

200-POINT LINE FINDER AND TRUNK FINDER EQUIPMENTS
NO. 1, 350A, 355A, AND 35E97 OFFICES
ENGINEERING INFORMATION
STEP-BY-STEP SYSTEMS

1. GENERAL

1.01 This section covers equipment information for 200-point line finder and trunk finder units for use in No. 1, 350A, and 355A step-by-step offices. The arrangements for using the line finder in 355A offices are also applicable to additions to 35E97 offices.

1.02 The function of line finder equipment is to establish a connection between a calling subscriber line and a first selector in preparation for dialing. The 200-point line finder unit is, in effect, a concentrating device by means of which 198 subscriber lines may be served by 20 or 30 switches (or less).

1.03 The 200-point trunk finder unit serves as a concentrating device for intercepting trunks which are to be connected to a switchboard in the same or another building or to an announcement machine. Equipment information is covered in Part 3 of this section.

2. 200-POINT LINE FINDER UNIT

A. Equipment Arrangements and Features

2.01 A 200-point line finder unit serves a maximum of 198 subscriber lines and may be equipped with a maximum of 20 or 30 line finder switches through which connections are established between calling lines and first selector switches.

2.02 A line finder unit consists primarily of the following equipment.

- (a) Relay equipment for the subscriber lines served.
- (b) Line finder switches with their associated banks.
- (c) Control equipment.
- (d) Alarm equipment, fuses.

2.03 Four basic types of line finder units are available, as follows:

- (a) 20-switch capacity, three wire.
- (b) 20-switch capacity, four wire.
- (c) 30-switch capacity, three wire.
- (d) 20-switch capacity, three wire, with provision for permanent signal lockout on 5 to 100 per cent of the subscriber lines.

The 3- and 4-wire 20-capacity units without the lockout feature are for general application in all four types of offices and are designed for average traffic requirements. The 30-capacity unit (3 wire) is intended for No. 1 and 350A offices only and provides extra call-carrying capacity for high calling rate line groups. The 3-wire 20-capacity unit with the permanent signal lockout feature is for 355A and 35E97 offices only. The switches of the present line finder units may be used for additions or replacements on earlier type units in No. 1, 350A, or 360A offices. However, they are not suitable for use on line finder units having the allotter control circuit in 355A or 35E97 offices. The earlier type switches cannot be used on the present line finder units.

2.04 The lockout line finder unit will be equipped to provide the lockout feature on any portion of the subscriber lines specified, in blocks of ten lines. Lines so equipped, when in a permanent signal condition, will automatically release the line finder and associated first selector after a timed interval.

2.05 The 3-wire line finder unit has a 600-point bank multiple providing for appearances of the "T," "R," and "S" leads of all subscriber lines served by the unit. The 4-wire line finder unit has an 800-point bank multiple carrying the "A" or "TR" leads of the subscriber lines in addition to the "T," "R," and "S," leads. The "A" or "TR" leads are used for the operation of mes-

sage registers or for a class-of-service indication, when required. See 2.14 of this section for use of 3- or 4-wire line finders for various classes of service.

2.06 The line finder units are mounted on universal switch frames 6 feet 1/2 inch in length, and 11 feet 6 inches, 9 feet, or 7 feet in height. The number of units per frame depends on the type of unit and the height of the frame, as follows:

TYPE OF LINE FINDER UNIT	11.5-FOOT FRAME	9-FOOT FRAME	7-FOOT FRAME
20 switch, 3 wire, nonlockout	3	2	1
20 switch, 4 wire, nonlockout	3	2	1
30 switch, 3 wire, nonlockout	2	—	—
20 switch, 3 wire, lockout	2	1 *	1

* Remaining space may be used for two switch shelves, which will be mounted *above* the line finder unit.

2.07 Switches — Arrangement and Numbering:

The line finder switches are arranged on either two or three shelves in the left bay of the unit. On the 20-capacity unit without lockout, the switches are on two shelves accommodating 10 switches each. The 30-capacity unit provides for three shelves of 10 switches each. The lockout units have three shelves, with seven switches on each of the two lower shelves and six on the upper shelf. The switches on each unit are numbered from 1 up, beginning in the left position of the lower shelf and continuing from left to right on this shelf and on the next higher shelf or shelves. Thus, switches having the same units digit are in vertical alignment on the nonlockout units, but not on the lockout units. Switches with the same units digit in any line finder unit constitute a line finder subgroup.

2.08 Line Equipment: Subscriber line relay equipment is provided in units comprising 10 lines each. These are mounted as part of the line finder unit. Units of line equipment used on

the lockout line finder unit are longer than those for the nonlockout finder unit, since provision of the lockout feature requires an extra relay per line, the LO, in addition to the line and cutoff relays. For the sets of 10 line circuits on a lockout unit which are not to be provided with the lockout feature, the lockout relay will not be furnished.

2.09 Line Appearances on Line Finder Banks:

The banks associated with each line finder provide appearances for the "T," "R," and "S" leads (and "A" or "TR" leads on 4-wire finders) of all lines served. Each of the ten bank levels handles 20 lines, 10 from the first hundred and 10 from the second hundred lines. A bank slip is provided, resulting in a different group of 20 lines being connected to the bottom level of successive line finders. The pattern of the slip for the first 10 finders is repeated on the second 10 finders, and on the third 10 finders in the case of 30-capacity line finder units. Therefore, all finders in a line finder subgroup (as defined in 2.07), have the same arrangement of lines. The 20 lines appearing on any one level of a line finder subgroup are known as a line subgroup.

2.10 Alternating First Choice: While any line finder can find any line, an order of choice is provided by the circuit arrangements which causes a calling line to be served on the lowest level permitted by traffic at the moment. The order of choice is determined (1) by an alternating arrangement in the group relay circuit which alternates first choice on successive calls between the first and second finders of the subgroup having the calling line on the first level, and (2) by progression of the start lead to other finders in a prescribed order, if the first choice finders are busy when a call is attempted. In the case of 30-capacity finder units, the alternating arrangement does not progress to the third finder in the subgroup. These third finders, however, receive added traffic as direct overflow from the second choice finders. The alternating of first choice on successive calls reduces the possibility of complete blocking of a call under light traffic conditions in the event of certain trouble conditions in one of the first choice finders or the associated first selector.

2.11 Line load control equipment is available for use with the line finder equipment. This arrangement provides preferential service

for certain lines during an overload, by denying originating service temporarily to the other lines on the same line finder unit. Lines are divided into preference classes, and all lines on a given line finder level must belong to the same class. Denial of service is effected by operation of a key on the line finder unit or in a common control cabinet provided in the office. Remote control equipment is also available, permitting control from another office.

2.12 Sleeve Resistance Limits: Line finders for operation with a high sleeve resistance (maximum 35 ohms) are available in either the 3- or 4-wire types for large No. 1 offices. These finders are for use only where the office layout involves such long cable runs that the sleeve lead resistance exceeds the normal limit of 13 ohms.

2.13 Normal Post Springs: Line finders may be provided with normal post springs, when specified, for discriminating between two classes of service handled by the same line finder unit or for indicating other information such as restricted service. When normal post springs are provided, the associated cams are adjusted to be effective for certain line subgroups on whatever level these lines appear on the various finders. Because of the bank slip, line finders on which normal post springs are used cannot be moved from one position to another on the unit without a readjustment or replacement of the cams.

B. Class-of-Service Arrangements

2.14 The following classes of service may be provided for the subscriber lines served by the line finders.

- (a) **Flat Rate:** Individual lines, party lines, or PBX trunks.
- (b) **Message Rate:** Individual lines or 2-party lines.
- (c) **Coin Box:** Dial prepayment or dial post-payment coin lines.

2.15 Use of 3- or 4-wire Line Finders: The choice of 3- or 4-wire line finders is dependent largely on the class-of-service requirements of the line group to be served. The following are the basic considerations which indicate the type of line finder unit to be used.

- (a) **Flat rate service** is normally handled by a 3-wire finder.

(b) **Individual message rate service** may be handled by either a 3- or 4-wire line finder. If a 4-wire finder is used, the message register is operated over the "A" lead (fourth wire) on normal central office battery. A 3-wire finder may be used only if (1) arrangements are provided for operating the message register over the sleeve lead or (2) auxiliary line circuits are provided. In order to use the sleeve as in (1) above, a high resistance message register is used, which will not operate when central office battery or ground is set up on the sleeve. A booster battery is employed in the trunk circuit to operate the registers. If auxiliary line circuits are used (arrangement 2), they must be furnished one per line. They are, therefore, suitable for use when relatively few lines in a line group are to be provided with individual message rate service. In this arrangement, the message register is operated over a lead to the auxiliary line circuit.

(c) **Two-party message rate service** requires the use of 4-wire finders, which permit the use of the fourth lead ("TR") for operating the message register for one of the parties, while the sleeve lead is used for the other party's register. Because the sleeve lead must be used to operate one of the registers, high resistance registers are used (in both leads) and the associated message rate trunks require a booster battery, as in the case of individual message rate service with 3-wire finders [2.15(b)].

(d) **Prepay coin box** lines are normally served by 4-wire line finders. The fourth wire permits discrimination on a per-line basis between public and semipublic lines. Coin long line circuits are indicated by levels by the use of a normal post spring arrangement. The 3-wire line finder may be used where it is felt that there will be no future requirement to distinguish between public and semipublic coin lines.

(e) **Postpay coin box** lines can be served by 3-wire line finders.

2.16 Combining Classes of Service in One Line Group: At times it may be desirable to combine different classes of service in one line group in order to accommodate a small number of lines in one class without using an additional line finder unit. Some combinations are not pos-

SECTION 814-410-170

sible or are not economical under certain circumstances. Consideration should be given to the following restrictions and recommendations.

(a) A group of individual message rate lines may be filled out with flat rate lines. However, all line finders of the unit must be connected to message rate trunks, and the flat rate lines are then operated with connections to message registers omitted.

(b) Two-party message rate lines are not, in general, combined with other classes of service, since the need for identifying the second party introduces extra features in the message rate trunks. Therefore, it usually becomes uneconomical to combine 2-party message rate with other classes of service in the same group.

(c) A group of postpayment coin box lines may be filled out with flat rate lines. If the number of coin box lines is small, they may be served by auxiliary postpay coin line circuits. Otherwise, all line finders in the group must be connected to postpayment coin box trunks. Normal post springs must be provided for identifying the coin box lines, in groups of twenty lines. (See 2.13.)

(d) Prepayment coin box lines cannot be combined with any other class of service.

C. Partially Equipped Units

2.17 When a 20-capacity line finder unit is equipped with less than 20 switches, the trunking patterns referred to in 2.21 are based on omission of switches in sets of two in the following order: 20, 15; 18, 13; 17, 12; 19, 14; 16, 11; 10, 5; 8, 3; 7, 2; 9, 4; 6, 1.

2.18 Where an odd number of switches per 20-capacity unit is specified, switches are omitted in the order shown in 2.17, except that they are omitted singly instead of in pairs. The trunking pattern for the next higher number of switches is used, but with the last equipped switch omitted.

2.19 When a 30-capacity line finder unit is equipped with less than 30 switches, the omission of switches will be in the following order: 30, 25, 28, 23, 27, 22, 29, 24, 26, 21, 20, 15, 18, 13, 17, 12, 19, 14, 16, 11, 10, 5, 8, 3, 7, 2, 9, 4, 6, 1.

2.20 When a line finder unit is equipped with less than 200 lines, the omission of lines will be in steps of 10 lines, starting with lines 191-190 and continuing in descending numerical order to 111-110; then 101-100; then 91-90, etc, to 01-00.

D. Cross-connections to First Selectors

2.21 *No. 1 or 350A Offices — 20-Capacity Line Finder Units:* Cross-connections between 20-capacity line finder units and first selectors in No. 1 or 350A offices are based on eight 20-finder line groups per division, and greater numbers of partially equipped line groups. In a full division, the eight or more line groups are connected to eight consecutive 20-capacity selector shelves, four in a left bay and four in a right bay. Standard cross-connection patterns are provided for full divisions connected to eight selector shelves and also for partial divisions connected to 2, 4, or 6 selector shelves. In all cases, selector shelves are equipped in even numbers, equally divided between the left and right bay. These standard patterns are such that a minimum number of rearrangements are required with growth in the number of line groups in the division, or with changes in the number of finders per line group. Details of the cross-connection patterns are shown on drawings covering line finder and first selector interconnection trunking patterns.

2.22 The 20-capacity line finder units which are equipped with less than 20 switches have switches omitted in the order shown in 2.17 or 2.18. The effect of these omissions, using the standard cross-connection pattern is to eliminate connections first to tenth selector switch positions on selector half-shelves, then to ninth selector switch positions, etc, without affecting the even distribution of traffic over all selector shelves. If desired, the selector switch positions thus released, may be equipped and used for fill-in finder groups. Standard patterns are provided for all such fill-in arrangements.

2.23 The cross-connection patterns have been designed not only to distribute the traffic as evenly as possible over selector shelves and trunks, but also to assure that successive calls from a line group will be routed to different selector shelves and to a greater or less degree to different selector bank multiple trunks. This works in conjunction with the alternating fea-

ture (2.10) to avoid continued blocking of calls by trouble conditions.

2.24 When present standard 200-point line finder units are combined in the same division with earlier type line finder units (20-capacity), it may sometimes be preferable to cross-connect the new line finders by the method used for the older finders. However, wherever practicable, introduction of the new cross-connecting patterns is desirable. To facilitate this, the older line groups may be recross-connected into the new patterns.

2.25 *No. 1 or 350A Offices — 30-Capacity Line Finder Units:* Cross-connections between 30-capacity units and first selectors are based on a maximum of ten line groups per division. The trunking patterns used with the earlier types of line finder units are retained for the present 30-capacity units, and the number of selector half-shelves per full, partial, or combined division varies with the number of line finders per unit.

2.26 *355A Offices — 20-Capacity Line Finder Units:* Cross-connections between the 20-capacity line finder units in 355A offices are based on three 20-finder line groups per division, and greater numbers of partially equipped line groups. Cross-connection patterns for these line groups are similar to those explained in 2.21 through 2.24, and include standard patterns for a full division of 3 or more line groups connected to six consecutive 10-capacity selector shelves, and for partial divisions connected to 1 to 5 selector shelves. The present standard line finder units, when used in 355A offices, may not be combined in the same division as older type finder units, which use an allotter circuit.

3. 200-POINT TRUNK FINDER UNIT

3.01 The 20-capacity, 200-point trunk finder unit (3 wire) may be used in No. 1, 350A, or 355A step-by-step offices. It acts as a concentrating device for a maximum of 198 intercepting trunks, connecting them to trunks to an announcement machine or a switchboard in the same or a distant building.

3.02 The trunk finder unit mounts on a universal switch frame, using the same unit framework as the 20-capacity, 200-point line finder unit (nonlockout), and having the same general equipment arrangements.

3.03 The intercepting trunks incoming to the trunk finder unit have their relay equipment mounted either on relay racks, or on the finder unit in the same manner as line relay units on line finder units. In general, 2-relay trunks can be mounted on the trunk finder unit and are available in 10-trunk units, similar to the line relay units.

3.04 In addition to the regular intercepting trunks, plugging-up lines may be handled by the trunk finder unit. When both types are connected to one trunk finder unit, normal post springs are used to distinguish between the trouble intercept (plugging-up lines) and regular intercept by causing appropriate lamps to light at the switchboard position.

3.05 When normal post springs are used, they are adjusted to be effective for all 20 trunks in a trunk subgroup, which will appear on different levels in different finders due to the bank slip. Regular and trouble intercepting trunks, therefore, cannot be combined in the same trunk subgroup. This corresponds to arrangements on line finders, covered in 2.13.

4. MAINTENANCE FEATURES AND TEST SETS

4.01 *Fusing:* Ten plug-in type fuses (70 type, 3 ampere) are located on each line finder unit for fusing the line finders. One fuse is provided for each line finder subgroup. Simultaneous stepping of two switches of a subgroup will not operate the fuse. In the case of 30-capacity units having three finders per subgroup, the circuit is so arranged that only two switches can be stepped at a time, thus insuring that the capacity of the fuse will not be exceeded. Other 70-type fuses are provided for the line and trunk circuits, group and alarm circuits, and line load control circuits.

4.02 *Alarms:* The usual indications are provided for indicating operated fuses. Separate alarms are provided for indicating calls blocked by trouble conditions (major alarm) and calls blocked because of no finders being available (minor alarm). When new type units are added to an office, the older units may be modified, if desired, to the present standard alarm arrangements. The split alarm is also available with the older types of line finder units which may be used for additions to existing frames.

4.03 Make-busy Arrangements

- (a) **Make-busy Keys:** A make-busy key is mounted on each line finder switch.
- (b) **Make-busy Cords:** A patching cord, coded W1AL, is used for busying out subscriber lines. The cord is 2 feet long and is terminated at each end by a chuck suitable for connecting to the terminals of the line circuit and ground terminal strips.

4.04 Testing Equipment: The following types of test sets are available for testing line finders and trunk finders. In general, these may be used in all types of offices. However, except for the dial hand test set, these test sets cannot be used for older types of line finders in 355A and 35E97 offices.

- J34715 (814-635-150) — Line finder and trunk finder test set for offices with individual and 2-party message rate and flat rate lines.
- J34718 (814-635-151) — Line finder and trunk finder test set for offices with individual message rate and flat rate lines.

- J34721 (814-636-150) — Test set for rapid operation tests of line finders and outgoing repeaters.
- J94704 (814-638-151) — Test set for line finders, selectors, and connectors, with test line control.
- J94710 (814-637-151) — Trunk test set. This is a multipurpose test set and includes facilities for testing certain features of line finders and trunk finders.
Dial hand test set.

5. REFERENCES

- 5.01** Reference may be made to the following sections.
 - 955-115-100 General descriptive information on 200-point line finder and trunk finder equipment
 - J32007 (814-413-150) — Equipment engineering information for line finder equipment
 - J32008 (814-415-151) — Equipment engineering information for trunk finder equipment