DESCRIPTION OF INTEROFFICE TRUNK TESTING PERMANENT BUSY, OPERATIONAL, AND DIAGNOSTIC TESTS NO. 2/2B ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

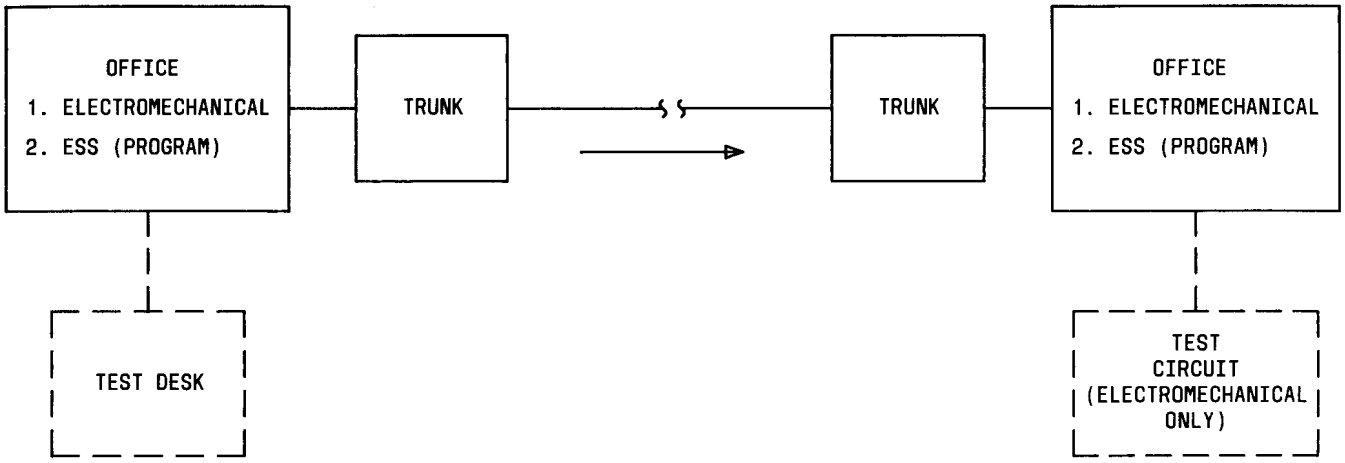
1.01 This section describes how interoffice trunk testing in a No. 2/2B Electronic Switching System (ESS) is controlled via program and translations and how tests are activated via TTY input messages or automatic trunk tests.

1.02 This section is reissued to incorporate engineering and field comments.

1.03 Trunk tests are made from an office (near-end office) over its outgoing trunks to a terminating office (or far-end office). The near-end office "dials" a telephone number of a "test line" in the far-end office. This test line connects the near-end office with a test circuit (in an electromechanical office), or to a series of program-initiated responses which will make use of general purpose test circuits in the ESS to aid in simulating a test circuit (in an ESS office). The near-end office then investigates the response to see if the trunk is responding properly. (See Fig. 1.)

A. Types of Tests

1.04 Two types of tests may be made on members of a trunk group which involves the placing of test calls. The types are: permanent busy test (PBT) and operational test (OPT). The operational test may be synchronous or nonsynchronous. The numbers to be dialed over the trunks for the test calls are included in the terminating office test access number (TOTAN) tables which are indexed from the trunk group to be tested (see Fig. 2). The tests may be requested by a TTY input message, or may be automatically initiated by the Traffic Work Table (TWT), and run for each member of the group. The automatic progression



OFFICE	TYPE TEST LINE
1. ELECTROMECHANICAL	SYNCHRONOUS OR
	NON-SYNCHRONOUS
2. ESS	SYNCHRONOUS

Fig. 1—Test Line Assignments

test (APT) is initiated by the TWT. It may be scheduled to run on any day(s) at any hour(s). Typically it runs early every morning. See 232-120-301 for more details on TWT.

1.05 Tests can be run on trunk types as follows:

- Permanent Busy Types only 2H174, 2H180
- Permanent Busy or Operational Types - 2H103, 2H112, 2H144, 2H148, 2H157, 2H158

See TG-2H or Section 232-105-302 for more details.

B. TOTANI

1.06 The TOTAN index (TOTANI) (a 6-bit number stored in the Trunk Group Translations table) is defined on the ESS 2505 Input Form and is assigned on ESS 2202 Input Form. The TOTANI is an index into the TOTAN table where the test information is stored. A given TOTANI may be shared among several trunk groups. The TOTANI (Fig. 2) contains the following test-related information:

(1) Telephone number used to dial the permanent busy (PB) test in the far-end office.

(2) Telephone number for the operational test as well as the SYN bit to indicate whether the number is for the synchronous or nonsynchronous test.

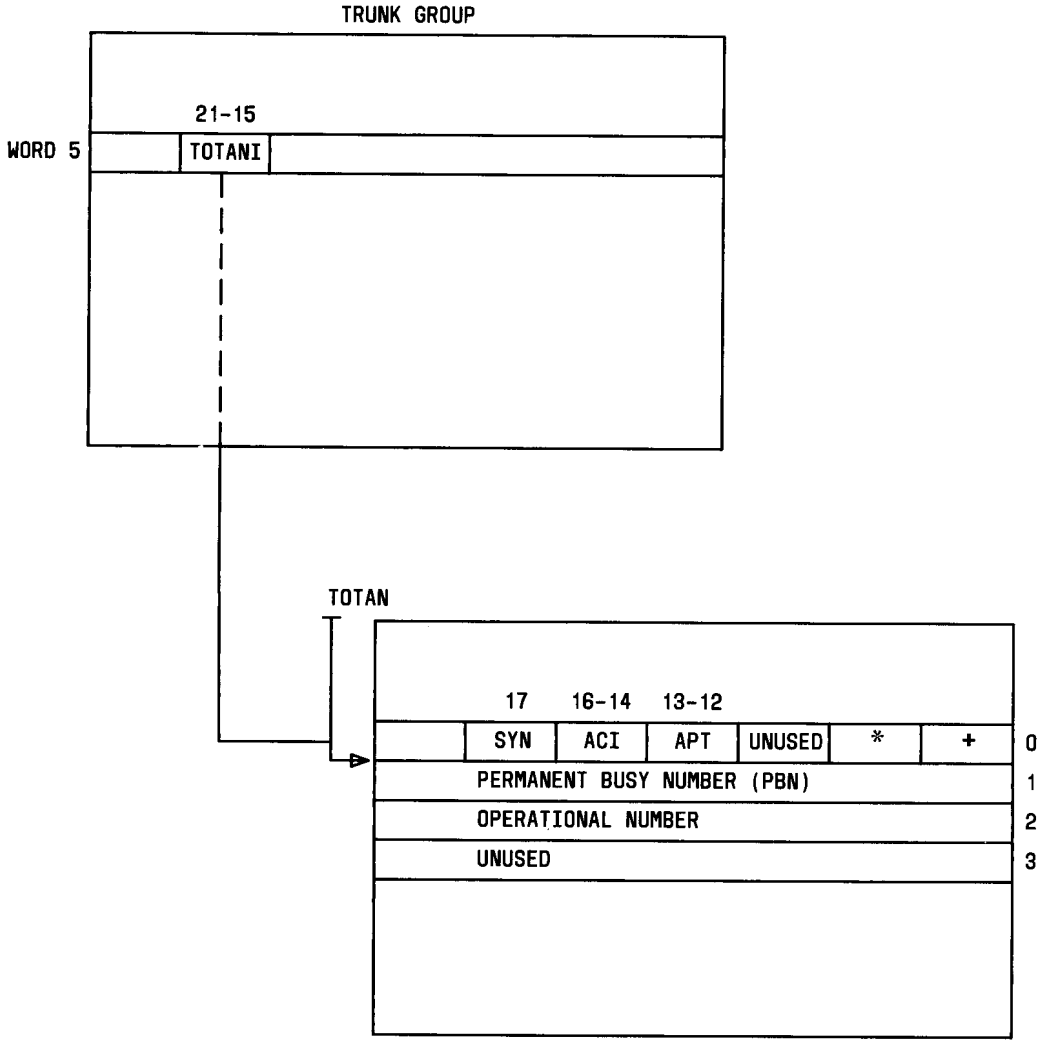
(3) The automatic progression test (APT) code for a diagnostic (DGN) test. This code determines whether the permanent busy, synchronous, or nonsynchronous test is to be run on the automatic test or on a manual request initiated at the maintenance TTY.

(4) Area Code Index (ACI) - An index into the ACTBL translator where either the area code and/or the tie trunk access code is stored.

C. Test Lines

1.07 Synchronous tests are more rigorous and have tighter tolerances than nonsynchronous tests. Both tests check for bad relays but synchronous test lines also check for marginal relays.

1.08 "Synchronous" type test lines are required for offices (usually in connection with the Bell System panel and crossbar offices) where



* PART OF OPERATIONAL NUMBER

\+ PART OF PERMANENT BUSY NUMBER

ACI - AREA CODE INDEX. AN INDEX INTO THE ACTHL TRANSLATOR WHERE EITHER THE AREA CODE OR THE TIE TRUNK ACCESS CODE IS STORED

APT - AUTOMATIC PROGRESSION TEST CODE:
- 00 = NONE:
- 01 = PERMANENT BUSY TEST:
- 10 = OPERATIONAL SYNCHRONOUS TEST:
- 11 = OPERATIONAL, NON-SYNCHRONOUS TEST.

TOTANI - THE TERMINANTING OFFICE TEST ACCESS NUMBER INDEX. OBTAINED FROM TRUNK GROUP DATA (SEE SECTION 610).

SYN - SYN = 1 SAYS THE OPTIONAL TEST IS SYNCHRONOUS.

Fig. 2—Near-End Office Translations

ringing, tripping, and supervisory features are in the incoming trunk relay equipment. Marginal tests of the supervisory and tripping functions are provided. Tests may be originated on either a manual or automatic basis. In 2/2B ESS offices, an equivalent program-controlled test line operation is provided to satisfy the requirements of the originating office test frames. The test line is required to perform the functions as described below:

(1) Test for application of the ringing signal.

(2) Test for pretripping of machine ringing during the silent interval.

(3) Provide interrupted audible ringing tone during one 2-second ringing interval.

(4) Test for tripping machine ringing during a 3-second silent interval.

(5) Provide the following supervisory tests:

(a) An off-hook signal of approximately 1.3-second duration for synchronizing with automatic progression test equipment in originating offices. During the off-hook period, soak current is applied to supervisory relays.

(b) The synchronizing signal is followed by two separate off-hook signals of 0.3-second duration during which the soak current is applied to the supervisory relays.

(c) Following one synchronizing signal and each of the two successive short off-hook signals, an on-hook signal of approximately 0.2-second duration is returned. During this time, the release current is applied to the supervisory relays.

(d) Return second series of off-hook signals, consisting of a synchronizing signal and two flashes, is returned. During each off-hook interval of this series, operate current is applied to the supervisory relays. During each on-hook interval, an open-circuit condition is presented to the supervisory relays.

(6) Send tone signals to the originating office as follows:

(a) Audible ringing tone for 0.3-second intervals interrupted for 0.2 seconds as an indication that the trunk circuit tripping features operated on the pretripping test.

(b) A "tick-tock" tone at the rate of 120 IPM without flash as an indication that the test termination has completed all tests and is awaiting disconnection.

Note: The incoming trunk circuit should return the regular audible ring to indicate tripping failure.

1.09 A "nonsynchronous" test line is required for all dial-type Class 5 offices not having the synchronous-type test line. This line provides an operation test which is not as complete as the synchronous test but can be made more rapidly. The nonsynchronous test is the only one required for those offices where marginal-type tests cannot be applied directly to the incoming trunk circuit as is frequently the case with step-by-step systems. However, test terminations provided for application of marginal-type tests to circuits, such as connectors in step-by-step offices, generally meet the minimum requirements for nonsynchronous-type incoming trunk test lines and are frequently used for this purpose. In some instances, connector test terminations can be used to apply marginal tests to such circuits as toll transmission selectors. The minimum requirements for a nonsynchronous test line where the synchronous test line is not provided are as follows:

(1) Starts to function under control of ringing signal.

(2) Permits audible ringing signal to be returned for a minimum 0.5 second to originating office.

(3) Causes ringing to trip.

(4) After ringing is tripped, returns the 60-IPM line busy signal which consists of alternate 0.5-second off and on-hook signals with low tone applied during each off-hook period until disconnections. Where the synchronous test line is provided, only the 60-IPM line busy signal is required.

1.10 The nonsynchronous test line, used in many Bell System step-by-step offices for the application of marginal tests to connector circuits, operates in the following manner:

(1) Start to function under control of the ringing signal.

(2) Permit audible ringing signal to be returned for 1.0 to 1.5 seconds.

(3) Return an initial off-hook signal of 1.0 to 1.5 seconds duration during which time ringing is tripped.

(4) Provide the following supervisory signals sequentially after the initial off-hook tests are applied:

(a) 0.5 second on-hook.

(b) 1.0 to 1.5 second off-hook.

(c) 0.2 second on-hook.

(d) 0.3 second off-hook.

(e) 0.2 second on-hook.

(f) 0.3 second off-hook.

(g) 0.2 second on-hook.

(h) 0.3 second off-hook.

(i) 2.0-second on-hook period to permit disconnection from the test line.

(j) Alternate 5.5-second off-hook and 2.0-second on-hook intervals are repeated until disconnect takes place. The first two 5.5-second intervals are provided to facilitate testing of the ringing forward (re-ring) and control feature provided on some operator-selected trunks to end offices and are desirable where these features are provided.

1.11 A "permanent busy" test line is a test of lesser quality than either the synchronous or nonsynchronous test, since the far-end office only returns the busy tone and the near-end office only checks for its presence.

1.12 When a far-end office is No. 2/2B ESS, the functions of the permanent busy test are performed by connecting the incoming trunk to a busy tone. The operational test is performed by connecting the incoming trunk to appropriate tone detectors, tones, and other terminations at proper intervals to simulate the actions indicated in paragraphs 1.08 and 1.10. The test circuits used in this simulation are SD 2H118 and either 2H127 or 2H185. See Section 232-105-302 for more details.

1.13 When the near-end office is No. 2/2B ESS, checks are made for the proper responses by appropriate timing done by the program, as well as connections to appropriate tone detectors, tones, and other test circuits. The test circuits used in these checks are SD 2H128, 2H132, and either 2H221 or 2H222. See Section 232-105-302 for more details.

1.14 Synchronous test signal information is contained in Fig. 3.

2. TRUNK TESTING FROM A NO. 2 ESS OFFICE

2.01 Both PBT and OPT are run automatically as specified in the Traffic Work Table, typically every 24 hours, according to the information in the trunk group and the TOTAN table (Fig. 2). A test may also be run at any time using the following messages:

M TK:(DGN):aaa bbb!
M TK:(OPT):aaa bbb!
M TK:(PB):aaa bbb!

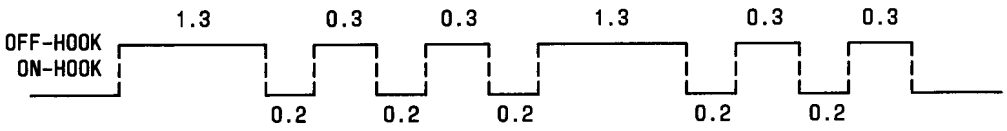
DGN = the command to run a diagnostic test as specified by APT in the TOTAN table

OPT = the command to run an operational test (synchronous or nonsynchronous) as specified by the SYN bit in the TOTAN table

PB = the command to run a permanent busy test

aaa = the 3-digit group number

bbb = the 3-digit member number.



ONE FULL PERIOD
OF AUDIBLE HAS
BEEN TRANSMITTED
BEFORE FIRST
SYNC PULSE
STARTS

NOTE: NUMBERS INDICATE NOMINAL DURATION IN SECONDS.

Fig. 3—Synchronous Test Signal

PERMANENT BUSY

2.02 If a permanent busy test is requested, the program will locate the telephone number for the test in the TOTAN table and set up the call to a far-end office.

OPERATIONAL TEST

2.03 If an operational test is requested, the program will first check the SYN bit in the TOTAN table. A "0" in the SYN bit in the program is to set up for a nonsynchronous test. A "1" in the SYN bit tells the program a synchronous test is to be run. The program will then obtain the telephone number to be called from the TOTAN table and set up the call.

DIAGNOSTIC TEST

2.04 When a diagnostic test (DGN) is requested, the program will check the 2-bit automatic progression test (APT) code.

2.05 The program will respond to the APT as follows:

(1) 00 - No test

(2) 01 - A permanent busy test is performed as in paragraph 2.02.

(3) 01 - An operational synchronous test is performed as in paragraph 2.03.

(4) 11 - An operational nonsynchronous test is performed as in paragraph 2.03.

2.06 If requested by a TTY type in, when the test is completed, the program will print out the following message:

MR TK a bbb ccc d

a = type of test run (DGN, OPT, or PBT)

bbb = Group number

ccc = Member number

d = ATP (all tests pass) upon successful completion of the test ***or a trouble number upon test failure.*** The trouble number designates at which point the test failed. Locate the trouble number in TLM 2H100 to determine which equipment must be replaced.

3. TRUNK TESTING TO A NO. 2/2B ESS OFFICE

3.01 At the far-end office, the information received goes through a 4-digit translator which contains a route index (RI) (Fig. 4).

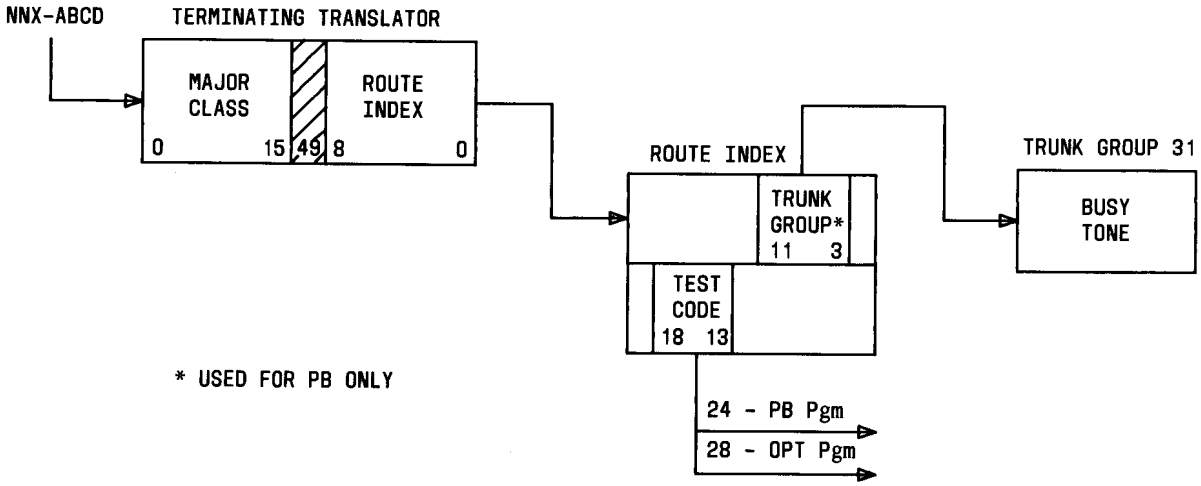


Fig. 4—Far-End Office Translations

3.02 For a permanent busy (PB) test, the program uses the group number in the route index which assigns the busy tone group for the test. For both synchronous and nonsynchronous tests, the trunk group number in the route index is unused; however, the test program has built-in access to the groups corresponding to the circuits mentioned in paragraph 1.12.

3.03 The route index also contains a code indicating the test program to be used to give the response (24 for PB and 28 for OPT). This code will set up the far-end office for the particular test being conducted.

4. DETAILED NEAR-END PROGRAM ACTIONS

4.01 When an automatic test is requested, the outgoing and 2-way trunk testing programs provide for operational tests on interoffice outgoing and 2-way trunks. The following outgoing trunk (OGT) tests are available:

(a) Permanent busy test (PBT)

(b) Synchronous line test (SYNC)

(c) Step-by-step or nonsynchronous line test (NOSYN).

4.02 A request for an outgoing interoffice trunk test is entered from the trunk diagnostic monitor. The scan point number (SPN) of the trunk to be tested is contained in the transient call record (TCR) along with a code that indicates which operational test is to be performed. The types of tests available for a particular trunk are assigned by the operating company. A trunk group may have the PBT and either the SYNC or NOSYN test specified. The test performed is designated by either a TTY request or by an APT during diagnostics started by the TWT. The monitor determines which test is to be performed, based upon the source of the test request and the data stored in memory.

4.03 Both supervisory ferrods in the trunk circuit are scanned to ensure that they are on-hook initially. A tone detector and path to the trunk are reserved to monitor the trunk for tones when outpulsing has been completed. The digits which need to be outpulsed to reach the far-end test line are placed into an originating register and control is passed to the outgoing trunk program (PD-2H208) for outpulsing.

4.04 At the conclusion of outpulsing, control is returned to trunk maintenance if outpulsing is successful. The tone detector, previously reserved, is connected to the trunk and placed in the tone detect state; the trunk is put in the local talk off-hook state. Control is then passed on to routine SYNC, NOSYN, or PBT, depending upon the type of test that is being performed.

4.05 If outpulsing is unsuccessful, the outgoing trunk program returns with a code which identifies the type of failure encountered. This code is used to determine if the failure could be a trunk trouble and to generate a dictionary number for the printout routine.

4.06 The SYNC routine maintains a count of the number of on-hook or flash supervisory reports that are received from the distant office and a count of the number of tone bursts detected. The responses that are expected from the synchronous test line are shown in Fig. 1. An initial time-out of 40 seconds is set in the TCR at the start of the test. Failure to receive any response during this period results in a test failure. Upon receipt of two on-hooks and/or flashes, the timer is changed to 10 seconds. If four additional on-hooks and/or flashes are received before a time-out occurs, this portion of the test is considered successful. In addition, at least one tone burst must have been received.

4.07 If the tone pulse reaches 3 at any point in the test sequence, a control is passed to the TNECK routine to determine the type of tone that is being received.

4.08 The NOSYN routine is entered when the test is being performed on a step-by-step or nonsynchronous test line. After the receipt of the first flash or on-hook, the initial 40-second time-out is changed to 6 seconds. An ATP is given if a total of four flashes and/or on-hooks are received before the 6-second time-out occurs. If a time-out occurs, the test is unsuccessful. A tone count of 3 before any flashes are received causes control to be transferred to the TNECK routine.

4.09 Permanent busy tests are routed to routine PBT. Receipt of an off-hook report from the tone detector within the 40-second timing period results in an ATP.

4.10 Upon completion of the test, the trunk and tone detector are idled and the trunk ferrods are again scanned. If either supervisory ferrod is off-hook, routine BON is entered to wait for the ferrod to go on-hook. Failure to find both ferrods on-hook within 2 seconds results in a test failure.

4.11 In the case of a test failure, a dictionary number is generated and printed out by the monitor program.

5. DETAILED FAR-END PROGRAM ACTION

5.01 The synchronous test line program is entered whenever a distant office transmits a directory number which translates to a route index with a test code exit and a destination code for the synchronous test line. (See PF-2H213.)

5.02 A network connection is made between the incoming trunk and a balanced termination test circuit, and a test is performed on the incoming trunk's line side ferrod. If this ferrod either saturates under no load or fails to saturate under load, an audible tone is returned to the distant office.

5.03 If the ferrod test passes, audible tone is returned to the distant office for approximately 8 seconds, followed by a sequence of six flashes; the first and fourth of which are synchronizing pulses of 1300- to 1400-ms duration, and the other four are 300 to 400 ms long. The on-hook periods between these flashes are of 200- to 300-ms duration. Timing is then done for 30 seconds to await an on-hook from the distant office. The trunk is routed to the permanent signal routine if it fails to go on-hook within the 30 seconds.

5.04 For the PB test, a network connection is made between the incoming trunk and a busy tone trunk. Busy tone is returned over the incoming trunk for a period of 14 seconds. During the first half of this period, the incoming trunk sends on-hook supervision to the distant office; during the second half, off-hook supervision is sent. Following this period of busy tone, the connection to the busy tone is abandoned and the ICT (incoming trunk) is connected to a steady high-tone trunk. A continuous sequence of on-hook (500 to 600 ms) and off-hook (1500 to 1700 ms) signals is sent to the distant office until disconnect.

5.05 All peripheral order buffer (POB) failures result in the trunk being routed to reorder tone.