

STEP-BY-STEP SYSTEMS
NO. 355A OR NO. 356A
LINE FINDER CONTROL CKT.
WITH OR WITHOUT MATE OPERATION*Control*
2 F

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The rating of this circuit is being changed to A&M Only and Mfr. Disc. for 355A. It is expected that there will be no further demand for 356A dial offices.
- D.2 Information is added to the multiple strap of the GC lead in Fig. 17.
- D.3 Note 107 which reads "48B2 lamps may be used interchangeably with 42 lamps and are shown only for maintenance purposes when this circuit is used in 35-E-97 of-fices," is removed.
- D.4 Note 201 is added.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit provides a jack mounted control circuit for controlling the selection of an idle line finder and stepping it to the terminals of the calling line. When arranged for mate operation it will, if the line is not found within a predetermined time, cause the mate control circuit to take over the call and vice versa. It also provides traffic registers for the associated line finders and alarm lamps to indicate various trouble conditions within the line finder group.

2. WORKING LIMITS

2.1 For associated line finder: maximum external resistance in "S" lead through selectors to holding ground - 10 ω .

3. FUNCTIONS

- 3.01 To step a line finder to the terminals of a calling line.
- 3.02 To seize the selector associated with the line finder.
- 3.03 To preselect another line finder as soon as one line finder has been directed to a line.
- 3.04 To transfer the start lead to the other control circuit if all finders served by it became busy when the control circuit is arranged for mate operation.

3.05 To prevent the line finder selector from running continuously when all the finders in a group served by it are busy.

3.06 When the (BY) key is operated, to cause the mate control circuit to serve the lines of both groups.

3.07 To transfer the start lead to the mate control circuit if a line is not found within a predetermined interval. (trouble transfer)

3.08 To become idle and again attempt to serve calls after a trouble transfer when all the finders served by the mate control circuit become busy.

3.09 To step the line finder selector to another idle finder if a line is not found within a predetermined time interval. (trouble kick off)

3.10 To cause a call blocked alarm if a call is not served within a time interval determined by the alarm circuit.

3.11 To keep the ringing machine or interrupter running as long as there is a line waiting to be served.

3.12 To light the (TO) lamp on a trouble transfer condition.

3.13 To operate a busy register, when provided, when all finders become busy.

3.14 When desired, to operate a peg count register whenever a line finder releases.

3.15 To cause an alarm after an interval if a release magnet operates but a switch fails to release.

3.16 To direct the line finders, one after another, to the zero level and the eleventh rotary step when the (TST) key is operated.

3.17 To prevent peg count registrations and trouble transfer while the (TST) key is operated.

3.18 To transfer the start lead to the mate control circuit if the control circuit fuse operates.

3.19 To operate an alarm if all finders are busy and a permanent signal condition exists.

3.20 To operate an alarm when a 48 volt fuse in the 355A office blows.

3.21 To provide lamps which will light when there are lines locked out on a permanent signal.

4. CONNECTING CIRCUITS

When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

4.1 Line Circuit - SD-31777-01.

4.2 Line Finder Circuit - SD-31909-01.

4.3 Power Ringing Circuit - SD-80780-01.

4.4 Miscellaneous Alarm and Register Circuit - SD-31931-01.

4.5 Miscellaneous Alarm Circuit Alarm Control and Aisle Pilots Permanent Signal Timing Circuit - SD-32192-01.

DESCRIPTION OF OPERATION

5. OPERATION OF CONTROL CIRCUIT ON A REGULAR CALL

5.1 Call Originated

When a subscriber originates a call, a relay in the line circuit operates connecting ground to one of the "ST" leads of Fig. 1. This ground appears directly on the commutator terminal corresponding to the bank level on which the calling line appears. This same ground operates the (ST) relay of Fig. 2 in series with one of the 2500 ohm resistances of Fig. 1.

5.2 Control Circuit Seized

The (ST) relay in operating grounds the "MS" lead to start the code ringing interrupter, grounds a lead to the alarm circuit, closes a circuit to the (T1) relay from the "CODE 2 GROUND" lead, and operates the (ON) relay. The purpose in performing the first three functions will be explained under Section 6.3.

The (ON) locks operated and with "V" wiring and G apparatus or with F option connects ground through the 500 ohms or with "W" wiring connects direct ground to the "R" lead to the ring of the selector. The selector is seized and returns ground on the sleeve. The operation of (ON) also connects the (S) winding of the (SP) relay to the "INT" lead, prepares a circuit for operating the (VS) relay on its (P) winding, places ground on the winding of the

(TR) relay to hold it if the last finder served by the control circuit is being used, and prepares a holding circuit for the (VS) relay.

5.3 Line Finder Vertical Hunting Control

The (SP) relay operates in series with the "INT" lead to ground on the back contacts of the vertical magnet of the finder on whose terminals the (ST) selector is standing. In operating it places ground on the "VM" lead to operate the vertical magnet of the line finder. The vertical magnet in operating releases the (SP) relay which in turn releases the vertical magnet. The (SP) relay reoperates and the cycle continues until the level on which the calling line appears is reached.

The commutator terminal of this level will have direct ground on it. When the commutator wiper moves onto the grounded terminal, the ground will be connected over the "TST" lead, through the (P) winding of the (VS) relay to the (S) winding of the (SP) relay which will hold operated. The (VS) relay will operate on its (P) winding and lock through a make first contact and its (S) winding to the (ON) relay contacts.

The (VS) relay transfers the front contact of the (SP) relay from the vertical to the rotary magnet. It also opens its own (P) winding, transfers the "TST" lead to the (P) winding of the (SP) relay, opens the original operating circuit of the (ON) relay, and provides an additional open in the (ST) selector magnet circuit. The (VS) relay is slow in operating in order to allow the bank wipers of the line finder to stop vibrating before the switch steps rotary. This prevents brush snagging.

The (SP) relay may release during the operation of the (VS) relay, but will re-operate as soon as the vertical magnet releases and operate the rotary magnet.

5.4 Line Finder Rotary Hunting Control

The rotary magnet in operating opens the (INT) lead which releases the (SP) relay which opens the "RM" lead. The (SP) relay reoperates continuing the cycle until the terminal on which the line appears, is reached. At this time battery connected to the bank sleeve terminal through a winding of the (L) relay of the calling line circuit, will cause a current to flow through the operating winding of the line finder cut through relay and the (P) winding of the (SP) relay to direct ground (K option). This current prevents the (SP) relay from releasing and removing ground to the "RM" lead, and operates the line finder cut through relay.

The 1000 ohm shunt on the (P) winding of the (SP) relay delays the releases of the (SP) relay slightly so that it will not fail to hold if the switch wipers overthrow.

With H or J option, the (E) and (D) resistances act as a potentiometer to apply a small negative potential to the hunting relay (SP) to prevent the finder from stopping on a line in the process of being seized by a connector.

5.5 Line Finder Seizes Calling Line

When the line finder cut through relay fully operates, it transfers the (S) winding of the (SP) relay (which is connected to the "INT" lead) from the back contacts of the vertical magnet to the "LF" lead to operate the (LF) relay of the control circuit. The (L) relay of the line circuit operates fully either in series with the line finder cut through relay or from direct ground on the selector sleeve and releases the (ST) relay.

5.6 Disconnect Prior to Seizing Calling Line

If the calling party disconnects before the line finder has seized the calling line the line finder will hunt to the eleventh rotary step and the eleventh rotary step springs connect the "INT" lead to the "LF" lead to operate the (LF) relay and hold the (SP) relay. The control circuit functions as on a regular call. When it removes ground from the selector ring, the selector and the line finder are released.

5.7 Control Circuit Preselects Another Line Finder

After the (LF) relay operates on its (P) winding, it locks to ground on the "H" lead on its (S) winding. It also removes ground from the selector ring lead (the selector will be held over the subscriber's loop), opens the "TST" lead, removes ground from the (SP) relay contacts, partially closes a circuit for running the (ST) selector, and releases the (ON) relay.

When the (ON) relay releases, it removes the (VS) and (SP) relays from the "INT" lead, disconnects the ground which it was furnishing to the winding of the (TR) relay, and releases the (VS) relay.

The (VS) relay in releasing restores the circuit conditions necessary for vertical hunting, prepares an operating circuit for the (ON) relay, and closes the circuit for running the (ST) selector.

The (ST) selector runs under self-interruption until the (LF) relay releases. The (LF) relay holds while the (ST)

selector is passing over grounded (busy) (H) terminals but releases when an ungrounded (idle) (H) terminal is reached, and stops the selector. The control circuit is then ready to handle another call.

6. CONTROL CIRCUIT FEATURES

6.1 Relation Between Control Circuits, Line Finder Groups, and Line Groups

6.1.1 Mate Operation - 200 Line Group

There are two control circuits for a group of 200 lines. Each of these control circuits has access to a group of ten or less finders. One group of finders is called Group A and the other Group B. Each group of ten or less finders normally serves a fixed group of 100 lines which appear in the lower 5 levels of the bank. However, under trouble conditions or if all the finders in one group are busy, a group of finders will serve 200 lines.

6.1.2 Mate Operation - 100 Line Group

There are two control circuits for a group of 100 lines. Each control circuit has access to a group of 5 or less finders and normally serves a fixed group of 50 lines. The control circuit and its associated finders are designated Group A or Group B.

6.1.3 Single Control Circuit - 100 or 200 Line Group - "Z" Wiring

Where a single control circuit serves a 100 or 200 line group, "Z" wiring is provided which serves to connect leads together so that all lines are normally served by one control circuit.

6.2 All Finders Busy - Mate Operation

If all the finders served by a control circuit become busy, there will not be ground on the "AB" lead of the control circuit and therefore the (TR) relay will release. The (TR) relay in releasing transfers the start lead from the (ST) relay of the control circuit whose finders are all busy, to the (ST) relay of the other control circuit. It also disconnects the ground which runs the (ST) selector so that the selector will not run continuously, operates the (LF) relay, and performs other functions which will be described later.

With the (TR) relay of one control circuit released, all calls will be served by the other control circuit since both start leads of Fig. 1 will be connected to the (ST) relay of the other control circuit.

When all the line finders of both Group A and Group B become busy, both (TR)

relays will be released and neither (ST) relay will operate. If a permanent signal condition exists at this time, ground from the "JW" lead will be connected to the (CB) lamp of Group A to bring in an alarm.

6.3 Operation Under Trouble Conditions

6.31 Mate Operation - Trouble Transfer and Trouble Kick-Off

If any trouble condition occurs which prevents a line from being connected to a first selector, the (ST) relay remains operated and the following operation takes place.

The (T1) relay operates from ground on the "CODE 2 GROUND" lead and locks to the back contact of the (T2) relay under control of the (ST) relay. Later, the (T2) relay operates on its (P) winding through contacts on the (T1) relay, through contacts of the (TST) key to ground on the "PKU" lead. The (T2) relay releases the (ON) relay to return the control circuit to normal, operates the magnet of the (ST) selector, and releases the (T1) and (TR) relays. The (T1) relay opens the circuit to the (ST) selector magnet and the switch steps to the next idle finder. This feature of stepping the control circuit off the finder which has failed to find the line is called "trouble kick-off".

The (T1) relay also opens the circuit to the (P) winding of the (T2) relay. However, if there is an idle finder in the group served by the other control circuit, the (T2) relay will remain locked in parallel with the (TR) relay of the other control circuit. With the (TR) relay of this control circuit released, the calls will all be served by the other control circuit. This feature of transferring the start lead to the other control circuit on a trouble condition is called "trouble transfer".

If, on the other hand, there is not an idle finder in the group served by the other control circuit when the (T1) relay releases, the (T2) relay will release and allow the (TR) and (ST) relays to reoperate. With the (ST) relay reoperated, the control circuit again attempts to serve the call in the regular manner. The attempt is made with a different finder since the selector stepped when the (T1) relay released,

The control circuit keeps repeating the trouble kick-off in attempts to serve the call, but if it is not successful after an interval determined by the miscellaneous alarm circuit, an alarm will be brought in and the (CB) lamp will be lighted by the alarm circuit. This alarm occurs because of the ground on the "CB" lead from the contacts of the (ST) relay. The (ST) relay is not released long enough during each trouble kick-off to retire the alarm.

Assuming that there was an idle finder in the group served by the other control circuit when the (T1) relay released, the (T2) relay remained locked until all finders in that group became busy, whereupon it released and the operation described in the fourth paragraph of Section 6.3 took place.

6.32 Single Control Circuit - Trouble Kick-Off

If a trouble condition occurs which prevents a line from being connected to a first selector, the (SD) remains operated and the circuit functions as follows. (T1) operates from ground on the "CODE 2 GROUND" lead and locks to the back contact of (T2) under control of (ST). When the "PKU" lead closes, (T2) operates on its (P) winding through contacts of (T1), and contacts of the (TST) key. (T2) releases (ON) to return the control circuit to normal, operates the (ST) selector and releases (T1) and (TR). (T1) opens the circuit to the (ST) selector and the switch steps to the next idle finder where an attempt will be made to serve the call. This feature of stepping the control circuit to the next finder is called "trouble kick-off". An all finders busy condition is prevented from being registered when (TR) releases on trouble kick-off by carrying the register operating lead through a break contact of (T2).

6.4 Register Circuits

6.41 All Finders Busy Register (AB) Fig. 5

6.411 Mate Operation

If all the finders of Groups A and B become busy, the (TR) relays of both control circuits will be released and the (AB) register will operate. If a permanent signal condition exists at this time, ground over the "JW" lead from the miscellaneous alarm circuit through the register contacts will cause an alarm to function and the (CB) lamp to light.

6.412 Single Control Circuit

If all finders become busy, (TR) is released and the (AB) register will operate. If a permanent signal condition exists at this time, ground over the "JW" lead from miscellaneous alarm circuit through the register contacts will cause an alarm and the (CB) lamp to light.

6.42 Peg Count Register (PC)

6.421 Figs. 4 & 17

Each time a line finder releases, the (RB) relay will operate in series with the release magnet. If the (PC) key

13,
7,
4,

contacts are closed, when "A" wiring and apparatus are used or when the master peg count cut-off key of the miscellaneous alarm circuit is operated, when "B" wiring is used.

6.422 Figs. 4 & 7

Each time a line finder releases, the (RB) relay will operate in series with the release magnet. If the (PC) key contacts are closed, when "M" wiring and apparatus are used or when the master peg count cut-off key of the miscellaneous alarm circuit is operated, when "Y" wiring is used, the (RB) relay locks to the back contact of the (PC) register and operates it. After the register operates, it opens the (S) winding of the (RB) relay which will release and open the register circuit when the (P) winding is deenergized. This arrangement insures that the register will operate even if the release magnet is energized for only a short time.

6.5 Alarms

6.51 Stuck Release Magnet

If the release magnet of the line finder is energized but the switch fails to release, the (RB) relay will remain operated and hold ground on the "RLS" lead through the (RSL) lamp. After an interval, this will cause the alarm circuit to bring in an alarm, and to light the (RSL) lamp by lowering the resistance to battery on the "RSL" lead.

6.52 Call-Blocked Alarm

The operation of the alarm when a call is not served because of some trouble condition is described in Section 6.3.

7. MAKE BUSY ARRANGEMENTS

7.1 (BY) Key

When the (BY) key is operated the "AB" lead is transferred to release the (TR)

relay and to light the (TO) lamp as an indication that the key is operated. Relay (TR) is released so that the calls will be served by the other control circuit. Key (BY) operated opens the locking circuit for relay (T2).

7.2 If an associated first selector is made busy by connecting ground to the sleeve, ground on the selector sleeve will be connected through the line finder to the "H" lead which will busy the line finder. A line finder selector standing on the terminal will be stepped to the next idle line finder. The same is true if the selector is removed from the frame. If the line finder is removed from the frame, the "H" lead is grounded by the jack springs and the "AB" lead is opened and the line finder is busied to the control circuit.

7.3 Where mate operation is provided, removing a control circuit from its associated jack will cause the other control circuit to handle all calls in both groups. Jack springs 1 and 3 make contact when the control circuit is removed and connect the "ST" lead to the other control circuit. The "A" and "B" line groups function as a single group.

8. TEST FEATURES

8.1 (TST) Key

If the (TST) key is operated, ground is connected to the winding of the (ST) relay. This will cause the control circuit to direct the line finders, one after another, to the zero level and then to the eleventh rotary step.

Peg count registrations are prevented by an open contact on the (TST) key, and another open contact of the (TST) key prevents a trouble transfer from occurring.

9. PERMANENT SIGNAL LAMPS (FIGS. 8 & 13)

The (PS) lamps light if there are lines locked out on permanent signals.

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