

AUTOMATIC ELECTRIC TRAINING SERIES

Bulletin **815**

# The TEST and VERIFICATION SWITCH TRAIN

**STROWGER AUTOMATIC  
TELEPHONE SYSTEMS**



**AUTOMATIC**



**ELECTRIC**

ORIGINATORS OF THE DIAL TELEPHONE

This is one of the helpful booklets in the  
AUTOMATIC ELECTRIC TRAINING SERIES  
on  
STROWGER AUTOMATIC TELEPHONE SYSTEMS

- 800 Electrical Principles of Telephony
- 801 Mechanical Principles of Telephony
- 802 Fundamentals of Apparatus and Trunking
- 803 Distributing Frames
- 805 The Plunger Lineswitch and Associated Master-Switch
- 806 Rotary Lineswitch
- 807 The Connector
- 808 The Selector
- 810 Pulse Repeaters
- 812 Power and Supervisory Equipment
- 813 Party-Line Connectors and Trunk-Hunting Connectors
- 814 Reverting-Call Methods
- 815 The Test and Verification Switch Train
- 816 Toll Switch Train
- 817 Switching Selector-Repeater
- 818 Private Automatic Exchanges with PABX Appendix
- 820 Manual Switchboards
- 821 Linefinder Switches

May we send you others  
pertaining to equipment in your exchange?

# TEST AND VERIFICATION SWITCH TRAIN

## 1. GENERAL

Every automatic telephone exchange is provided with facilities for testing the outside cable plant, subscribers' equipment, and central office equipment. A certain amount of this testing can be done directly from a test desk located in a central dial office, as will be explained in this bulletin. In a multi-office exchange, testing can be handled on a centralized or non-centralized basis, or on a combined centralized and individual test-desk basis. The latter method is the one most commonly used, as it expedites the handling of complaints and increases the efficiency of the testers and sub-station repairmen, permitting more economical operation.

The test switch train is made up of two or three types of switches depending on whether the exchange is a single office or multi-office system and, in the latter system, upon the number of offices. In a single office exchange and in some of the multi-office exchanges, the switches used are a test distributor and a test connector. In other multi-office exchanges a test-distributor selector is required in addition to the aforementioned two types of switches. The test-distributor selector is a switch similar in appearance to an ordinary selector, except that both of its banks have double contacts. Like the selector, it has a dial-controlled vertical motion and an automatic rotary motion. The test distributor and the test connector are both similar in appearance to an ordinary connector and, like the connector, they have dial-controlled vertical and rotary motions. The test distributor, however, has a 600-point bank.

The test-distributor selectors are located in the same office as the centralized test desk, and are connected to it by means of four-conductor trunks. The test distributors are connected to the test-distributor selectors by four-wire inter-office trunks, and the test connectors, one for each hundred-line group, are connected to the banks of the test distributors in the same office by means of six-conductor trunks. The purpose of the test-distributor selector is to select an idle test distributor in any one of the offices of the exchange network; that of the test distributor, to select the test connector associated with any one of the hundred-line groups in the office; and that of the test connector, to select the line to be tested in a particular one-hundred line group. Multi-

office exchanges having only a few offices employ direct trunks from the test desk to the test distributors in each office, thus doing away with the test-distributor selector. As the latter system is simpler, while still containing all of the elements of the testing scheme, the latter circuit will be the one explained herein.

## 2. THE TEST SWITCH TRAIN CIRCUIT

### 2.1 Impulsing to the Test Distributor

The circuit of the test switch train is shown in Fig. 1. The testman operates the distributor key, which energizes the polarizing winding of relay F-1 and completes a connection to the test distributor. After operating the dial key, the circuit between the test desk and the test distributor is traced from (-) battery through the winding of the line relay A, contacts of the reversing relay F, "-" line, "distributor" key, "release" key, "dial" key, dial, 60-ohm winding of relay F-1, 500-ohm resistance, "connector release" key, "B.C.O." key, "dial" key, "distributor" key, "+" line, contact relay F, winding of line relay G to (+) battery. F-1 does not operate at this time, as the current in its two windings are in opposition. Relays A and G close parallel circuits to relay B, which operates. Relays A and G release on each impulse from the dial, but only A is concerned with the impulsing path. The vertical magnet is operated from (+) battery at the contact of relay A, contact relay B, off-normal springs, winding of relay C, through the vertical magnets to (-) battery.

After the last impulse of the first series, relay C falls back and transfers the impulsing circuit from the vertical magnet to the rotary magnet. Each time relay A falls back, during impulsing, a circuit is closed to relay J and to the rotary magnet. Relay J, operating, closes the circuit from ground at B, to relay H, which operates and disconnects the "test" lines from the "test" wipers, so that the test distributor will not interfere with the test connectors, over the terminals of which its wipers rotate. Relay J also opens a part of the incomplete circuit to relay D, so that relay D will not operate when H operates. Due to its slow-to-release action, relay J remains operated during the impulsing and holds H operated.

## 2.2 Dialed Test Connector Busy

The busy test is not made at once, but occurs when relay J falls back at the end of the second series of impulses. In case the dialed test connector is in use, relay J, on restoring, transfers the circuit of H, by means of make-before-break contacts, from (+) battery at B to (+) battery on the E.C. wiper through the 250-ohm winding of the busy relay E. Busy relay E operates through its 250-ohm winding in series with H; opens a part of the incomplete circuit to the rotary magnet, so that the rotary magnet will not operate if the circuit to A is again interrupted; opens the circuit to D, so that D will not operate at this time; places the busy tone on the (+) line back to the test desk; and closes the circuit to relay F, from ground at a make contact of E. Relay F operates and reverses the current on the line, operating the polarized relay F-1 and causing the supervisory pilot lamp to glow. Thus the tester receives both a busy tone and a visual signal when the dialed test connector is in use. The tester is not forced to release but may hold the trunk until the connector becomes idle.

## 2.3 Test Connector Idle

When the test connector becomes available, removal of ground from the E.C. wiper opens the circuit to H and the 250-ohm winding of E. Relay E, restoring, removes the busy tone from the line, opens the circuit to relay F, which causes F-1 to restore, extinguishing the pilot lamp; and closes the circuit to D from ground at B. Relay H, due to its slug, remains operated long enough to insure the operation of relay D, which operates and closes its locking circuit so that it will not restore when H falls back. Relay D also closes the loop circuit to the test connector through the contacts of A and the "operate" wipers, seizing the connector. Relay H, restoring, connects the "test" lines through to the "test" wipers. The absence of the busy tone and the visual signal inform the tester that the dialed connector is now available.

## 2.4 Impulsing to the Test Connector

The last two digits are then dialed, relay A repeating the impulses to the test connector. Relay J, as before, operates on each series of impulses and closes the circuit to relay H. Relay J also opens the incomplete circuit to F from the C wiper to keep the circuit open after the operation of H. Relay H operates and disconnects the test lines from the test wipers, so that the test connector will not interfere with the lines over which the wipers pass.

As before, the busy test is not made the instant the wipers come to rest, but occurs when relay J of the test distributor falls back at the end

of the last series of impulses. If the dialed line is busy, relay F operates from (+) battery at the control wiper of the test connector, C wiper of the test distributor, make contact of relay H (relay H, being slow to release, remains operated temporarily after J releases), break contact of J, through the winding of relay F to (-) battery. When H restores, it transfers the circuit to relay F to another circuit from the same ground on the C wiper, and connects the test lines to the test wipers. The pilot lamp at the test desk glows, because of the operation of F and F-1, but the busy tone is not received.

The tester may either wait for the line to become available or release the connection. When the line becomes free, assuming the tester waits, relay F releases, in turn releasing F-1, and thus extinguishing the pilot lamp at the test desk. The dial key is restored to normal upon completion of the connection to the line to be tested. The test distributor remains operated by the loop through the 60-ohm winding of relay F-1.

## 2.5 Testing

The testing circuit is closed from the test apparatus through the distributor key, the test trunk, contacts of relay H, test wipers of the test distributor, wipers of the test connector to the line under test. The (+) battery, which is connected to the control wiper of the test connector through a make contact of G, causes the B.C.O. relay of the line equipment to operate and clear the line of attachments. To make an "inward" test through the line equipment, the "B.C.O." key is operated, allowing relay G to fall away, thus opening the holding circuit to the B.C.O. relay of the line under test. Relay A remains operated from ground (+) at the B.C.O. key, when this key is operated, in order to hold the test distributor operated. The B.C.O. relay restores to normal and connects the line relay of the line equipment across the test lines. The line equipment operates and connects the line to a first selector.

To test additional lines in the same one-hundred group, the tester momentarily operates the "connector release" key, causing relay A to fall back releasing the test connector, but not the distributor. Relay G is held from (-) battery at the connector release key in order to hold the test distributor. The tester then dials the last two digits of the next desired line.

When there is more than one line on the same connector level to be tested, the test connector need not be released, but only an additional digit dialed to rotate the test connector wipers to the next line. This feature is generally employed when routine tests are made on all telephone lines.

### 3. VERIFICATION SERVICE

Aside from the use of the test switch train for testing purposes, it can also be utilized by certain operators for verification and toll offering services. In these cases, a separate group of test distributors or test-distributor selectors, having access to the same test connectors used by the tester, are usually furnished for the operators' exclusive use. These test distributors or selectors are generally termed "verification switches." By means of this "test and verification switch train" it is possible for an operator at a position on which the verification trunks terminate, to dial a busy telephone number and listen in on the line to verify

whether it is busy, or to inform one of the talking parties that a toll call is being held, awaiting the termination of the conversation. The toll call, however, is completed over the regular channel provided for the purpose and not over the test and verification switch train.

#### 3.1 Verification Switch Circuit

When used for verification service, the test distributor has the line and test wires connected by 2-M.F. condensers, as shown dotted to the left in Fig. 1. These condensers furnish the circuit by means of which the verification operator's telephone is connected to the test lines and hence to the dialed line.

