General Telephone Technical Journal
July, 1959

# AUTOMATIC ROUTINERS *for* DIRECTOR-TYPE SATT SYSTEMS

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To make sure that Strowger Automatic Equipment will operate under all normal and many adverse conditions, and to disclose incipient faults before they affect service, the equipment is periodically tested in accordance with a pre-planned program of routine maintenance, known as "routining." This testing is usually done manually, but it became evident long ago that this was a type of work that lent itself to automation, and so *automatic routiners* were developed—the first of them about 1930. With the increasing complexity of telephone switching networks, automatic routining has

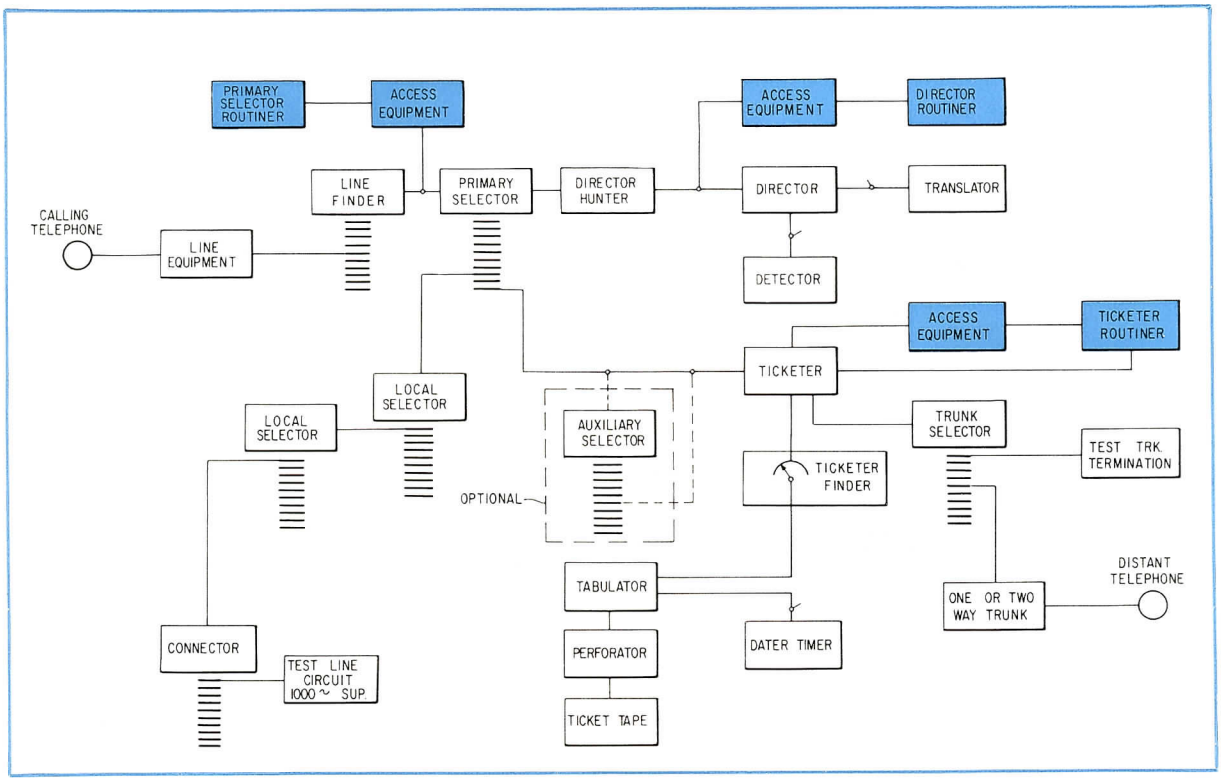


Figure 1. Connection of Automatic Routiners into Director Type SATT System

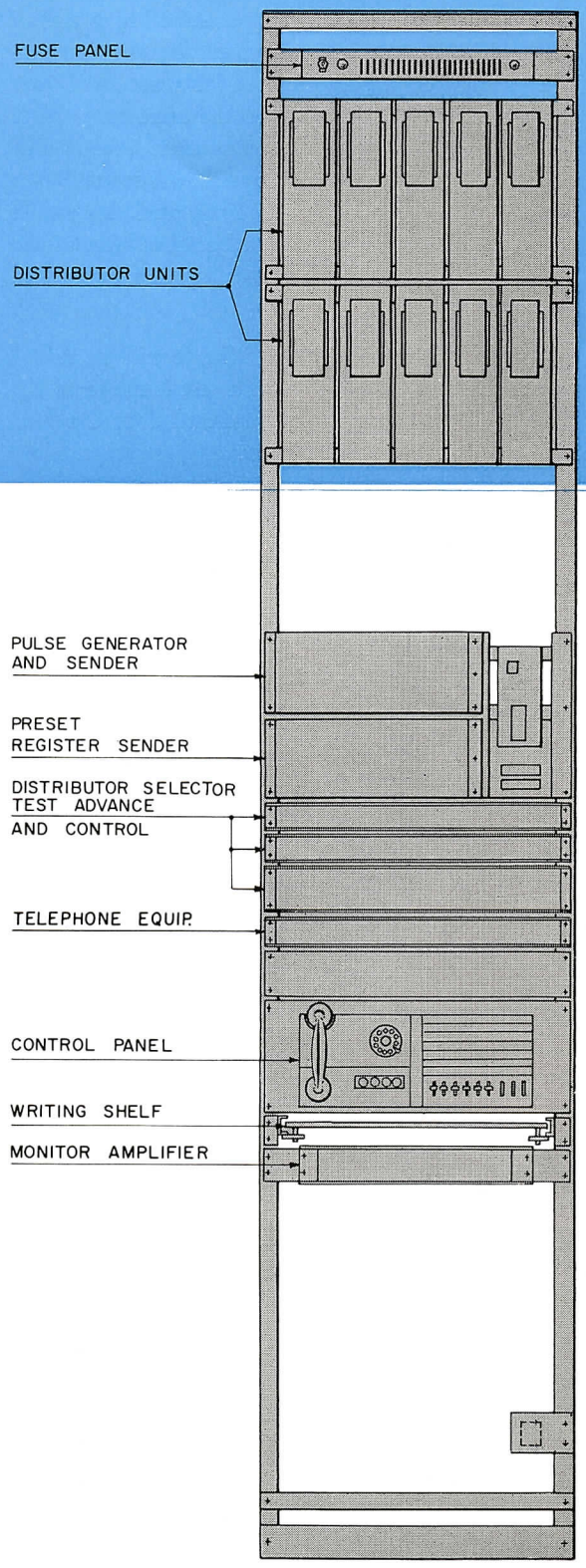


Figure 2. Primary Selector Routiner

been found by many telephone companies to solve two basic problems: the need to establish sound maintenance practices in large offices, and the high cost of adequate routining in such offices on a manual basis.

Most complex of all Strowger Automatic networks is the Type "A" (Director-type) SATT system used in large metropolitan areas. Laboratories has therefore developed automatic routiners, described herein, for Type "A" SATT equipment.

The Type "A" SATT system is fully automatic—requires only the dialing of a local directory number for a call within the home numbering-plan area, and only a toll area code, plus the local directory number, for calls to other areas. Detection and recording of the calling station number is automatic, even on party lines; party-line telephones are equipped with special dials having an auxiliary spring combination that identifies the calling station as the called number is dialed. Equipment and circuitry required to provide such completely automatic toll services are quite complex, and the great volume of traffic carried through these large systems necessitates prompt and efficient correction of any faults. Type "A" SATT equipment is regularly supplied with "monitor" panels that indicate the status of various equipment units as calls progress through them; these panels are so equipped that testing of individual units and of the overall system can be done from a central location. The automatic routiners described herein are an additional step toward assuring the establishment of sound maintenance practices in large SATT offices.

Automatic routiners required for Type "A" SATT equipment are: primary selector routiner, Director routiner, and ticketer routiner. These routiners will handle the three basic categories of SATT equipment in such an exchange, as shown in Figure 1.

*Primary Selector Routiner* (Figure 2)

The primary selector corresponds to the first selector in a non-Director system. Before subscriber dialing commences, the primary selector extends the call to a Director and indicates to it the class of service of the calling line. Its other functions (vertical and rotary stepping) are similar to regular selectors, except that it is always pulsed from a Director.

To adequately test such a selector, a routiner must be capable of making tests of every step in selector operation—seizure, class-marking, stepping to the correct level, switch-thru, etc. All these tests, and others, are provided by the new primary selector routiner, which can be made to access a maximum of 5000 primary selectors, and to routine them sequentially, one at a time, shelf by shelf. The routiner is placed in operation by simply operating a few keys on the routiner control panel (Figure 3).

To routine all primary selectors, in all shelves, the PRESET key is operated, followed by the START key. This causes the access equipment to select the first primary selector of the first shelf.

This selector is immediately tested to determine whether it is idle or busy. If it is busy, the routiner does one of three things; normally, it advances the access equipment to the next primary selector. However, if the routiner busy control key is placed in its TIMED CAMP-ON position, the routiner will "camp" on a busy selector for a specified time interval, before proceeding to the next one. Or, if the key is operated to the permanent CAMP-ON BUSY position, an audible signal will sound when the routiner finds a selector busy, and this signal will continue until the selector becomes idle, or the routiner is advanced manually, by key operation, to the next selector.

If the primary selector is idle, it will be seized by loop closure. At this point a test is made to determine if ground is being returned over the "C" lead by the "B" relay in the primary selector. If no ground is received, routining stops, a trouble-indicating lamp lights, and an alarm is sounded. If ground is returned over the "C" lead, the routiner permits the Director hunter to attempt to seize a Director and extend it to the primary selector. If no Directors are idle, "all-Directors busy tone" will be received; this fact is noted, and the routiner released. A second attempt is then made to routine the same primary selector. If neither dial tone nor busy tone is received, routining stops, a trouble-indicating lamp lights, and an alarm is sounded.

If dial tone is received, a continuity test is made of the leads which forward the "class" marking, via the primary selector, to the Director. If this test fails, routining will stop, and alarms are transmitted. If continuity exists over the "class" leads, the routiner sender is called into operation. A seven-digit local telephone number is pulsed out, directing the call to a test line termination that is connected to a one-milliwatt, 1000-cycle source.

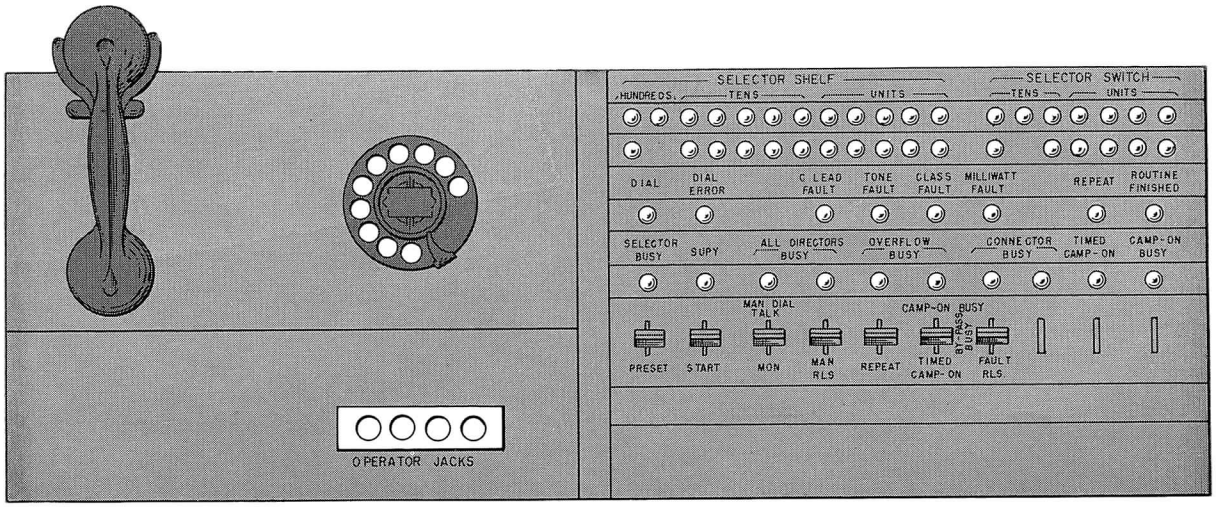


**Figure 3. Control Panel for Automatic Primary Selector Routiner**

After five digits have been sent, a test is made to see if an overflow busy tone has been encountered anywhere along the established switch train. If so, this fact is recorded, and the routiner releases; a second attempt is then made to routine the same primary selector. If no overflow busy tone is received, the last two digits of the local test number are sent out by the routiner, to seize the Test Line Termination circuit.

After seizing the Test Line Termination circuit, the routiner waits for the period of a complete ringing cycle, to insure tripping the ring-trip relay in the connector. After this timed interval, the routiner tests for the 1000-cycle tone. If the tone is received, the routiner releases, and the test of this switch is completed. The routiner then proceeds to access the next primary selector.

If line-busy tone is received, this fact is recorded, and the routiner releases. A second attempt is then made to routine the same primary selector. However, if ringback tone is received, or if no 1000-cycle tone is returned, routining will stop, and visible and audible alarms will begin.

Thus, in the manner described, all selectors are routined sequentially, and when the last primary selector of the last shelf has been tested, a signal is given, indicating that testing has been completed.

The routiner control panel has associated with it supervisory lamps which will advise the maintenance man as to the selector circuit being tested, and the point of failure of that circuit.

A "preset selection" circuit is also provided, which permits one to routine a specific primary selector, or to start the office routining operation with a specific selector. The PRESET key is operated, and an arbitrary three-digit code that has been assigned to that selector shelf is dialed by the maintenance man. Following this, a two-digit code is dialed to access the particular selector within the shelf. Now, when the START key is operated, the desired selector within the selected shelf is set up for test purposes.

If several test cycles are desired at one particular primary selector, the REPEAT key may be operated, and the same selector circuit will be routined continuously.

A manual test, talk, and monitor circuit is provided to facilitate manually testing a particular primary selector. When the routiner is set to "CAMP-ON-BUSY," the monitor circuit may be employed to ascertain whether selectors that test busy are actually in use.

*Director Routiner* (Figure 4)

The Director is a register-translator-sender applied to the Strowger system. When Directors are used, the subscriber is required, on toll calls within the home numbering-plan, to dial only the called station number—and on calls to other toll areas, only the toll area code plus the called-station directory number. The Director then automatically routes the call to the terminating office, and also, with the aid of the detector, accumulates and transmits to a ticketer the initial data required to produce a call record (ticket).

In order adequately to check the Director, an automatic Director routiner must, of course, be capable of initiating all types of calls that the Director is capable of handling (e.g., Local Calls of both the translated and non-translated type, AB Toll Calls, Long-Haul Toll Calls, 10-digit Free-Service Calls, Special-Service Calls, Reverting Calls, etc.). In addition, the routiner must be capable of checking on the supervisory features of the Director (e.g., fault seizure operation, incomplete detection, permanent signal timing, stop-dial operation, etc.). The new automatic Director routiner performs all the aforementioned functions—giving the operator 80 tests from which to choose by simple key operation.

This routiner can be made to access a maximum of 500 Directors, and to routine them in sequence, one at a time. All tests are "programmed" (i.e., one could test an entire office on one or on several items, or the entire sequence of tests could be applied to the entire office).

Associated with this routiner as an integral part is an automatic Digital Read-Out Printer which records the calendar date of the test, the particular test or tests being run (each test is identified by a number), the Director number, and whether the Director failed or passed a particular test or tests.

When it is desired to routine all Director circuits in the office, a PRESET key is operated on the Control Panel (Figure 5), followed by one or more TEST SELECTION keys (which determine the tests to be applied) and the START key. The automatic printer immediately records the date (month and day) and the numbers of the tests selected by the various operated TEST SELECTION keys.

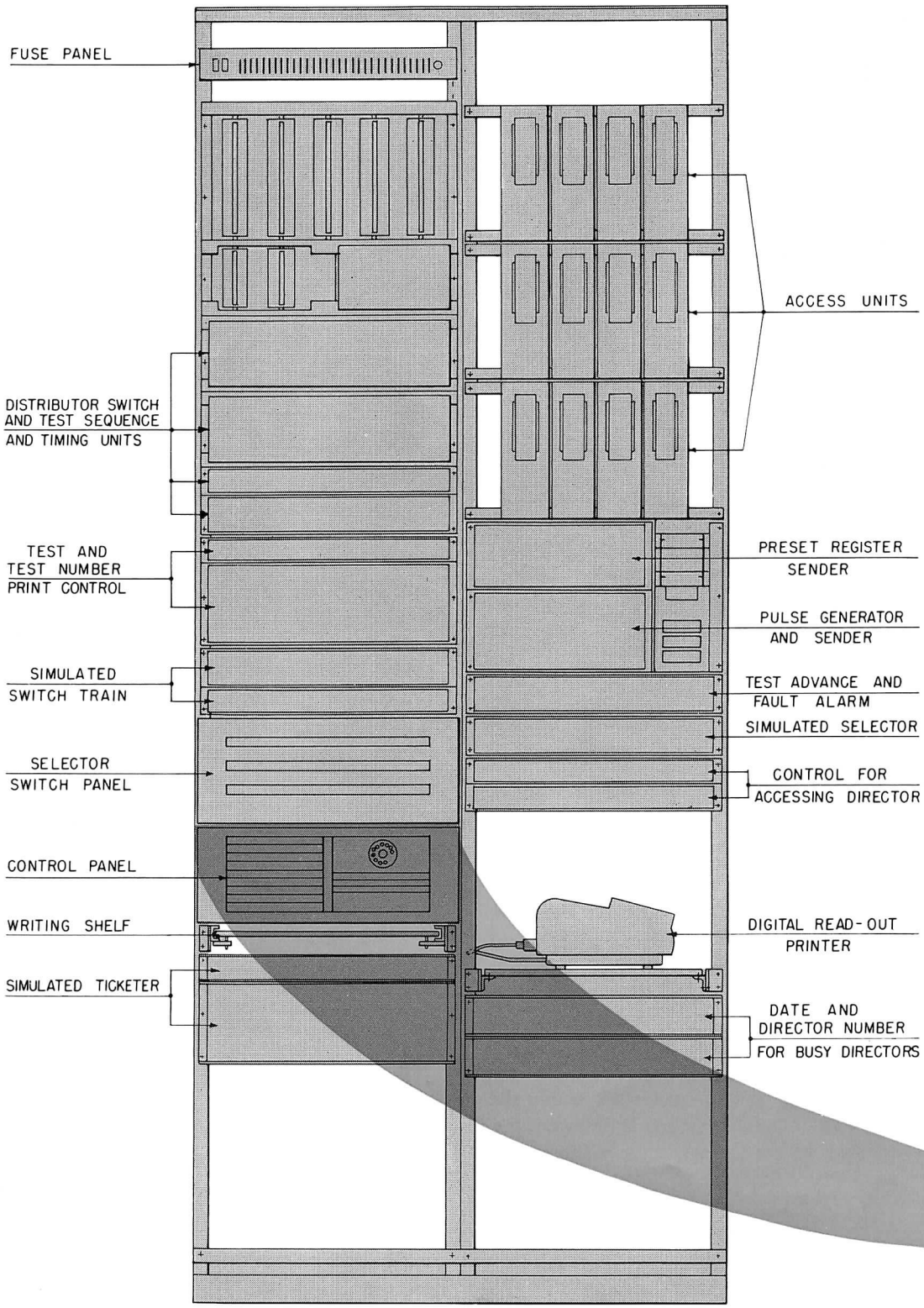


Figure 4. Director Routiner and Access Equipment

After this information is recorded, the access equipment steps off-normal, selecting the first Director in the office.

The "G," or guard, lead is now tested to ascertain whether the first Director is busy or idle. If it is busy, the routiner "camps" on this Director for approximately 60 seconds. If at the end of this time the Director has not become idle, a "marking" pulse is sent to the printer, and the access equipment is advanced to the next Director.

If the Director is idle (or becomes idle during the "camping" period), the routiner registers at the printer the number of the Director being routined. After this information has been sent, the routiner examines the leads between the Director and the Director Hunter, for crosses and foreign potentials. If the leads are satisfactory, the routiner closes resistance battery to the Director, to check its "pre-seizure" operation.

If the Director responds correctly, a tone-detection circuit is prepared to detect dial tone. When dial tone is returned by the Director, the routiner prepares to send the first selected test call into the Director.

It should be noted that if a Director fails the test for crosses and foreign potentials, or the "pre-seizure" operation test, or if it does not return dial tone, the routiner considers the Director as having failed the basic seizure test; the Director number and a code number denoting such a failure will then be recorded by the printer. An alarm will be sounded continuously (this alarm must be released manually); however, the routiner will not stop but will continue its testing on the next Director.

If a Director successfully passes the basic seizure test, the routiner proceeds to call its sender into operation, causing the first digit of the first test call to be sent into the Director. The remaining digits of the test call are subsequently sent and, depending upon the type of test call, the routiner's simulated ticketer and simulated switch train may be called into operation. The information received from the Director by each of these units is then compared with the correct information marked on the banks of the test sequencing switches. If the information received agrees with that marked on the banks of these switches, the routiner checks for proper release of the Director. If the Director releases correctly, the routiner considers it to have passed this first call test successfully, and proceeds to apply the second test call to the same Director.

Assume that the Director fails on the second test call. The number of the test, plus a number that indicates which portion of the test the Director failed, will be recorded by the printer, and, as above, a continuous alarm will be sounded, while the routiner continues its testing operation on the next Director.

A "STOP ON FAULT" key has been provided in the routiner, so that, if desired, it will stop routining when a fault is encountered; use of this key is left to the discretion of the operator. By operating keys on the routiner control panel, loop and leak conditions may be applied to the Directors, to simulate line conditions. The routiner also has facilities to test the Director's ability to receive and record SATT "spotter" dial pulses.

After testing the last Director in the office, a signal is given, to indicate that routining has been completed.

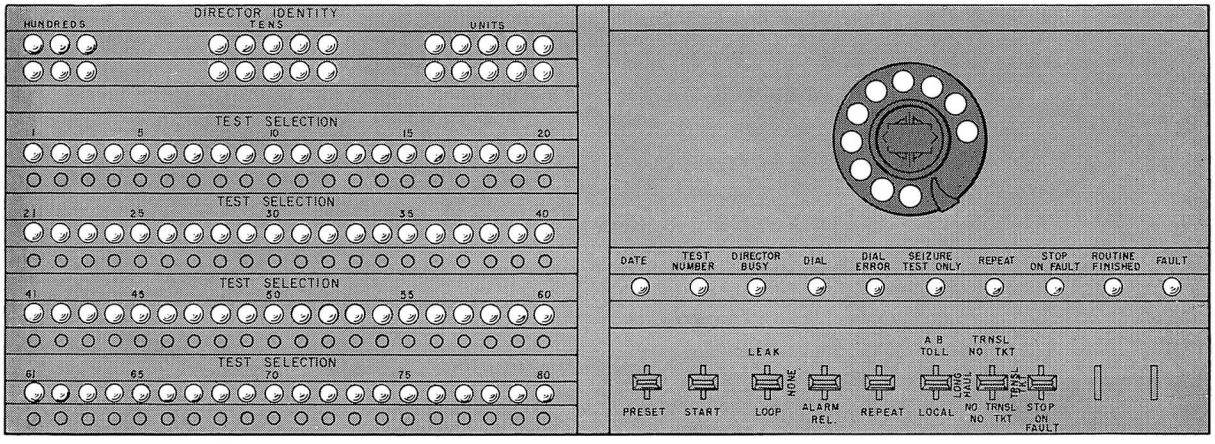


**Figure 5. Control Panel for Automatic Director Routiner**

The routiner has associated with it supervisory lamps which indicate to the maintenance man the specific Director being tested, and the progress of routining.

As in the primary selector routiner, a "preset selection" circuit is provided which can be used when it is desired to routine a specific Director or to start office routining with a specified Director. The PRESET key is operated, as previously described, and the Director number is manually dialed. With the operation of the START key, the selected Director is set up for test purposes. If several test cycles are required on one particular director, the REPEAT key may be operated; the same Director will then be routined continuously.

In addition to all these completely automatic tests, the Director routiner is provided with a group of manual selector switches for additional special operating conditions, for which tests are not provided in the automatic portion of the routiner.

*Ticketer Routiner* (Figure 6)

The ticketer is the principal unit of the ticketing equipment. It stores all ticketing data that has been forwarded by the Director, remains with the call during the conversation period to time the call, adds the conversation time and the identifying number of the ticketer to the ticket data, and forwards this information to an idle tabulator for further processing. The new automatic ticketer routiner tests both short- and long-haul (7- and 10-digit) ticketers progressively and on a fully automatic basis.

The tests applied by the routiner to each ticketer are tests that years of experience have found to be desirable. Among these are tests of the ticketer's conversation-timing features, its storage data-sending ability, and the continuity of ticketer output leads, and an overall test that includes the relays in the trunk selector.

As with the Director routiner, the ticketer routiner has associated with it a "Digital Read-Out" printer which records the calendar date, the particular test or tests being run, the ticketer number, and whether the ticketer failed or passed a particular test or tests. A tape, equivalent to that produced by the Director routiner, is made by the ticketer routiner.

This routiner can be made to access a maximum of 500 ticketers. All tests are programmed and the routiner is placed in operation in a manner similar to the Director routiner.

When the access equipment is stepped off-normal by operation of the routiner START key, it checks whether the first ticketer is busy or idle, and whether this ticketer is a short-haul (7-digit) or long-haul (10-digit) ticketer.

As with the primary selector routiner described above, the ticketer routiner may do any one of three things, on finding that a ticketer is busy. Normally, it advances the access equipment to the next ticketer. However, if the TIMED CAMP-ON feature is used, the routiner will "camp" on a busy ticketer for a timed interval, before proceeding to the next one; or if the PERMANENT CAMP-ON BUSY feature is used, an alarm will sound until the ticketer becomes idle or the routiner is advanced manually (by key operation) to the next ticketer.

If the ticketer is (or becomes) idle, the routiner registers at the printer the number of the ticketer being routined. After this information has been sent to the printer, the routiner's simulated call recorder is placed in operation, seizing the ticketer via its test common leads. The routiner then proceeds to send simulated call data into the ticketer to actuate its codel data-storage equipment. In conjunction with this operation, the trunk selector is seized and stepped to a level having access to a "test termination" trunk.

After all pulsing has been completed, the trunk selector, and subsequently, the test termination trunk, are checked for switch-thru operation. If these conditions are correct, the ticketer is placed in the "answer" condition. A predetermined number of time pulses are now sent to the ticketer conversation-timing circuit. These pulses are like those used in the timing of calls, but are sent at a high speed. After the pulses have ended, the routiner will initiate the release of the ticketer, as if upon completion of a regular ticketed call.

The routiner now initiates a continuity check of the leads between the ticketer and its simulated tabulator; if the ticketer passes this test, it is allowed to transmit its stored ticket data. The information received from the ticketer is then compared with the correct information, marked on the banks of the routiner's test-sequencing switches. If the information received agrees with that marked on these banks, the routiner considers the ticketer as having passed this test successfully, and proceeds to

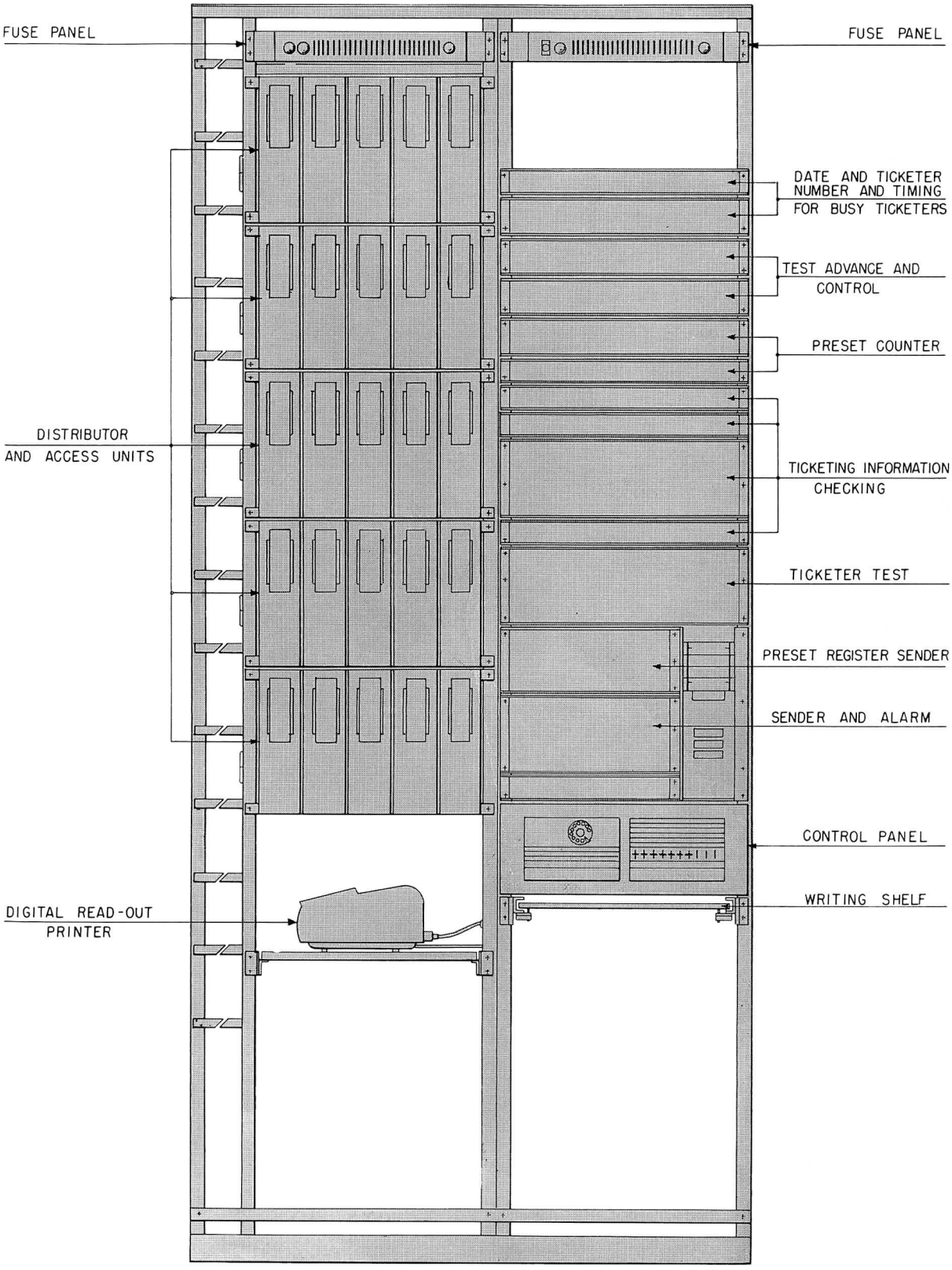


**Figure 6. Ticketer Routiner and Access Equipment**

apply a second test call to the same ticketer. A series of only four tests of this kind is required to assure the proper functioning of all codel units.

If the ticketer fails the second test call, the printer will record the number of the test, and of that portion of the test that failed. An audible alarm will also be given, which must be released manually; however, the routiner will not stop but will continue its testing operation on the next ticketer.

When the last ticketer has been tested, a signal is given, indicating the conclusion of routining.

As with the Director routiner, the ticketer routiner has a REPEAT TEST feature and a preset selection circuit, each of which operate as previously described.

### Summary

The three routiners described, used together as a complete automatic routiner for Type "A" SATT equipment, put all the basic equipment units "through their paces" in such a way that the operating company may be sure of satisfactory operation. These routiners test all details of switch operation—accurately, and rapidly.

In the latter part of this year the first SATT routiners of this type will be placed in operation by Middle States Telephone Company of Illinois in its Park Ridge and Des Plaines Offices.

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