should not exceed 25 ohms. Where lamps are connected in multiple not more than 12 shall be connected to one lead and the conductor loop resistance should be limited to 25 divided by the number of lamps connected to the lead. Table 2 gives the approximate maximum length of wire or cable between the apparatus cabinet and signal lamp.

**TABLE 2**  
**A-C LAMP VOLTAGE SUPPLY (25-OHM LIMIT)**

<u>No. of Lamps per pair</u>	<u>Maximum Feet of Wire or Cable between Apparatus Cabinet and Telephone Set</u>	
	<u>22 Gauge</u>	<u>24 Gauge</u>
1	750	460
2	375	230
3	250	155
4	185	115
5	150	90
6	125	75

6.10 **A-C Supply Lamp Feeder Circuit:** The leads between the power supply and the apparatus cabinet should not be smaller than 20-gauge copper or equivalent when two ampere fuses are used at the power plant or transformer. The equivalent 24-gauge inside wiring cable is three pairs of conductors. When such equivalent is used these conductors should be securely connected together and the cable sheath should be carried inside the equipment or apparatus enclosures. The resistance of these leads shall not exceed the maximum noted in the following table.

TABLE 3

1.15 Volt Max. Drop in Feeder Leads			.90 Volt Max. Drop in Feeder Leads		
No. of 51A Lamps	Max. Allowable Resistance	* Length of run of 1 pair of 20 ga. cu. cond.	No. of 51A Lamps	Max. Allowable Resistance	* Length of run of 1 pair of 20 ga. cu. cond.
		Feet			Feet
5	6.6	330	35	.74	37
10	3.3	165	40	.65	32
15	2.2	110	45	.58	29
20	1.65	83	50	.52	26
25	1.32	66	55	.47	23
30	1.10	55	60	.43	21
35	.93	47	65	.40	20
			70	.37	18

Note — Four G2 lamps are equivalent to five 51A lamps

\* One pair of solid copper wire is equivalent to about three pairs of 20-ga. JKT wire or about six pairs of 24-ga. JKT.

**Caution: Wire with wrapped cotton insulation is not satisfactory for cross-connecting power leads because of fire hazard.**

6.11 51A or G2 lamps should be operated from a d-c supply only when the use of a-c supply is not feasible. When lamps are operated from a d-c supply a series resistance for voltage limitations should be used for each lamp (Note 1.05 of SD-69203-01). In addition, the conductor loop resistance between the resistance and the signal lamps should not exceed 10 ohms. Several lamps on the same line may be supplied over a single pair of wires but in order to reduce burn out of lamps due to failure of one lamp in such a multiple connection the number of lamps connected in this manner should not be less than 3. When three or more lamps are supplied over the same pair of wires, the loop resistance should not exceed 10 divided by the number of lamps on the pair and the resistors of the resistance unit for these lamps should be connected in parallel.

Other battery supply limitations on d-c supplies, are shown on the schematic circuit drawings. Table 4 shows the approximate maximum length of cable permissible to meet the 10-ohm loop limit.

**TABLE 4**  
**D-C SUPPLY WITH RESISTANCE IN LAMP LEADS**  
**(10-OHM LIMIT)**

<u>No. of Lamps Connected to Lead</u>	<u>Maximum Feet of Wire or Cable between Resistance Unit and Telephone Set</u>	
	<u>22 Gauge</u>	<u>24 Gauge</u>
1	300	180
2	150	90
3	100	60
4	75	45
5	60	36
6	50	30

6.12 Where lamp power for more than six stations is supplied over conductors in the same cable, or where the conductor loop limits given in Tables 2 or 3 are exceeded, additional lamp leads, as required, should be provided. When metallic return is required, lamp ground leads for all lamps at a given station shall be strapped together **at the station connecting block**. Where runs from the apparatus cabinet are short and loop limits permit, more than six lamps may be supplied over one pair if the use of a larger size cable or the installation of additional cables can be avoided thereby.

6.13 Where lamps are provided in key telephone sets as well as indicators or associated 101-type key boxes, Table 5 shows the type of lamps required:

**TABLE 5**

<u>Signal Lamp Supply</u>	<u>Tel. Set</u>	<u>Lamp Type Indicator and/or 101 Key Boxes</u>
10V a-c	51A	G2
14-26V d-c	51A*	A3
47-50V d-c	51A*	K2

\* With resistance in series (see Paragraph 6.11)

6.14 Where 15-type lamp indicators are used throughout for signals with A3 or K2 lamps the limits given above do not apply and all lamps associated with one line may be connected to common leads as indicated on the circuit drawings.

## 7. FINAL TESTS

7.01 Upon completion of a key telephone system 1A1 installation, check that all features of the system operate properly.

7.02 Check to insure that the lamp is positioned forward toward the button against the shoulders of the slot in the lamp recess in order to insure maximum illumination.

7.03 Check that all key telephone sets and other stations are equipped with correct designation cards or strips. Also check that any unused keys in the 4 and 6-button telephone sets are blocked in the non-operated position by the P-339942 key blocking device. This is an eyelet shaped device which is assembled flange up under the key button which it is desired to block. Guard D-96008 may be used to block unused keys in the 6021D, 6027D and 6028D-type keys. This device snaps on the key plunger rod immediately under the key button.

7.04 Before leaving the job see that the subscriber or a competent representative fully understands the method of operation of the particular system that has been installed.

7.05 On systems supplied by transformer and rectifiers from commercial power (without floater battery) disconnect this source of power long enough to check that outgoing calls may be made, with commercial power off.