CIRCUIT DESCRIPTION

CD-3H520-01
ISSUE 2A
APPENDIX 2B
DWG ISSUE 4B
DISTN CODE 7T11

26

ELECTRONIC SWITCHING SYSTEMS

NO. 3

PERIPHERAL TEST

CIRCUIT

CHANGES

D. Description of Changes

D.1 Changed leads T(MT1)14 and R(MT1)14 to T(MT1)12 and R(MT1)12 to agree with the ringing and tone plant.

D.2 Much of the drawing has been redrawn to correct errors or for clarity.

BELL TELEPHONE LABORATORIES, INCORPROATED

DEPT 5332-GDD-UKS

ELECTRONIC SWITCHING SYSTEMS

NO. 3

PERIPHERAL TEST CIRCUIT

CHANGES

A. Changed and Added Functions

A.1 Added the capability to test the lamps on the trunk and line test panel and the voltmeter panel.

B. Changes in Apparatus

B.1 Removed	Replaced By
K3 Relay BJ13 - Sheet J4	K3 Relay BJ14 - Sheet J4
K4 Relay BF4 - Sheet J4	K4 Relay BF3 - Sheet J4
K5 Relay BF4 Sheet J4	K5 Relay BF3 - Sheet J4
K14 Relay BJ13 - Sheet J4	K14 Relay BJ14 - Sheet J4
K16 Relay BF46 - Sheet J4	K16 Relay BF59 - Sheet J4
K17 Relay BF46 - Sheet J4	K17 Relay BF59 - Sheet J4
K18 Relay BF46 - Sheet J4	K18 Relay BF59 - Sheet J4

B.2 Removed

R58 Resistor KS-20289,L6C, 681 ohms -
Sheet J5

R60 Resistor K2-20289,L6C, 1050 ohms -
Sheet J5

R61 Resistor KS-20289,L6C, 681 ohms -
Sheet J5

R62 Resistor KS-20289,L6C, 562 ohms -
Sheet J5

R65 Resistor KS-20289,L6C, 562 ohms -
Sheet J5

R66 Resistor KS-20289,L6C, 681 ohms -
Sheet J5

R67 Resistor KS-20289,L6C, 1050 ohms -
Sheet J5

Flash key SB1DDV451-1

B.3 Added

CR5 to CR31 Diode 533G -
Sheet J5

D. Description of Changes

D.1 Made circuit pack FB519 optional.

D.2 Relocated capacitor C9 and contact 9 of relay K1 (T1) in the circuit on the trunk and line test panel. This allows the ballistic capacitance test to be done by the voltmeter without any effect from capacitor C9.

D.3 Changed relays K3, K4, K5, K14, K16, K17, and K18 to allow proper circuit operation with all tolerance variations on the trunk and line test panel. The removal of resistors R58, R60, R61, R62, R65, R66, and R67 is also part of this change.

D.4 Added the lamp test key to test each lamp and light emitting diode on the trunk and line test panel. Also a diode per lamp or light emitting diode is added to allow this testing.

D.5 Removed the flash key on the trunk and line test panel because it was decided to be unnecessary.

D.6 Changed the CDF IN and CDF OUT relay logic on the turnk and line test panel. This allows a trunk or line to be connected to the network when both relays are operated.

D.7 Changed the ALIT wiring to accommodate FB523 series 4-5 or 5 and FB524 series 6-7 or 7 circuit packs.

F. Changes in Description of Operation

F.1 Add the following to Section II after 3.42:

Lamp Test

3.43 The lamp test key tests the lamps on the trunk and line test panel and voltmeter panel. The keys that do not contain lamps are labled with a dot in the corner of each lens cap.

F.2 In Section II, 4.56, delete the words"A flash key is included to momentarily break the phone connection. The flash key, when operated, breaks the ring lead in the phone input line and shorts out the receiver."

F.3 Add to the end of Section II, 4.26, the sentence "When both CDF IN and CDF OUT keys are operated, the line or trunk is connected to the network."

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5332-GDD-UKS

ELECTRONIC SWITCHING SYSTEMS

NO. 3

PERIPHERAL TEST CIRCUIT

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TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The peripheral test circuit (SD-3H520-01) is located on the test frame. It contains test circuits which, under program control, are used to verify that the peripheral circuits of No. 3 ESS (eg, trunks, junctors, service circuit, and network) are working correctly and to diagnose problems in the periphery detected by regular call handling software. These circuits are mounted on circuit packs. Mounted in front of the housings containing the circuit packs is the trunk and line test panel (TLTP) which is used to manually test the periphery as well as trunks and lines. The SD defines the electrical connectivity of these two parts.

1.02 The test frame also contains a voltmeter, a phone, and an optional transmission measuring set. The parts of the test frame, which work closely with the TLTP, will be described in this CD along with the TLTP.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The circuits included in this SD and the circuit pack codes which comprise each circuit are listed in 2.02.

2.02 The circuits included in SD-3H520-01 are as follows:

(a) FB500 - Continuity and polarity detector

(b) FB501 and FB502 - Dial pulse receiver test circuit

(c) FB504 - Transmission test termination

(d) FB505 through FB509 - Milliwatt and transmission environment test circuit

(e) FB510 - Loop environment test circuit

(f) FB511 through FB515 - Trunk and line test panel

(g) FB516 and FB517 - Tone presence detector

(h) FB518 - TTY line circuit

(i) FB519 - Local test desk incoming trunk circuit

(j) FB521 and FB522 - Station ringer test line circuit

(k) FB523 through FB525 - Line insulation test circuit

(l) FB526 through FB529 - TOUCH-TONE* receiver test circuit.

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* Registered in U.S. Patent Office.

SECTION II - DETAILED DESCRIPTION

1. GENERAL

1.01 The following information describes the characteristics and operation of the circuit packs in the peripheral test unit (SD-3H520-01). The level of detail excludes circuit component descriptions. For information on the component level, the CD for the respective circuit pack should be consulted. In the case of the TLTP, a detailed description is included in this CD.

2. DESCRIPTION OF OPERATION (FB500 THROUGH FB502 AND FB504 THROUGH FB510)

FB500

A. General

2.01 The FB500 circuit pack is the continuity and polarity detector. Its main purpose is to check for continuity from distant trunks and to determine the polarity of any dc voltage on that trunk.

B. Specific

2.02 The continutiy and polarity detector is designed to check the polarity of dc voltage on the tip and ring using a high-impedance detector. The circuit is used to check the polarity applied by a distant office to a trunk. To prevent false seizures, the high input impedance prevents tripping of the supervisory element at the distant office.

2.03 The states provided by the circuit are a 1.8-KOHM continuity state for the junctor continuity test, a state for checking low resistance on tip or ring, and a state for checking for low battery on tip or ring. The two latter states described are for detecting fault conditions.

FB501 AND FB502

A. General

2.04 The dial pulse receiver test circuit consists of two circuit packs and is used for sending digits under various loop conditions, under loop and leakage conditions, and with or without simulated ringers. For customer dial pulse receivers (CDPRs) the circuit can test for range extension battery, reverse battery on the tip and ring, and the coin testing state.

B. Specific

2.05 The dial pulse receiver test circuit provides essentially four main functions: test 2-party-coin detection state of CDPRs, CDPR battery testing, testing to provide three conditions on loop and leak, and four pulsing conditions for each of the three loop and line conditions.

2.06 Tests are provided for tip-party nonoperate and tip-party operate tests. The tip-party nonoperate test provides a 10-KOHM resistance between the tip lead and ground with the ring lead open to simulate a no-coin condition or ring party. If the CDPR is operating correctly, it should not respond. The tip-party operate test provides a 5100-ohm resistance between the tip lead and ground to simulate a coin-in-slot condition or tip party. If the circuitry is operating correctly, the CDPR should respond.

2.07 The CDPR reverse battery test involves checking the tip lead to verify that it has -48 volts and that the ring lead is grounded. If these conditions exist, the dial pulse receiver test circuit scan point (SC00) should operate.

2.08 A variation on the CDPR battery test is the range extension test which looks for -72 volts on the ring lead and ground potential on the tip lead.

2.09 There are three tests that provide three conditions of loop and leak. The first test provides 10 KOHMS between tip and ring, simulating a leakage condition. A simulated five ringers is applied across tip and ring and a 100-ohm short loop is simulated. The second test again provides the 10-KOHM tip to ring leakage condition and the 100-ohm short loop simulation but with no ringers. The last test provides a 1650-ohm long loop simulation only.

2.10 The four available pulsing conditions are: 20.9 PPS with 52.4 percent break, 20.9 PPS with 71.4 percent break, 12.9 PPS with 50 percent break, and 12.9 PPS with 70.6 percent break. The pulse timing is generated via the 440-Hz ringing and tone plant signal that is divided down in frequency. When the dial pulses are generated, the digit 12 (12 pulses) is sent out. At the end of the 12-pulse cycle, the pulsing stops. If the pulse-start relay is cycled, 12 more pulses will be sent out (relay F is the pulse start relay). The duty cycle and rate at which dial pulses are sent is controlled by the D and E relays. The other tests, loop conditions and coin and battery tests, are provided by the A, B, and C relays. The loop and line conditions can be applied with any of the four pulsing rates.

FB504

A. General

2.11 The transmission test termination provides either ac short or ac open circuits.

B. Specific

2.12 The transmission test termination provides an ac short via a capacitor or an ac open via an inductor. In either case, a dc path exists.

FB505 THROUGH FB509

A. General

2.13 The milliwatt and transmission environment test circuit provides two ports, each of which can provide a milliwatt reference signal or balanced termination. In addition, a loop-around path (ie, port-to-port connection), with various degrees of signal attenuation to test MF transmitters is also provided. By using these various attenuator pads and the internal 1100 Hz oscillator, MF receivers may be checked. The circuit also has a resistor circuit which can be used to allow continuity checks from tip to ring.

B. Specific

2.14 The milliwatt and transmission environment test circuit is used primarily for transmission measurements. Two ports of 0-dBm, 1-kHz signal are provided as reference levels for transmission loss testing. They can also provide a balanced termination (900 ohms in series with 2.15 uF) for transmission path noise checks. In order to make bidirectional transmission loss measurements of trunks, a loop-around connection is provided. This connection provides ac coupling of both ports.

2.15 In the loop-around test mode, the 60A unit is inserted to prevent fraud. This unit detects the presence of tones other than 1 kHz. Any signal outside the 1000 Hz ±5Hz band will be detected by the 60A unit. When a detection occurs, the path is opened for a period of time before the connection is restored. This prevents fraudulent use of the loop-around connection.

2.16 Two attenuation pads can be connected for marginal testing of MF transmitters. The tone presence detector is used in conjunction with the two attenuation pads to check the MF transmitter operation. The MF level accuracy is checked to verify that it is between -6.5 and -5.5 dBm.

2.17 Four additional attenuation pads are provided for marginal testing of MF receivers using level accuracy checked MF transmitters as the tone source. An 1100-Hz tone source is also used to test the MF receivers.

2.18 The six attenuation pads and their uses follow.

(a) Pad 1 - The flat-loss pad provides a 15.4 dBm nominal loss and is used in testing the six tones in the MF transmitter and for marginal testing of MF receiver circuits.

(b) Pad 2 - The twist pad provides a 4-dBm loss at 700 Hz and 10-dBm loss at 1500 Hz. It is used to test the ability of the MF receivers to detect tones with differences in tone levels of 6 dBm.

(c) Pad 3 - The MF detect pad provides 23.4 dBm of loss and is used to check that MF transmitters are sending tone levels of greater than -6.5 dBm. With this pad, the tone presence circuit should detect the tone from the MF transmitter.

(d) Pad 4 - The MF nondetect pad provides 25 dBm of loss and is used to check that an MF transmitter is sending a signal less than -5.5 dBm. With this pad, the tone presence ciruit should not detect the tone from the MF transmitter.

(e) Pad 5 - The double-keying pad provides 6 dBm of loss and is used in MF receiver testing. Two tones at -12 dBm are taken from the MF transmitter and added to an 1100-Hz tone at -12 dBm; the MF receiver should reject all three tones.

(f) Pad 6 - The modulation products pad adds two tones from the MF transmitter at -6 dBm to an 1100-Hz tone at -21 dBm to test the ability of the MF receivers to accept the two tones and reject the low-level tone.

FB510

A. General

2.19 The loop environment test circuit provides circuitry to simulate tip and ring loop and leak conditions on tip and ring. It can also apply ±130 volts to the test vertical circuit of the network to allow checks for cross-detection circuitry and to check the coin control circuit for proper operation. It can put a termination on tip and ring for ringing checks to see if ringing can be tripped.

B. Specific

2.20 The loop environment test circuit is used to provide terminations for various tests. The basic types of termination are as follows: open circuit, trip and nontrip test state, safety trip operate and nonoperate test state, ringing on tip or ring state, minimum leakage resistance not detected, minimum leakage-resistance detected states, coin relay operated and

nonoperated state, coin collect and return voltage test state, power cross plus and minus test to tip or ring, and restore verify ground or loop-start test state.

2.21 The following is a list of the impedances placed relative to tip and ring for each of the states specified. In each use, the actual impedance includes the resistance of a 2C ferrod.

TABLE A

IMPEDANCES RELATIVE TO TIP AND RING

State	Impedance Connected
Open Circuit	Tip to Ring
Trip Test	3010 ohms, Tip to Ring
Nontrip Test	7860 ohms, Tip to Ring
Safety Trip Operate	1210 ohms, Ring to Ground
Safety Trip Nonoperate	2260 ohms, Ring to Ground
Minimum Leakage Resistance	5800 ohms, Tip to Ring
Coin Relay Operate	2610 ohms, Tip to Ground
Coin Collect	2150 ohms and Diode (Negative Voltage Check)
Coin Return	2150 ohms and Reversed Diode (Position Voltage Tip to Ground)
Power Cross Positive Ring (Tip)	+130 volts to Ring (Tip) through 5110 ohms
Power Cross Negative Ring (Tip)	-130 volts to Ring (Tip) through 5110 ohms
Restore Verify Ground	-48 volts through 400 ohms on Ring
Loop Start Test	Tip to Ground 2000 ohms, 2000 ohms to -48 volts for Ring Lead

3. GENERAL DESCRIPTION OF OPERATION FOR THE TRUNK AND LINE TEST PANEL (INCLUDING FB511 THROUGH FB515)

FUNCTION

3.01 This circuit provides facilities for testing trunks, junctors, lines, and service circuits in a No. 3 ESS 2-wire office. All of the trunks, junctors, lines, and service circuits are accessible by this circuit, through the use of a panel-mounted telephone set that is installed on the test frame. This circuit has two network appearances (access trunks 1 and 2), enabling the system to connect up to two lines, trunks, or service circuits to this circuit at a given time.

3.02 The test equipment, mounted on the trunk test frame, may be used independently from the access trunks. Jacks are provided on the frame to connect external circuits or equipment to the zero dbm or -10 dbm 1-kHz signal source.

3.03 Jacks are provided for connecting external test equipment to any or all of the two access trunks. These jacks may be used to test circuits when the required test equipment is not provided on the trunk test frame. The voltmeter and optional transmission measuring set can be supplied with each frame.

3.04 Trunks, line, junctors, and service circuits may be taken out of service or put into service from this circuit.

3.05 Incoming calls may be made to access trunks 1 and 2. A second bell is provided on the frame to indicate incoming calls.

OPERATION

3.06 To simplify this description, only trunk connections will be discussed, although the circuit operation is the same for trunks, lines, or service circuits.

A. Communication Between the Trunk and Line Test Panel and The System

Trunk and Line Test Panel to System Communication

3.07 Communication from the trunk and line test panel to the system is accomplished with scanner ferrods located in the scanner. These scanner ferrods are controlled by keys in the access trunk control area, keys in the state change control area, keys in the associated junctor control area, and status control area.

System to Trunk and Line Test Panel Communication

3.08 The following lamps are system controlled and establish communication from the system to the trunk and line test panel.

(a) The trunk access lamps indicate the access trunks which are in use.

These lamps may also be manually operated by depressing the key.

(b) The equipment STATUS lamps indicate the state of the trunk to be tested when the initial connection is made between the trunk and the trunk test panel.

(c) The progress and error lamp reports the call progress.

(d) The called supervision lamp indicates the state of the trunk side scan relay when the trunk under test is connected to access trunk 1.

(e) The circuit limit lamp indicates that most circuits in a circuit group are out of service.

B. System Connection and Access Trunk Control

General

3.09 The panel-mounted telephone set is used to request the system to connect the desired trunk to the trunk and line test panel. The access trunk to be used is selected by depressing its associated access trunk key. A head telephone set can be used instead of the handset associated with the telephone set. Insertion of the handset into the A and B jacks operates the TRFR relay. This simulates removal of the handset from the telephone set switch hook.

3.10 When the connection between a trunk and the trunk and line test panel has been established, the trunk to be tested is connected to the telephone set via the access trunk circuit. The access trunk control circuit may now be used to connect the test panel through the network to the tested trunk. If the trunk to be tested is busy when the initial request for connection is made, a traffic busy verification can be made for stable calls only. Operation of the MON (monitor) key, for the access trunk being used, connects a high impedance monitor across the tip and ring of the desired trunk. The trunk can be monitored from the telephone set located on the trunk test panel or a headset. A HOLD key is provided for each access trunk connection.

C. Transmission Measuring Circuit and Control

General

3.11 The transmission measuring circuit is accessible from access trunks 1 and 2. Operation of the TRMT (transmission) key in the access trunk control area connects the trunk under test to the transmission measuring circuit.

3.12 Operation of the CAL (calibrate) key allows the test set to be calibrated. With CAL key operated, the access trunk circuit is not connected to the test set.

3.13 Jacks are provided on the trunk test panel to plug in external test equipment for calibration with the frame mounted equipment. When the plug is inserted into the jacks, the frame mounted equipment is electrically removed from the transmission measuring circuitry.

3.14 The on-hook, off-hook state of the trunk under test is indicated by the call supervision lamp. The system will indicate the status of the trunk by controlling the interruption rate of the called supervision lamp.

Trunk Terminations

3.15 Operation of the TRMT OPEN or TRMT SHORT keys provides open or short terminations for the access trunk being used.

Sending

3.16 Access trunk 1 is used to transmit signals on the trunk for loop-around tests. The TRMT 1 key has to be operated in conjunction with the access trunk 1 key.

Receiving

3.17 Access trunk 2 is used to receive signals for loop-around tests. The TRMT 2 must be operated in conjunction with the access trunk 2 key.

Loop-Around

3.18 Signals may be transmitted on access trunk 1 and received on access trunk 2 by requesting a loop-around at the distant office.

Transmission Tests on Local Lines

3.19 Line transmission testing is performed in the same manner as trunk transmission testing with the following exception. The TRMSN LINE TEST key is operated to supply battery and ground to the ring and tip leads, respectively, to the line connected to the transmission measuring circuit. Line transmission testing is available on access trunk 1.

D. Voltmeter Circuit and Control

General

3.20 Operation of the voltmeter (VM) key, in the access trunk control area, connects the trunk to the voltmeter test circuit.

Ground and Resistance Test

3.21 Operation of the VM key connects the T and R leads to the voltmeter circuit. The meter deflection indicates the ring to ground leakage resistance. The chart in BSP 233-135-205 on the SD may be used to convert the scale reading to the external resistance. No deflection indicates an infinite resistance to ground. A 100-volt deflection indicates that the ring lead is grounded. Operation of the 20K or 1K key on the voltmeter increases the meter sensitivity for more accurate resistance readings. If the initial meter deflection is beyond full scale, the presence of battery (-48 volts) on the ring lead is indicated and the foreign battery test is required (see 3.23).

3.22 Operation of the tip and ring reverse (TRR) key effectively interchanges the tip and ring lead connections to the voltmeter circuit. In this state, the tip lead of the trunk is checked for leakage resistance to ground.

Foreign Battery Test

3.23 Operation of the foreign EMF (FEMF) key tests the ring lead for a negative potential with respect to ground. Operation of the TRR key at this time tests the tip lead for a negative potential. If the direction of meter deflection is incorrect, the voltmeter reverse (VMR) key can be used to determine the positive voltage on the lead being tested.

Test for Voltage Between Tip and Ring

3.24 Operation of the metallic voltmeter (MVM) key tests the ring lead for a negative potential with respect to the tip lead. This connection tests the tip and ring for continuity when battery and ground are being supplied by the distant office. If the VMR key is operated, the voltmeter tests for a positive potential on the ring with respect to the tip.

Test for a Short Circuit Between Tip and Ring

3.25 Operation of the ground (GRD) key puts ground on the tip lead of the trunk. If the trunk is short circuited, the voltmeter shows the same deflection when the VMR key is operated and restored.

Capacitance Test

3.26 To determine the trunk capacitance, the GRD key is operated. After the needle comes to rest, the TRR key is operated, causing a momentary deflection proportional to the capacitance on the ring lead. Restoring the TRR key causes a momentary deflection proportional to the capacitance or the tip lead.

Positive and Negative Station Gas Tube Ringer Testing

3.27 Operation of the +STA key is used to break down the gas tube in either plus tip party or plus ring party depending upon the state of the tip-ring reversal (TRR) switch located on the voltmeter panel. The meter will indicate current flow if the gas tube ionizes. Similarly, for the -STA key, the minus tip party or minus ring party is tested.

Breakdown Testing

3.28 The breakdown test is initialized by operation of the BT key on the voltmeter panel. This applies +200 volts through a 100K resistor and the meter to the ring voltmeter lead. Operation of the TRR key reverses tip and ring applying the +200 volts to the tip. Any resistance to ground of the tip or ring will show up as a current value on the meter.

E. State Change Control

State Controls

3.29 The state change control circuitry is used to request the system to place a trunk in any of its possible states. The A, B, and C keys are used for the state change control. These three keys are used in conjunction with the EXECUTE key. The PD triplet rotary switch selects the PD triplet with which the ABC switches are associated (ie, POSITION DEF has switch A associated with D, and B with E, etc).

Access Trunk 1, 2 State Control

3.30 The access trunk state control switch defines which access trunk the state change requested is to be effective. This avoids making a state change on the wrong circuit when two similar circuits are connected to both of the access trunk circuits of the panel.

Associated Junctor, State Control

3.31 The associated junctor state control switch allows the junctor in the path under test to change state. This control affects only the junctor.

F. Status Control

Out-of-Service and Circuit Limit Controls

3.32 The out-of-service control is used in conjunction with a circuit under test. Activating this switch prior to disconnect from the circuit under test by the TLTP will place the tested circuit out of service if there are a sufficient number of that type of circuit, within the same group, still in service. If, however, there are insufficient circuits of that

group in service, the circuit limit lamp will light. The circuit can still be forced out of service by using the EXECUTE key.

Active Idle Control

3.33 This control is used in conjunction with a circuit under test by the TLTP to restore to service the circuit previously placed out of service. In general, if neither this control nor the out-of-service control are activated, the circuit under test will be restored to its original state upon completion of testing by the TLTP.

PD Group Control

3.34 This control is designed to be used in connection with either the active idle or out-of-service control and a circuit under test. Upon activation of this control, the entire PD group of circuits will be either placed into service or removed from service. This control is especially useful when a PD circuit pack must be changed, since it allows all circuits associated with that pack to be disabled at one time.

G. Line Test Controls

Coin Circuits

3.35 Associated with the coin circuits are the coin collect, coin return keys, and the coin lamp. These keys are used in conjunction with pay telephones to manually collect or return the coins. The coin lamp indicates that the tip lead is grounded when either the coin collect or coin return keys are operated.

Receiver Off-Hook Circuit

3.36 The receiver off-hook (ROH) is used to apply the receiver off-hook tone to the tip and ring leads of the accessed circuit.

Talk Line Circuit

3.37 Talk battery may be provided to the tip and ring lines of the TLTP by operating the talk line key.

Combined Distributing Frame (CDF) Circuits

3.38 Direct access to subscriber lines for the purpose of manual testing, is accomplished via the "shoes" on the CDF. When the TLTP is connected to one of these terminal pairs on the CDF, operation of the CDF IN key will allow testing of circuits from this connection point toward the network. Operation of the CDF OUT key allows testing from this point out to the subscriber phone.

H. Miscellaneous Test Circuits

On Circuit

3.39 In order to operate the TLTP, the program associated with the TLTP must be loaded into the system. To accomplish this requires the operation of the ON key. If the program cannot be loaded, the button flashes at 120 IPM. When the program is being loaded, the button flashes at 60 IPM until the system is ready at which time the lamp will glow steadily. To deactivate the program requires that the switch be pressed a second time.

Ring Circuit

3.40 This circuit allows ringing signals to be applied to the tip and ring lines of the TLTP for purposes of ringing tested circuits. Triplet SPEC RING is used only for selecting a particular ringing combination in conjunction with the ABC keys. Any other position of the PD TRIPLET switch will cause normal ringing combination to be applied to the line.

Communications and Monitor Circuit

3.41 The COMM LINE key is used to connect the telephone circuit to the network line connection of the communication line for normal phone conversations. The MONITOR key allows the telephone to monitor the network path used by the circuit to be tested.

Monitor Amplifier

3.42 When the monitor circuit is selected, the MONITOR amplifier is placed across the line, and its output fed to the telephone set. The amplifier has sufficient input impedance so as not to produce an audible click when connected (KS-19328-L1 amplifier).

4. SPECIFIC DESCRIPTION OF OPERATION FOR TRUNK AND LINE TEST PANEL (INCLUDING FB511 THROUGH FB515)

FUNCTION

4.01 This circuit serves to test trunks and lines.

SYSTEM CONNECTION

4.02 To initiate a connection between the trunk test panel and a circuit to be tested, an access trunk key 1 or 2 is operated to specify the access trunk to be used to set up the connection.

4.03 An origination is entered into the system by lifting the handset or inserting headset plugs into TELA and TELB jacks. When a headset is used, a TRFR relay is operated with respect to the headset. With

the TRFR relay operated or the handset off-hook, an off-hook signal is sent to the system. The system responds to an origination by providing dial tone when the initial setup has been completed satisfactorily on the selected access trunk. The system can now accept information to identify the circuit to be tested. The TOUCH-TONE dial associated with the telephone set provides the following information:

(a) The first digit specifies the type of circuit to be tested according to the following list:

(1) Trunk circuit, service circuit, tone circuit, auxiliary line circuit

(2) Subscriber line

(3) Junctor circuit.

(b) After the identifying digit, the following information is dialed in, as appropriate:

(1) Line connection - Dial in the directory number followed by the start digit.

(2) Tone or service circuit connection - Dial in the trunk group and member number for the desired circuit followed by the start digit.

(3) Trunk connection (without outpulsing) - Dial in the trunk group and member number for the desired trunk followed by the start digit.

(4) Trunk connection (with outpulsing) - Key in the trunk group and member number of the desired trunk followed by the outpulse digit. The user must then wait for dial tones. Then dial in the digits desired to be outpulsed over the trunk. Finally, dial in the start digit.

(5) Junctor circuit connection - Dial in concentrator group number and group switch number followed by start digit.

Note: Connection to the junctor circuit must be initiated on access trunk 1. Also, access trunk 2 must be idle. A double connection (both ends) of the dialed circuit is made to access trunks 1 and 2.

4.04 Upon receipt of the start digit, the system determines the status of the circuit to be tested and causes operation of the equipment status lamp on the TLTP for the selected access trunk. The equipment status lamp (controlled by a peripheral decoder) indicates the status of the selected circuit according to the following lamp states:

(a) Steady - Circuit was idle.

(b) Flashing at 60 IPM - Circuit was traffic busy.

(c) Flashing at 120 IPM - Circuit was maintenance busy.

4.05 If the selected circuit was traffic busy, it is not connected to the test panel. However, if the MON key on the access trunk control panel is operated at this time, the MON relay energizes. The system responds by connecting the access trunk via a no-test veritical to the selected circuit. Contacts on the MON relay connect a high-impedance monitor amplifier across tip and ring of the access trunk and remove the termination of the telephone circuit. The amplifier output is connected to TLTP handset and may be switched to the TELA or TELB jacks by simply plugging in those jacks. A head telephone set may be plugged into these jacks to monitor the selected circuit. The handset can also be used to monitor.

4.06 If the selected circuit was maintenance busy, the system connects the circuit to be tested to the TLTP via the previously specified access trunk. The progress or error lamp comes on steady to indicate the successful connection. Control of the connection is then transferred from the telephone set to the access trunk control keys.

ACCESS TRUNK CIRCUIT AND CONTROL

4.07 Operating an access trunk control key operates the respective T(N) relay (N = 1, 2, or 3) connects ground to its associated relay, and the relay energizes. When the key is released, the ground connection to the relay is maintained through the make-contact on the T(N) relay.

4.08 Operation of the HOLD key (nonlocking) allows ground to be applied to the HLD relay associated with the access trunk selected. This ground path causes operation of the HLD relay. When the HOLD key is released, the relay-locking path is completed to ground through the RLS key, HLD relay (break contact), and the T(N) relay. The operation of the hold button keeps the associated access trunk ferrod up.

4.09 This relay locking path effectively interlocks the T(N) and HLD relays along with the locking MON, VM, TRANS, and BAL keys for a particular access trunk. Operating a key to change the access trunk connection breaks the ground path to the previously energized relay. This interlock feature prevents multiple connection of test circuits to the same access trunk at the same time.

4.10 Cross-connection of access trunks is prevented on the monitor, voltmeter, and talk functions in the following manner. The energized path of the relay includes the break-contact of the other relay associated with the other access trunk. For example, if the MON1 relay is energized, the MON2 relay cannot be energized. The energized MON relay must be released before another access trunk can be connected to the monitor circuit. The T(N) and VM relays are interlocked in the same manner.

4.11 The indicator lamps are operated by make-contacts on their associated access trunk control relays. When a relay is energized, the lamp is on.

4.12 Operating a TRANS, VM, BAL, or COMM LINE key energizes its associated relay. Transfer contacts on the selected relay disconnect the access trunk from the telephone circuit and connect the circuit to be tested to one of the following test facilities:

(a) TRMT key - Energizes the XMS relay and connects the access trunk to the transmission measuring circuit. This is provided for access trunks 1 and 2 only. The state change control can then be used to manually select circuit states.

(b) VM key - Energizes the VM relay, and connects the access trunk to the voltmeter circuit. The state change control can then be used to manually select circuit states.

(c) BALANCE key - Energizes the respective BAL relay and places a balanced termination (898 ohms + 2.15 UF) across the associated access trunks.

(d) COMM LINE key - Energizes the T3 relay and connects the access trunk to the TELA and TELB jacks. This connection is made through contacts on the TRFR relay and contacts on the COM LINE relay. If a headset is not in the TELA or TELB jacks, the COMM LINE is connected to the panel handset. In this state, battery and ground are supplied on the tip and ring of the access trunk by inductor L3. Capacitors C6 and C7 provide dc isolation between the access trunk and the TEL SET. The COMM LINE can be operated first, using it for telephone set communications (voice) without the ON switch.

4.13 Jack access to access trunk 1 and 2 is provided at the At1 and AT2 jacks. These jacks may be used to connect external test equipment to the access trunks. When a plug is inserted in the jack, the access trunk is disconnected from the TLTP, and the circuit under test is connected to the external equipment through the network and access trunk. When the plug is removed from the jack, connection to the TLTP equipment is restored.

TRANSMISSION MEASURING CIRCUIT AND CONTROL

A. General

4.14 When the XMS relay for access trunks 1 and/or 2 is operated, the access trunk(s) is connected to the transmission measuring set.

4.15 Operation of the CAL key (locking) causes the CAL relay to operate. When the CAL relay is operated, access trunks 1 and 2 are disconnected from the test equipment. Test equipment calibration can then be accomplished by depressing the appropriate test keys.

4.16 The reverse access trunk key operates the RT relay. When the relay is energized, the tip and ring leads of access trunk 1 are interlocked with the corresponding leads of access trunk 2, allowing full transmission testing capability on access trunk 2.

4.17 Jacks are provided on the TLTP to plug in external signaling sets, test sets, etc, onto the access trunks. These jacks, labeled TM1 and TM2, can be used to test the connected trunk when the required test equipment is not provided on the frame. When a plug is inserted in the jack, the access trunk is disconnected from the sending and receiving functions of the transmission measuring circuit. Test sets plugged into the TM1 and TM2 jacks are connected to the access trunks through capacitors C1 and C3 on FB511 for TM1 and C1 and C2 on the TLTP for TM2. These capacitors isolate the test equipment from any dc voltage which may be present on the access trunk. The battery feed key (TRMSN LINE TEST) can be used to connect talking battery onto the access trunk, when required. Termination keys TRMT OPEN and TRMT SHORT can be used when required to create appropriate ac line conditions. The operation of one of these keys removes the connection to the TM1 jack.

4.18 Jacks are provided on the writing shelf so that external connections can be made to the frame-mounted test sets for testing, calibration, etc. These jacks are labeled according to their functional termination as follows.

0 dBm

-10 dBm

4.19 When external equipment is plugged into these jacks, the associated frame-mounted test set facility is disconnected from the transmission measuring circuit and connected to the plug.

B. Trunk Terminations

4.20 Operating the TRMT OPEN key breaks the tip and ring connection and presents an open circuit termination to the trunk.

4.21 Operation of the TPMT SHORT key provides an ac short circuit termination to the trunk circuit. This is done by providing capacitor C2 of FB511 across the tip and ring leads.

C. Sending

4.22 The milliwatt (0 dBm), and -10 dBm signals are available in the TLTP. The -10 dBm is derived from the same source as the 0 dBm signal, the transmission measuring milliwatt distributing circuit. The attenuation from 0 dBm to -10 dBm is accomplished with R1, R2, R3, R4, and R5 on the FB511 circuit pack. The transmission measuring milliwatt distribution circuit (TMMD) is terminated in 898 ohms (RT). When either the 0 dBm or -10 dBm key is depressed, the TMMD circuit is connected to AT1 (XMS1 key operated). The receive portion of the TLTP is disconnected from the send portion since the RT relay is released. Therefore, when signals are being transmitted on an access trunk, the receiving test sets cannot be connected to that access trunk.

D. Receiving

4.23 With the TRMT1, TRMT2 keys operated, incoming signals can be measured by the transmission set via ATs 1 and 2. The incoming signals on the AT can be measured by depressing the REVERSE ACCESS TRUNK key. Releasing the TRMT keys allows the incoming signal to be heard with a head telephone set plugged into the TEL A and B jacks or at the TLTP handset.

E. Loop-Around

4.24 To make loop-around transmission tests, AT1 is the sending facility and AT2 is the receiving facility. Selecting either 0 dBm or -10 dBm key determines the type of signal being transmitted on AT1 (TRMT1 operated). With TRMT key operated, the receive signal is present on AT2. Operation of the reverse access trunk key permits sending on AT2 and receiving on AT1.

F. Transmission Tests on Local Lines

4.25 Line transmission testing is performed in the same manner as trunk transmission testing with the following exception. The TRMSN LINE TEST key is operated to supply battery and ground to the ring and tip leads, respectively, of the line connected to the transmission measuring circuit. Line transmission testing is available on AT1 only.

G. CDF Access

4.26 With the CDF IN or CDF OUT keys operated, the input tip and ring of access trunk 1 of the TLTP is disconnected and the selected CDF tip and ring are connected to the access trunk 1 circuitry for testing. Selection of the CDF IN key allows testing from the CDF toward the network while the CDF OUT key allows testing from the CDF toward the subscriber line or trunk. Testing proceeds as in the cases where the line is accessed directly by the panel via the network connection.

H. Coin Testing

4.27 Operation of the COIN COLLECT key or COIN RETURN key operates the CO relay which connects the tip side of the accessed line to either +130 volts or -130 volts. If the COIN COLLECT key is operated, +130* volts is connected via the CN relay to the tip, while -130* volts is connected via the CN relay to the ring if the COIN RETURN key is operated. When the CN relay operates, the COIN lamp will light. The COIN lamp will light whenever there is a low impedance path to ground from the tip of the line being tested, such as a coin being present.

VOLTMETER CIRCUIT AND CONTROL

A. General

4.28 Operation of a VM access trunk control key operates its associated VM relay. When a VM relay operates, the circuit connected to the corresponding access trunk is disconnected from the telephone circuit and connected to the voltmeter circuit through transfer contacts on the VM relay. Operation of a VM relay also enables the MVM, FEMF, 1K, and 20K

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* TELCo OPTION

relays through their respective keys. These keys and relays are used along with the GRD, VMR, and TRR keys to perform the various tests made with the voltmeter circuit.

4.29 Control keys and relays not specifically mentioned in the following test descriptions are assumed to be nonoperated or released.

4.30 The MVM, FEMF, 20K, and 1K relays are interlocked such that only one of these relays may be operated at a given time. The interlock is provided by the relay holding path which includes break contacts on the MVM, FEMF, 1K, and 20K keys. When one of these keys is operated, the holding path for a previously energized relay is interrupted; that relay releases.

B. Meter Scale Selection

4.31 The selection of the meter scale to be used for measuring is a function of the external resistance in the circuit being tested. The designations 1K and 20K indicate roughly the external resistance which would cause half-scale deflection. BSP 233-135-205 shows the correlation between the meter deflection and the external resistance. The accuracy of measurements increases as the meter deflection approaches half scale, because in this region of the curves a small change in external resistance causes a large change in the scale reading.

4.32 The 1K and 20K relays are enabled by a contact on a VM relay. This arrangement prevents operation of the 1K and 20K relays until one of the VM relays is energized. In addition, the 100K range is used when the initial voltmeter to trunk connection is made, since the 1K and 20K relays are released until their respective keys are operated. When the 20K relay is operated by operating its key, relay contacts disconnect the 100 volts from the 120-volt meter terminal and connect +20 volts to the 24-volt terminal. When the 1K key is operated and its relay energizes, the same voltage connection to the meter is made as in the 20K range; but in addition, a shunting resistor, VM, is connected between the negative terminal and 24-volt terminal of the meter. This shunting resistor decreases the current flow through the meter movement, producing a lower scale deflection for a given external resistance.

4.33 The relay interlock between the MVM, FEMF, 20K, and 1K relays (see 4.30) prevents the use of the 1K or 20K ranges when measuring voltages on the circuit being tested. If the MVM or FEMF relay is energized, the meter automatically reads 120 volts full scale.

C. Resistance to Ground Test

4.34 When the initial connection is made between the circuit to be tested and the voltmeter circuit, all of the voltmeter control relays (MVM, FEMF, 1K, and 20K) are released. In this state, +100 volts from the test voltage supply circuit is connected to the 120-volt meter terminal through break-contacts on the 1K, 20K, FEMF, and MVM relays. The ring lead of the circuit under test is connected to the negative meter terminal through break-contacts on the TRR and VMR keys. The tip lead of the external circuit is open, since the MVM relay and the GRD key are both released. With these connections, the meter deflection reflects the resistance of the ring lead to ground with the 100K meter range. The 20K or 1K keys may be operated as needed to obtain a midscale deflection. The actual value of external resistance may be obtained by applying the scale reading to the appropriate curve on BSP 233-135-205.

4.35 The tip lead to ground resistance can be obtained by operating the TRR key, which connects the ring lead to the make-contacts of the MVM relay and the GRD key. The operated TRR key also connects the tip lead of the external circuit to the negative meter terminal through the break-contact on the VMR key. The 20K or 1K keys may again be used to obtain the most accurate scale deflection.

4.36 If the meter deflection exceeds 100 volts in the 100K range for either the ring or tip lead, the presence of an external voltage source is indicated on that lead, and the foreign battery test should be performed (see 4.39).

D. Capacitance Test

4.37 After the external circuit to be tested has been connected to the voltmeter circuit (see 4.28), the GRD key is operated. This action grounds the tip lead of the external circuit through a break-contact on the TRR key. The ring lead of the external circuit is connected to +100 volts through break-contacts on the TRR and VMR keys, the 100K-ohm meter resistance between the negative terminal and the 120-volt terminal, and break-contacts on the MVM, FEMF, 20K, and 1K relays.

4.38 The trunk capacitance charges to this 100 volts potential (- on tip, + on ring) through the 100 K ohm meter resistance. After the meter needle stablizes, the TRR key is operated, reversing the tip and ring connections such that the ring lead is now grounded and the tip lead connects to +100 volts through the meter, a break-contact on the VMR key, and break-contacts on the MVM, FEMF, 20K, and

1K relays. The trunk capacitance now charges to this new potential (+ on tip, - on ring). The TRR key is now released, and the original voltage polarity (- on tip, + on ring) is applied to the circuit being tested. The meter deflections resulting from the operation and release of the TRR key are proportional to the trunk capacitance.

E. Foreign Battery Test

4.39 The foreign battery test is used to determine the magnitude and polarity of a voltage between ground and one of the leads of the circuit under test. To make this test, the FEMF relay is energized by operating the FEMF key. When the FEMF relay is operated, the 120-voltmeter terminal is grounded through a make-contact on the FEMF relay, break-contacts on the MVM relay, and a break-contact on the VMR key (FS 1). The ring lead of the external circuit is connected to the negative meter terminal through break-contacts on the TRR and VMR key. The tip lead of the external circuit is connected to the open contacts of the nonoperated GRD key and MVM relay. The 120-voltmeter range is used for this test, since the FEMF and 20K (or 1K) relays cannot be operated at the same time (see 4.33). With the connection stated above, the meter reads the magnitude of the voltage on the ring lead of the external circuit which is negative with respect to ground.

4.40 If the meter deflects in the wrong direction, the VMR key is operated, which reverses the meter connections such that the negative terminal is grounded and the 120-volt terminal connects to the ring lead. This condition reads the positive voltage on the ring lead with respect to ground.

4.41 The tip lead of the external circuit is tested for foreign battery by operating the TRR key. Operating this key interchanges the tip and ring connections, such that the ring lead is open and the tip lead connects to the meter. Again the meter reads a negative voltage to ground if the VMR key is nonoperated, and a positive voltage to ground if the VMR key is operated.

F. Test for Voltage Between Tip and Ring

4.42 This test determines the magnitude and polarity or a voltage between tip and ring. Only the 120-voltmeter range can be used (see 4.33).

4.43 To perform this test, the MVM relay is operated by operating the MVM key. When this relay operates, the tip lead of the external circuit is connected to the 120-volt voltmeter terminal through make-contacts on the MVM relay and break-contacts on the TRR and VMR keys. The ring lead is connected to the negative terminal through break-contacts on the TRR and VMR keys. With these connections, the meter reads the negative voltage on the ring lead with respect to the tip lead.

4.44 If the direction of needle deflection is incorrect, the VMR key is operated to reverse the tip-ring meter connections. This mode indicates the positive potential on the ring lead with respect to the tip lead.

G. Test for a Short Circuit Between Tip and Ring

4.45 This test examines the tip and ring leads of the external circuit for a short circuit. The 20K or 1K meter ranges may be used, since the MVM and FEMF relays are nonoperated for this test. The 1K range is more useful than the 20K or 100K ranges for this test since it is more sensitive to low resistance in the external circuit.

4.46 The GRD key is operated to ground the tip lead through a break-contact on the TRR key. The ring lead is connected to the test voltage (+100 or +20, depending on the range) through the meter, break-contacts on the TRR and VMR keys, and relay contacts on the control relays. The meter current equals the test voltage divided by the sum of the meter resistance (constant) and the resistance of the external circuit. The scale reading is a function of the amount of external resistance between tip and ring. This reading approaches the test voltage as the external resistance approaches zero (short circuit).

4.47 The VMR key is repeatedly operated and released. When the key is operated, the negative meter terminal is grounded through a make-contact on the VMR key and a break-contact on the MVM relay. This ground path does not include the tip-ring resistance of the external circuit, which is included when the VMR key is released. As the VMR key is operated and released, the resistance in the circuit being tested is switched to the current path for the meter. If this external resistance is not zero, the meter current varies with the VMR key position, and a deflection change is seen on the scale. If the external circuit is short-circuited, no change in deflection occurs.

H. Test Voltage Supply Check

4.48 The test voltage supply can be checked by using the voltmeter circuit. The VMR key is operated, connecting ground to the negative meter terminal through a break-contact on the MVM relay and a make-contact on the VMR key. The supply voltage being checked is determined by the

1K and 20K relays. If these relays are both released, +100 volts is connected to the 120-volt terminal through break-contacts on the MVM, FEMF, 20K, and 1K relays, and the meter reads the level of the +100 volt supply. If either the 20K or 1K relay is energized, the +100 volts are disconnected, and +20 volts are connected to the 24-volt terminal through a make-contact on the operated relay. In this state, the +20 volt supply is checked. To check the +116 V or -116 V voltages, operate the +STA or -STA key with the VMR key operated respectively.

I. Gas Tube Ringer Testing

4.49 The voltmeter can be used to test both positive and negative gas tube ringers by operating the +STA or -STA keys, respectively. Operation of the +STA key connects the +116 volts of the test voltage supply in series with the voltmeter to the ring lead of the voltmeter circuit. With a positive gas tube ringer connected to the ring lead, the meter will deflect indicating current flow resulting from the gas tub ionizing. Operation of the TRR key (tip-ring reversal) tests positive gas tubes tied to the tip side. Similarly, the -STA key will test tip or ring connected negative gas tubes. Interlocks are provided to prevent simultaneous operation of both keys.

J. Breakdown Testing

4.50 Testing of insulation up to 200-volt breakdown can be accomplished by operating the BT key on the voltmeter. This circuit connects the +200 volt terminal of the test voltage supply in series with a 100K resistor and the voltmeter to the ring lead of the voltmeter. Operation of the TRR key connects the +200 volts to the tip side. Any current indication on the meter indicates leakage from tip or ring to ground.

STATE CHANGE CONTROL

A. General

4.51 The state change control circuitry is used to specify a particular state for the circuit being tested. The state of the circuit depends on the condition (operated or released) of the state relays in that circuit.

4.52 Operation of state control switches A, B, and C serves to saturate a ferrod in the system scanner circuit which in turn causes appropriate processor action. Operation of the associated junctor and access trunk switches will also cause a ferrod to operate. With the state control switch in the up position, the ferrod is saturated. Moving the switch to the down position (A, B, C, No. 1) does not saturate the ferrod. The PD selection rotary switch codes two PD points in a 1-out-of-4 code to denote the triplet selected.

TELEPHONE CIRCUIT

A. Talk and Monitor Circuit and Telephone Circuit

4.53 The monitor function is accessible at the telephone handset or by plugging a headset into the TELA and TELB jacks. This facility is used to monitor a network connection or to listen to tones or signals being received over access trunk 1 when it is in the TRMT mode. When the MON1 or MON2 relays are operated the high-impedance input of the monitor amplifier (PS 1) is connected across the access trunks. The TRFR is operated when the headset is plugged into the TELA and TELB jacks. Either T1 or T2 and HLD1 or HLD2 must be operated or the circuit will be released. Varistor RV1 reduces clicks in the receiver of the connected head set.

4.54 The talk function is used in conjunction with either the handset, or a headset plugged into the TELA and TELB jacks. The TALK LINE key supplies battery and ground to a line under test from the access trunk in order to allow communication from that line.

4.55 When the handset is lifted off-hook, the TLS relay is operated via the switch-hook switch which, in turn, performs the identical functions the switch-hook switch previously performed and also connects the ring lead to the guard assembly and removes the short across the receiver.

4.56 The telephone set of the TLTP consists of a modified type 2750 set. A guard assembly is placed in the input tip-ring leads to guard against polarity reversal. A 241B-type amplifier is included to boost the signal when the transfer (TRFR) relay is operated and the headset is used instead of the phone handset. A flash key is included to momentarily break the phone connection. The flash key when operated breaks the ring lead in the phone input line and shorts out the receiver.

5. DESCRIPTION OF OPERATION FOR FB516 THROUGH FB519 AND FB521 THROUGH FB524

FB516 AND FB517

A. General

5.01 The tone presence detector is designed to detect the presence of a tone greater than a preset level at voice band

frequencies. An output response will occur if the tone is present for more than a predetermined period of time. In the voice test mode, signals greater than -22 dBm at frequencies above 200 Hz, which have pauses of less than 5 seconds will be detected. In the junctor test mode, signals present which are greater than -1.2 dBm are detected. In addition, there is an ac continuity test for testing trunks. A test state is also provided to test three port conference circuits.

B. Specific

5.02 The tone presence detector is a precision nonadjustable tone detector. It has a 50-ms hold-up time in which it will keep its scan point up for 50 ms after the detected tone has been removed.

5.03 There is an ac continuity state in which a 1-kHz signal is sent out on the ring lead. The circuit looks for an ac impedance of 2 KOHMS or less between tip and ring of a trunk or carrier facility. If this impedance condition is met, the circuit responds by activating the scan point.

5.04 The operation of the circuit in the tone state is as follows: when tone is applied to the T and R it is amplified and compared to a reference source. If the tone applied is greater than -30 dBm, the peak detector will give a logic pulse to the timers. Two timers are started. One timer checks for a repetition rate in excess of 200 Hz, while the other timer checks for the presence of this signal for at least 50 ms. If the repetition rate timer stops before the signal presence timer stops, the circuit is reset; however, if the opposite condition occurs, the tone presence scan point is set. Once tone stops, the 50-ms bridge timer is started. If the tone returns before this timer times out, the signal is indicated as being still present. If the timer times out before the tone returns, a lack of presence is indicated, scan point nonoperated, and the circuitry is reset.

5.05 In the junctor state if the input level is greater than -1.2 dBm, the circuit will respond; the amplifier, however, is switched out. All other parameters are the same as in the tone state.

5.06 The 3-port state accepts an input level greater than -3 dBm, all other parameters being the same as in the tone state.

5.07 The voice state accepts signals greater than -22 dBm and times the absence of the signal for 5 seconds. As before, all other parameters are the same as in the tone state.

FB518

A. General

5.08 The TTY line circuit is used in conjunction with the 108D data set. The function of this circuit is to switch the TTY data set to either a private line or a network line termination, thus allowing communications through the switched network to any trunk or over the dedicated facility. Switching and dc path for supervision is provided on the circuit pack.

B. Specific

5.09 The TTY line circuit is designed to allow connection of the 108D data set to either a newtork connection or a private line. The selection of this connection is via two PD points which selects one or the other path and connects the network, if that path is chosen a line-feed type inductor is connected from tip to ring to provide a dc supervision path while the 108D leads are ac coupled to prevent saturation of the output transformer of the data set. Two such circuits are provided on the circuit pack.

FB519

A. General

5.10 The local test desk incoming trunk circuit provides the necessary auxiliary interface to the local test desk; and, once a connection to it is established, it provides a dc path to the network.

B. Specific

5.11 The local test desk incoming trunk circuit is designed to interface No. 3 ESS with either the No. 14, or No. 16 local test desk (LTD), or No. 3 test cabinet (TC). The purpose of these circuits is to provide the interface to the LTD or TC to test customer lines.

5.12 A second connection is provided to connect the customer line to the station ringer test circuit for checking of the customer TOUCH-TONE pad. This second connection is made when the local test desk connector is broken from the customer line. In this second connection mode, the local test desk is connected to a second port on the station ringer test circuit for monitoring of the testing. In the second connection mode, tests can be made for party grounds (ie, ring-to-ground continuity check). It also checks for party grounds (ring to ground). The local test desk can come in on a dedicated pair of wires or a 99311 far-end test trunk circuit to the FB519.

5.13 If the LTD is beyond the 1500-ohm loop length, it will not function properly. The 99311 far-end test trunk circuit is used to connect the dc signals to carrier-compatible signals to allow the test desk to connect to the No. 3 test circuit. A continuity check function of the FB519 puts a 1-KOHM resistor across the tip and ring to satisfy the junctor continuity test during normal call processing.

FB521 AND FB522

A. General

5.14 The station ringer test line circuit is used in conjunction with the TOUCH-TONE station test circuit and the local test desk circuit as an interface circuit. It also provides ferrod amplifiers as interface circuits with the scanner. It also detects on and off hooks as well as checking for status party identity grounds.

B. Specific

5.15 The station ringer test circuit (SRTC) has tip and ring appearances at the network and the ringing and tone plant. The circuit has a detector to detect party ground failures. In the idle state, the tip and ring to one port of the switched line network is open. In the TOUCH-TONE test state, dial tone appears on the tip and ring of both ports to the network. When the party ground and ringer test state is configured, dial tone is removed from the tip and ring ports. A detector is connected to the tip and ring for detection of a station ground. The idle state with an on-hook without a flash or software time-out input returns all ferrods and distributes points back to idle. One port to the network is opened. Finally, a high tone configured state is used to return continuous high tone to both switched line ports.

5.16 The SRTC is used in conjunction with the LTD (FB519) and the TOUCH-TONE station test circuit when testing customer TOUCH-TONE pads. It has two ports, one which is connected to the customer line during testing, and the other which is connected to the LTD (FB519) for monitoring the tests. The checking of the TOUCH-TONE pad can be made either via the LTD or directly from the customer phone.

FB523 THROUGH FB525

A. General

5.17 The line insulation test circuit is used to perform gross resistance measurments between tip and ring and between tip or ring to ground. In addition, it provides a test for a foreign potential on either the tip or ring. When in the resistance measurement mode, the range of sensitivity can be selected to measure leakage from 20 KOHMS to 2.56 MOHMS.

B. Specific

5.18 The line insulation test circuit is essentially an ohmmeter designed to check for resistance between tip and ring, between tip and ring to ground, or between tip and ring to battery. The three tests performed are: short or ring to ground (SRG), tip or ring to ground (TRG), and foreign electromotive force (FEMF). The circuit is capable of making go/no-go types of resistance measurements in the range of 20 KOHMS to 2.56 MOHMS. The first range includes 20 KOHMS, 40 KOHMS, and 80 KOHMS with three resistance comparators. The second range includes 80 KOHMS, 160 KOHMS, 320 KOHMS, and the third range includes 640 KOHMS, 1.28 MOHMS, and 2.56 MOHMS. A 7-Hz low-pass active filter is incorporated to minimize 20-Hz and 60-Hz noise interference. Due to the floating circuit concept, the measuring circuitry is insulated from battery or ground by the breakdown voltage of the dc-to-dc converter transformer and the optoisolator breakdown voltage specifications. In addition, the front end of the circuit is protected against fast rise-time surges. The FB525 provides a self-check feature allowing the integrity of the circuit to be tested by selectively placing known resistance across the input and checking the response of the circuit. The values of these resistors are chosen to allow the circuit tolerance drift to be checked.

FB526 THROUGH FB529

A. General

5.19 The TOUCH-TONE receiver test circuit generates precise and pure TOUCH-TONE signals in which both the frequency and amplitude are controllable. The two sine wave synthesisers are combined to produce the TOUCH-TONE signals which can then be used to check proper response of the TOUCH-TONE receiver circuit.

B. Specific

5.20 The TOUCH-TONE receiver test circuit is basically a pair of precision oscillators whose frequencies can be programmed. Using digital synthesis techniques, a sinusoidal wave form with a programmed period is generated. Nominal frequencies of 672 Hz through 1692 Hz can presently be generated to provide both inband and out-of-band frequencies for all TOUCH-TONE frequencies. By selecting the appropriate output frequency, the response or lack of response of a TOUCH-TONE receiver can be checked. The output levels

generated can be selected as 0 dBm, -10 dBm, or -21 dBm. Modes of operation include generation of one or both tones; generation of a third noise tone (for third-tone rejection testing); setting of the tone level at 0 dBm, -10 dBm, or -21 dBm; placement of the circuit in the idle state (no tone generated); and generation of a power-off circuit state. In the power-off state, there are 909 ohms between tip and ring. Due to the digital nature of the circuit, PD points are used to set the register bits in the circuit, which determine the frequency of generation as well as the other circuit states previously mentioned.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 -48 V Supply -42.5 V to -52.5 V.

+24 V Supply +22.5 V to +26.8 V.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Functional Group	Designation	Meaning
Access	HLD1	Hold access trunk 1
Trunk	HLD2	Hold access trunk 2
Control	HLD3	Hold access trunk 3
	MON1	Monitor on access trunk 1
	MON2	Monitor on access trunk 2
	T1	Access trunk 1
	T2	Access trunk 2
	T3	Access trunk 3
	VM1	Connect access trunk 1 to voltmeter control
	VM2	Connect access trunk 2 to voltmeter control
	XMS1	Connect access trunk 1 to transmission measuring control
	XMS2	Connect access trunk 2 to transmission measuring control
Control	BAL1	Insert balance network into access trunk 1
	BAL2	Insert balance network into access trunk 2
	A	A or A state control switch
	B	B or B state control switch
	C	C or C state control switch
	ACCT	Select access trunk 1 or 2
	Junctor	Associated with a junctor or not junctor associated
Telephone Circuit	TRFR	Transfer control to headset
Trans-mission Measuring Control	-10	Connect milliwatt directly to the -10 dB pad
	CAL	Calibrate the frame-mounted test sets
	CS	Called supervision
	RT	Reverse test
Voltmeter Control	1K	Set meter circuit resistance to 1000 ohms
	20K	Set meter circuit resistance to 20,000 ohms
	FEMF	Set meter circuit for foreign battery test
	MVM	Set meter circuit for metallic voltmeter

2.02 Keys, lamps, jacks, and switches are detailed in BSP 233-135-205.

3. FUNCTIONS

3.01 Provides for this circuit facilities for the manual testing of trunks, lines, and service circuits in the office.

3.02 Provides line testing facilities on a limited basis (voltage, transmission, etc).

3.03 Provides for the use of frame-mounted test facilities for external circuit testing by plugging into the appropriate jacks.

3.04 Provides frame-mounted equipment testing control and capabilities listed below:

(a) Provides control of the type of testing (voltmeter, transmission, etc) being performed on the circuits connected to the access trunks.

(b) Provides control of trunk terminations and other functions related to transmission testing on the connected circuit.

(c) Provides control of the voltmeter test being conducted (resistance, capacitance, voltage, etc) on the connected circuit.

(d) Provides for manually setting the state of the connected circuit.

(e) Provides headset and speakerphone access to the access trunks.

(f) Provides transmission testing (sending or receiving) capability on the connected circuit.

(g) (Voltmeter circuit) - Provides the meter and switched connections required for voltmeter tests.

(h) (Monitor circuit) - Provides for tone monitoring and for establishing a talking connection on the connected circuit.

(i) Provides connection to a telephone set to be used to input connecting circuit information to the system.

4. CONNECTING CIRCUITS

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

Peripheral Control Circuit - SD-3H110-01

Test Frame - SD-3H904-01

Control Frame - SD-3H902-01

Miscellaneous Power Circuit - SD-3H905-01

5. MANUFACTURING TESTING REQUIREMENTS

Intermediate Requirements

5.01 None.

End Requirements

5.02 This circuit shall be capable of meeting all the requirements listed in the circuit requirements table.

6. ALARM INFORMATION

6.01 None.

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 This equipment is in use only for testing purposes. The test panel can be taken out of service by taking the access trunk network appearances out of service. No circuit packs should be removed without first removing associated fuses.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 Provided complete CD information.

BELL TELEPHONE LABORATORIES, INCORPORATED

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