

CIRCUIT DESCRIPTION

CD-66073-01  
ISSUE 17B  
APPENDIX 1D  
DWG ISSUE 18D

6

PBX SYSTEMS  
NO. 701A, 701B, 711A, 711B,  
740A, 740B, 740C OR 740E  
TEST SET CIRCUIT  
FOR TESTING LINE FINDER, TRUNK FINDER,  
CONNECTOR, SELECTOR AND  
SELECTOR CONNECTOR CIRCUITS

CHANGES

B. Changes in Apparatus

B.1 Superseded

A varistor, 33L,  
Fig. B, option M

Superseded by

A varistor, 104A,  
Fig. B, option K

D. Description of Changes

- D.1 The rating for the 740E PBX used in conjunction with this circuit is changed from Standard to A&M Only.
- D.2 Option M is designated and rated Mfr Disc. Option K is added and rated Standard. Option K changes the code of varistor A from 33L to 104A.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 3224-RCL-RVL

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## 5

PBX SYSTEMS  
NO. 701A, 701B, 711A, 711B,  
740A, 740B, 740C OR 740E  
TEST SET CIRCUIT  
FOR TESTING LINE FINDER, TRUNK FINDER,  
CONNECTOR, SELECTOR, AND  
SELECTOR CONNECTOR CIRCUITS

## CHANGES

## A. ADDED FUNCTIONS

## A.1 Connector Tests

- (1) To test connectors arranged for camp-on to a busy line.
- (2) To light the SPV lamp as an indication of busy, camp-on and ringing.

## A.2 Selector Tests

- (1) To test selectors arranged to return supervision over a fourth wire

## B. CHANGES IN APPARATUS

## B.1 Added

238A Jack (SPV)  
50A Lamp socket (SPV) E/W E1 lamp and  
2AY LC  
5P3B Cord  
3W3A Cord  
19 DU Resistor (N)  
18 AW Resistor M

## D. DESCRIPTION OF CIRCUIT CHANGES

D.1 This circuit description is rewritten to describe the operation of this test set when testing connectors arranged for camp-on and selectors and connectors arranged to return supervision over a fourth wire.

D.2 The apparatus listed under B1 and the necessary wiring is added to provide for these tests.

D.3 Note 115 is added.

## 1. PURPOSE OF CIRCUIT

1.1 This circuit is used, for testing line finders, trunk finders, connectors, selectors, and selector connectors.

## 2. WORKING LIMITS

2.1 None

## 3. FUNCTIONS

## 3.1 Line Finder Tests

3.11 To simulate the calling line conditions on line finder bank terminals of the test lines.

3.12 To start any finder in the group hunting for the test line.

3.13 To provide a means for connecting to the line terminals and for testing any line circuit.

3.14 To indicate, by lighting the busy lamp, if the line is busy (701A, 701B, 711A, 711B, and 740E PBXs, only).

3.15 To provide a means for setting up a connection to other test circuits.

3.16 To test for restricted service.

## 3.2 Trunk Finder Tests

3.21 To start a trunk finder to hunt for the finder test trunk.

3.22 To verify that a trunk finder has found the finder test trunk using the finder upper bank terminals.

3.23 To verify that a trunk finder has found the finder test trunk using the finder lower bank terminals.

## 3.3 Selector Tests

3.31 To test vertical and rotary action of the selectors.

3.32 To detect an overstep of the selector brushes.

3.33 To provide an audible signal for use in detecting weak cam springs.

3.34 To light the busy lamp when the selector is busy.

3.35 To test for restricted service.

3.36 To light the SPV lamp when supervision is returned over the fourth wire.

#### 3.4 Connector Tests

##### To Test

- 3.41 The pulsing conditions.
- 3.42 The ringing conditions.
- 3.43 The talking conditions.
- 3.44 The release conditions.
- 3.45 For reversed battery. (701A, 701B, 711A, 711B, or 740E PBX).
- 3.46 For busy.
- 3.47 To test the camp-on condition.
- 3.48 To light the SPV lamp as an indication of ringing, busy and camp-on.
- 3.5 Selector-Connector  
Same as for selectors and connectors.

#### 4. CONNECTING CIRCUITS

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

- 4.1 Selector Circuit - SD-66359-01\*.
- 4.2 Connector Circuit - SD-66144-01\*.
- 4.3 Selector - Connector Circuit - SD-65721-01.
- 4.4 Line Finder Circuit - SD-65901-01\*.
- 4.5 Test Line Circuit - SD-66037-01\*.
- 4.6 Trunk Finder Circuit - SD-65794-01\*.

\*Typical

#### DESCRIPTION OF OPERATION

##### 5. LINE FINDER TESTS

###### 5.1 Particular Line Finder

Regular tests are made by connecting jack (A) of the test set to either jack (A) or (B) on the finder unit, jack (B) of the test set to the remaining jack (A) or (B) on the finder unit, jack (C) of the test set to jack (C) on the finder unit, and jack (LF) of the test set to the test jack of the finder under test. When testing the 740 type PBX, the same connections will be made except that jack (A) of the test set shall be connected to jack (A) on the frame and jack (B) is to be

disregarded. Battery and ground shall be supplied to the test set by connecting the (BAT or SPV) cord to the (BAT) jack of the test set and to a battery and ground supply. The (MB) key of the finder under test and the (LK) or (LP) key on the test set shall be operated. This connects ground over the (LF) and (C) jacks to the line finder start relay and commutator, respectively, and battery through resistance (G) to the sleeve terminal over the (A) jack. The line finder now hunts for the line and cuts through in the regular manner. Dial tone is supplied from the first selector or the selector-connector indicating that the line finder has functioned.

###### 5.2 Particular Line Tests

The test circuit is arranged to permit tests to be made from any particular line terminal by connecting the test clips of the (T1) cord to the line terminals and inserting the plug of the (T1) cord into the (T) jack. In the 701A, 701B, 711A, 711B, or 740E PBX, the (C) jack of the test set shall be connected to the "S" lead of the line circuit by using the (C1) cord. If the line is busy, the (BSY) lamp will light. The telephone set shall be inserted into the (TEL) jack or the handset into the (HS) jack. If the handset is being used the (TRS) key shall be operated. The test man can now originate a call by operating the (LK) or (LP) key which operates the line relay of the line under test. The line finder will then find the line in the regular way.

###### 5.3 Restricted Service Test

See Paragraph 11.

#### 6. TRUNK FINDER TEST

The operation of the trunk finder can be tested by connecting jacks (A), (B), and (C) of the test set to the (A), (B), and (C) jacks, respectively, of the trunk finder circuit, and jack (LF) of the test set to the (TST) and (MON) jack of the trunk finder. Cord (LF1) is used for the latter connection. The (H) key in the trunk finder circuit must be in its normal or unoperated position. Battery and ground shall be supplied to the test set by connecting the (BAT or SPV) cord to the (BAT) jack of the test set, and to a battery and ground supply. The handset shall be plugged into the (HS) jack of the test set and the (TRS) key shall be operated. The (MB) key of the finder being tested shall be operated.

The (A) jack connects the handset through to the (T) and (R) leads of the finder test trunk circuit, and also connects resistance battery to the sleeve lead of the upper bank of the trunk finder.

The (B) jack connects a ground on the sleeve lead of the lower bank of the trunk finder, which is a mate of the upper bank sleeve. Stopping the finder on the terminals connected to the finder test trunk circuit imposes the worst circuit conditions for holding the relay in the trunk finder circuit.

Operation of the (LK) or (LP) key on the test set connects a ground to the tip of the (C) jack and a ground to the ring of the (LF) jack. The ground on the (C) jack is connected through the commutator level on which the finder test trunk appears. The ground on the (LF) jack causes the trunk finder to hunt for the finder test trunk.

When the finder finds the finder test trunk, it causes a trunk lamp to light at the switchboard. When the attendant answers, verification is made that the trunk finder has functioned correctly. The (LK) or (LP) key on the test set must be returned to its unoperated position before the attendant disconnects. If not, the trunk finder will not release.

With the connections made as described above, the trunk finder connected the finder test trunk to the attendant trunk using the upper bank terminals. The test can be repeated using the lower bank terminals by transposing the cords that are plugged in the (A) and (B) jacks of the test set and operating the (H) key in the trunk finder circuit.

## 7. SELECTOR TESTS

### 7.1 General

Before testing a selector, the test man shall connect the (T) jack to the test jack of the selector by means of the (T2) cord. The telephone set shall be inserted in the (TEL) jack, or the handset into the (HS) jack. Battery and ground shall be supplied to the test set using the (BAT or SPV) cord and jack as described above. If the selector is busy, the (BSY) lamp will light because of ground on the sleeve of the test jack. If an incoming selector is being tested, the tie line shall be disconnected from the selector before testing.

### 7.2 Semi-Rotation to Detect Overstepping

The (LK) or (LP) key shall be operated and the switch dialed to the proper level. If the handset is being used, the (TRS) key shall be operated and the handset used for dialing. The selector should then rotate and stop on the first idle terminal.

### 7.3 Release

At the termination of each test on a selector, the (LK) or (LP) key shall be released to restore the apparatus under test to normal.

### 7.4 Cam Spring Adjustment Test

The switch is dialed to the proper level for test by means of a telephone set in the (TEL) jack, or a handset in the (HS) jack. When the dial restores to normal, and should the cam spring break momentarily during the rotary action of the selector a sound will be heard in the receiver indicating weak adjustment of the cam springs.

### 7.5 Restricted Service Test

See Paragraph 11.

## 8. SELECTOR TESTS

For selectors arranged to return supervision over the fourth wire.

8.1 Before testing a selector, the test man shall connect the red shell of the (T3) cord to the (T) jack of the test set and the black shell of the (T3) cord to the (B) jack of the test set. The telephone set shall be inserted in the (TEL) jack, or the handset into the (HS) jack. Battery and ground shall be supplied to the test set by connecting the (BAT-1) cord to the (BAT) jack of the test set. The (BAT-1) cord tips shall be connected to the battery and ground supply as follows:

- (1) White cord tip to -48V DC
- (2) Red cord tip to ground
- (3) Blue cord tip spare

The (BAT) or (SPV) cord shall be connected to the (SPV) jack and connected as follows:

- (1) The (WHITE) cord tip shall be connected to +10V DC when the supervisory lamps at the PEX are arranged for +10V DC operation.
- (2) The (RED) cord tip shall be connected to -48V DC when the supervisory lamps or relays at the PEX are arranged for -48V DC operation.
- (3) The spare cord tip shall be stored in such a way as to prevent it from crossing with either battery or ground. The plug on the end of the (T3) cord is now connected to the (T) jack of the selector under test. If the selector is busy, the

(BSY) lamp will light because of ground on the sleeve of the test jack.

## 8.2 Semi-Rotation to Detect Overstepping

See Paragraph 7.2

## 8.3 Release

See Paragraph 7.3

## 8.4 Cam Spring Adjustment Test

See Paragraph 7.4

## 8.5 Supervision Test

The (LP) or (LK) key shall be operated and a busy line dialed.

Observe that the (SPV) lamp flashes. Release the switch and reoperate the (LK) or (LP) key, dial a level and step the switch to the 11th rotary position observe that (SPV) lamp flashes.

## 9. CONNECTOR TESTS

### 9.1 General

Before testing a connector, battery and ground shall be supplied to the test set by connecting the (BAT or SPV) cord to the (BAT) jack of the test set, and a battery and ground supply. In the 701A, 701B, 711A, or 711B PBX the (TL) jack of the test set shall be connected to the (TL) jack of the test line circuit by means of the (TL) cord. The (T) jack of the test set shall be connected to the test jack of the connector by means of the (T2) cord. The telephone set shall be inserted in the (TEL) jack, or the handset into the (HS) jack. The (ID), (TP) and (T) keys are not used with the 740A, 740B, 740C, or 740E PBX. If the connector should be busy, the (BSY) lamp will light because of ground on the sleeve of the test jack.

### 9.2 Busy

The test line is normally busy in the 701A, 701B, 711A, 711B PBX. It shall be made busy in the test line of the 740-type PBX. With the (LK) or (LP) keys operated, the test man shall dial the terminals assigned to the test line. Busy tone should be received. If the handset is being used the (TRS) key shall be operated and the handset used for dialing.

### 9.3 Ringing and Pre-Trip Tests

The test man shall now dial the test line with the busy removed and the (ID) key operated for the 701A, 711A or 711B PBX. The test line is now set up to test for ring and to test the (F) relay of the connector for pre-trip. The subset in the test line should ring. In the 701A, 701B, 711A or 711B PBX the trip key (TP) shall be operated. In the 740A, 740B, 740C, or

740E PBX the tip and ring shall be shorted. This connects a resistance across the line to test the (F) relay of the connector for tripping.

### 9.4 Talking Tests 701A, 701B, 711A, or 711B PBX

After ringing has been tripped, the (T) key shall be operated. This causes the test line to connect tone to the tip and ring of the test line as an indication that the connector is in talking condition.

### 9.5 Reverse Battery Test 701A, 701B, 711A, 711B, or 740E PBX

To determine whether a connector has reversed battery, the (REV) key shall be operated. The key shall not be held partly operated. This would cause the switch to be held because its (A) relay would be operated through one of its windings in series with the (A) or (F) resistance, depending on whether the battery or ground winding is connected to the tip. If the battery is reversed, the (REV) lamp will light.

### 9.6 Release

After making each of the tests described above, the circuit may be restored to normal by releasing the (LK) or (LP) key and then restoring the (ID) key.

## 10. CONNECTOR TEST

For connectors arranged for camp-on and supervision over a fourth wire.

### 10.1 General

Before testing a connector the test man shall connect the red shell of the (T3) cord to the (T) jack of the test set and the black shell of the (T3) cord to the (B) jack of the test set. The telephone set shall be inserted in the (TEL) jack or the handset into the (HS) jack. Battery and ground shall be supplied to the test set by connecting the (BAT-1) cord to the (BAT) jack of the test set. The (BAT-1) cord tips shall be connected to the battery and ground supply as follows:

- (1) White cord tip to -48V DC
- (2) Red cord tip to ground
- (3) Blue cord tip to +10V DC or +24V DC

The (BAT) or (SPV) cord shall be connected to the (SPV) jack and connected as follows:

- (1) The white cord tip shall be connected to +10V DC when the supervisory lamps at the PBX are arranged for +10V DC operation.

(2) The red cord tip shall be connected to -48V DC when the supervisory lamps or relays at the PBX are arranged for -48V DC operation.

(3) Only one of the above shall be connected and the spare lead shall be stored in such a way as to prevent it from crossing with battery or ground.

The plug on the end of the (T3) cord is now connected to the (T) jack of the connector under test. If the connector should be busy, the (BSY) lamp will light because of ground on the sleeve of the test jack.

#### 10.2 Busy

The test line is normally made busy. Operate the (LP) key; busy lamp should light. Dial the terminal assigned to the test line; busy tone should be received; and the (SPV) lamp should flash (60 IPM). Restore the (LP) key; connector should release. Repeat test using the (LK) key.

Note: If the handset is being used the (TRS) key shall be operated and the handset used for dialing.

#### 10.3 Ringing and Pre-Trip Tests

Operate the (ID) key; the test line busy is removed. Operate the (LP) or (LK) key; (BSY) lamp lights. Dial the test line; ringing tone should be received, test line bell should ring and the (SPV) lamp should wink (30 IPM). Operate the (TP) key momentarily during the silent period; ringing tone is removed and the test line bell should not ring.

#### 10.4 Talking Tests

See Paragraph 9.4

#### 10.5 Reverse Battery Test

See Paragraph 9.5

#### 10.6 Release

See Paragraph 9.6

#### 10.7 Camp on Test

Operate the (LP) or (LK) key; (BSY) lamp lights. Dial the terminals assigned to the test line; busy tone should be received and (SPV) lamp flash (60 IPM). Operate (TP) key momentarily; busy tone is removed and (SPV) lamp continues to flash (60 IPM). Operate (ID) key; ringing tone should be received, the test line bell should ring and the (SPV) lamp change to a wink (30 IPM). Operate (TP) key momentarily during the silent period, ringing tone is removed, test line bell should not ring and the (SPV) lamp is extinguished. Restore (LP) or (LK) key, then (ID) key; connector releases and (BSY) lamp is extinguished.

#### 11. RESTRICTED SERVICE TEST

To test the line finder and selector or selector-connector for the restricted service feature, operate the (RS) key and the (LK) or (LP) key. If the restricted service feature of the line finder has operated satisfactorily, the (RS) lamp will light. The (RS) key shall then be restored in the 701A, 701B, 711A, or 711B PBX, but not in a 740-type PBX. The selector shall then be dialed to the restricted level. This should return busy tone to the test man.

#### 12. SELECTOR-CONNECTOR TESTS

The tests outlined in sections 7 and 9 for selectors and connectors may be made on selector-connectors.

#### 13. TALKING

The test man may talk over the switch under test by operating the (TRS) key.

#### 14. TESTING 740E PBX

When testing a 740E PBX, the (740E) key shall be operated. This removes a short circuit from resistance (K) which is in series with the ground to the line finder commutator. The operation of the key also removes short circuits from the (J) and (L) resistances, thus increasing the resistance of the LOOP test and the resistance in series with the battery supply to the line finder sleeve terminal.

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