DIGITAL LINE CIRCUIT (SD-73095-01), DIGITAL TEST LINE CIRCUIT (SD-73099-01), AND DIAL TONE SPEED MEASURING CIRCUIT (SD-73103-01) OPERATION TESTS 758C SWITCHING SYSTEM FOR SWITCHED DIGITAL DATA SYSTEM (SDDS)

1. GENERAL

1.01 This section provides information for testing the operational functions of the digital line circuit, digital test line circuit, and dial tone speed measuring circuit. It also provides trouble diagnostic information on possible digital line, test line, and dial tone speed circuit failures, and provides an interface with Section 551-568-305.

1.02 This section is reissued to include trouble diagnostic information and to change the format to provide an interface with Section 551-568-305. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Operational tests provided for the circuits include idle, call origination and connection, and call termination conditions. Tests are also provided for the line unit clock alarm and for the dial tone speed measuring circuit.

1.04 Testing of the alarms extended to the bay alarms, power, and timing (BAPT) unit and the bay clock, power, and alarms (BCPA) unit caused by the line unit is included in Section 551-569-500.

1.05 The digital line circuits require no routine maintenance. These tests are to be performed at the time of installation and when trouble is suspected in one of the circuits. Trouble diagnostic procedures are outlined in Part 6.

When it is necessary for maintenance purposes to remove the +5 volt power to the first (bottom) line unit in the J70178A (common equipment) bay, the J70178B (digital line/trunk) bay, or the J70178D (digital line/trunk/BCPA) bay, the procedures outlined in 1.06 through 1.09 MUST be observed.

BAPT Unit—Fusing

1.06 Fusing of the +5 volt power required to operate the BAPT unit in the J70178B digital line/trunk bay is shared with the first (bottom) line (or trunk) unit in that bay. Removal of the F4 and FA-4 fuses from the bottom 5-volt power supply shelf (5V PSS) in the J70178B bay will remove +5 volts from the BAPT unit and a portion of the first line unit in the bay.

Caution: During the time that these fuses are removed, the BAPT unit will not respond to alarm conditions (other than blown fuses) from units within the bay.

1.07 When it is necessary to remove the F4 and FA-4 fuses to perform maintenance on the first line unit, first remove the fuses and then remove the shop-connected wire from upper terminal 2 of TS 2 of the J70178AC unit, then replace the F4 and F4-A fuses to restore the +5 volt power to the BAPT unit. After maintenance has been performed, remove the fuses, reconnect the wire to upper terminal 2 of TS 2, and replace the fuses. To verify that the BAPT unit is again functional, test for a major or minor alarm per Section 551-569-500.

BCPA Unit—Fusing

1.08 Fusing of the +5 volt power required to operate the BCPA unit in the J70178A or J70178D bays is shared with the first (bottom) line (or trunk) unit in the respective bays.

Caution: When it is necessary for maintenance purposes to remove the +5 volt power to the first (bottom) line unit in the J70178A or J70178D bay, the simultaneous removal of the F2 and FA-2 fuses along with the F4 and FA-4 fuses from the bottom 5-volt power supply shelf (5V PSS) in the J70178D bay (or the bottom right-side 5V PSS in the J70178A common equipment bay) must be avoided since this will remove all +5 volt power from the BCPA unit and will result in "loss-of-timing" causing interruption of service. Note that the removal of the F4 and FA-4 fuses from the 5V PSS will cause the BCPA unit (a) to transfer to the backup +5 volt supply provided by the F2 and FA-2 fuses also located at the 5V PSS and (b) to light the BYP lamp. The BYP lamp will remain lighted for as long as the F4 and FA-4 fuses are removed and serves as a reminder of the loss of the regular +5 volt supply to the BCPA unit (since the BYP key is not operated).

1.09 The following sequence should be followed during maintenance affecting the +5 volt power to the first J70178AC unit in those bays.

(1) Ensure that the BYP lamp is not lighted at the BCPA unit and ***do not proceed*** until the condition causing the lighting of the BYP lamp is corrected.

(2) Remove the F2 and FA-2 fuses at the 5V PSS (J70177AK).

(3) Remove the shop-connected wire from upper terminal 5 of TS 2 of the J70178AC unit.

(4) Replace the F2 and FA-2 fuses.

(5) Remove the F4 and FA-4 fuses (BYP lamp lights at the BCPA unit).

(6) Remove the shop-connected wire from upper terminal 2 of TS 2 of the J70178AC unit.

(7) Replace the F4 and FA-4 fuses (BYP lamp extinguishes at the BCPA unit).

When the procedure sequence above is followed, "loss-of-timing" will not occur. After maintenance has been performed on the bottom line unit, repeat Steps (1) through (7) above except that now the wires removed in Steps (3) and (6) are reconnected.

Reference Documents

1.10 This section is based on the following documents:

SD	TITLE
73095-01, Iss 2A	Digital Line Circuit
73099-01, Iss 2A	Digital Test Line Circuit
73101-01, Iss 2B	Digital Register-Sender Interface Circuit
73103-01, Iss 1	Dial Tone Speed Measuring Circuit

If this section is to be used with equipment or apparatus reflecting later issues of the drawings, reference should be made to the SDs and their related CDs to determine the extent of the changes and the manner in which the section may be affected.

1.11 For information on the description, operation, and maintenance of associated and test equipment used with the SDDS, refer to the following sections:

SECTION	TITLE
107-602-100	Digital Signal Test Unit
551-563-305	Digital Register-Sender Interface Unit—Method of Operation
551-563-500	Digital Register-Sender—Operation Tests
666-600-101	Switched Digital Data System—950B Testboard (J70176C)—Description and Operation
666-600-301	Switched Digital Data System—950B Testboard (J70176C)—Maintenance Procedures

666-600-501 Switched Digital Data System—950B Testboard (J70176C)—Inspection and Maintenance Tests

Line Circuit Tests

1.12 The test covered are:

DIGITAL LINE UNIT CLOCK ALARM

A. Digital Line Unit Clock Alarm—Failure and Transfer: This test checks the ability of the clock alarm circuit to indicate the absence of timing to either the A shelf (lower) or B shelf (upper) part of the line unit and, if failure occurs, to transfer and indicate failure of the clock supply on the affected shelf in the line unit by lighting a light emitting diode (LED) on the clock circuit pack (CP) on the affected shelf and an alarm lamp on the BCPA or BAPT unit.

DIGITAL LINE CIRCUIT

B. Originating Call—Connection to Digital Test Line Circuit From Digital Line Circuit: This test checks the ability of the digital line circuit to send an idle condition toward the station and originate a call to the digital test line.

C. Originating Line Disconnects by Receiving IDLE From Station—Digital Line Circuit: This test checks the ability of the digital line circuit to return to its idle condition after receiving an idle indication from the station.

D. Originating Line Disconnects by Receiving NOT RDY From Station—Digital Line Circuit: This test checks the ability of the digital line circuit to release a connection and enter its not ready condition after receiving a not ready indication from the station.

E. Originating Line Disconnects by Receiving Abnormal Station Code (ASC) From Station—Digital Line Circuit: This test checks the ability of the digital line circuit to return to its idle condition after receiving an ASC code from the station.

F. Originating Call to Check Call Progress Code Indications—Digital Line Circuit: This test checks the ability of the digital line circuit to receive and pass to the station call progress codes.

G. Originating Call From a Terminate Only—Digital Line Circuit: This test verifies that a digital line circuit cannot originate a call when the ***terminate only*** option is provided.

H. Originating Call to a Digital Line Circuit—Load Control Test: This test checks the ability of the digital line circuit to delay its reseizure immediately after a previous incomplete attempt to originate a call is made when the system is in the overload condition. This test also checks that the digital line circuit does not delay its reseizure immediately after a previously completed call when the system is in the overload condition.

I. Terminating Call—Connection and Answer—Digital Line Circuit: This test indicates that a digital line circuit can terminate an incoming call from a station or trunk and provide the connection to a terminating station.

J. Terminating Call—Disconnect by Going Control Mode Idle: This test checks the ability of a terminating or an originating line circuit to disconnect after its station transmits an idle indication.

K. Terminating Call—Disconnect by Going Not Ready: This test checks the ability of a terminating or an originating line circuit to disconnect after receiving a NOT RDY indication from its station.

L. Originating or Terminating Call—Disconnect on Receipt of NUL (From Switch): This test checks the ability of the line circuit to disconnect and send an idle condition to the station after an NUL signal is received from the switch.

M. Terminating Call—Digital Line Circuit Tests Busy: This test determines that a busy indication will be returned to the calling station when the terminating line circuit is busy.

N. Terminating Call—Digital Line Circuit Responds to Test Code: This test indicates that a digital line circuit can terminate an incoming call from a test trunk and assume the test mode condition in response to BEL TEST signals.

DIGITAL TEST LINE CIRCUIT

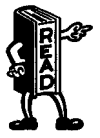
Originate Call to Digital Test Line Circuit

1.12 This test checks the ability of the test line to answer a call from a line or trunk and perform a loopback function and return transmitted data information to the calling station.

DIAL TONE SPEED MEASURING CIRCUIT

Originating Call

1.13 This test checks the ability of the circuit to originate calls and indicate on a register the percentage of calls on which dial tone was not received within a predetermined timed interval.



Before making any tests, follow local procedures to obtain customer approval or to notify the customer that the affected line is being taken out of service.

2. APPARATUS

2.01 ***Tests B Through L*** require the following:

- J70176AD digital signaling test unit
- Digital register-sender interface unit.

2.02 ***Tests E and H Through L*** require the following:

- KS-20908 data test set (receiver) with the following provided:
  - (a) KS-20908, L2 test signal cord
  - (b) KS-20908, L3 clock cord
  - (c) KS-20908, L4 power cord
  - (d) KS-20908, L5 test point adapter.
- KS-20909 data test set (transmitter) with the following provided:
  - (a) KS-20908, L2 test signal cord
  - (b) KS-20908, L3 clock cord
  - (c) KS-20908, L4 power cord
  - (d) KS-20908, L5 test point adapter.
- One 1W13A cord (893 cord equipped with 360A tools).
- One 624B terminal connecting tool.
- One KS-6278 connecting clip.

2.03 ***Test—Digital Test Line Circuit*** requires the following:

- J70176AD digital signaling test unit
- Digital register-sender interface unit (SD-73101-01).

2.04 ***Test—Dial Tone Speed Measuring Circuit*** requires the following when traffic registers are not provided:

- KS-14510 volt-ohm-milliammeter (VOM), or equivalent.

3. PROCEDURE

3.01 The digital signaling test unit (DSTU) and the digital register-sender interface unit (DRSIU) are electrically coupled together with connecting cables, located in the rear of the chassis, and function as a unit in testing the line circuits.

3.02 In the originating line circuit tests, the DSTU and DRSIU function to simulate an originating station (Fig. 1). In this arrangement, test calls into the 758C switch are made with the DSTU via the DRSIU access jack appearance at the 950B testboard to any line appearance, with a patch cord in the jack field.

3.03 In the terminating line circuit tests, the DSTU, DRSIU, and dedicated test trunks function to simulate an incoming call from a station or trunk (Fig. 2). In this arrangement, test calls are made directly into the 758C switch via the dedicated test trunk and switched to the selected line circuit for termination. The KS-20908 receiver and the KS-20909 transmitter function to simulate a terminating station.

3.04 The tests described in this section may be performed in order from A to N, or a particular test may be performed when a specific trouble is suspected. Each test (with the exception

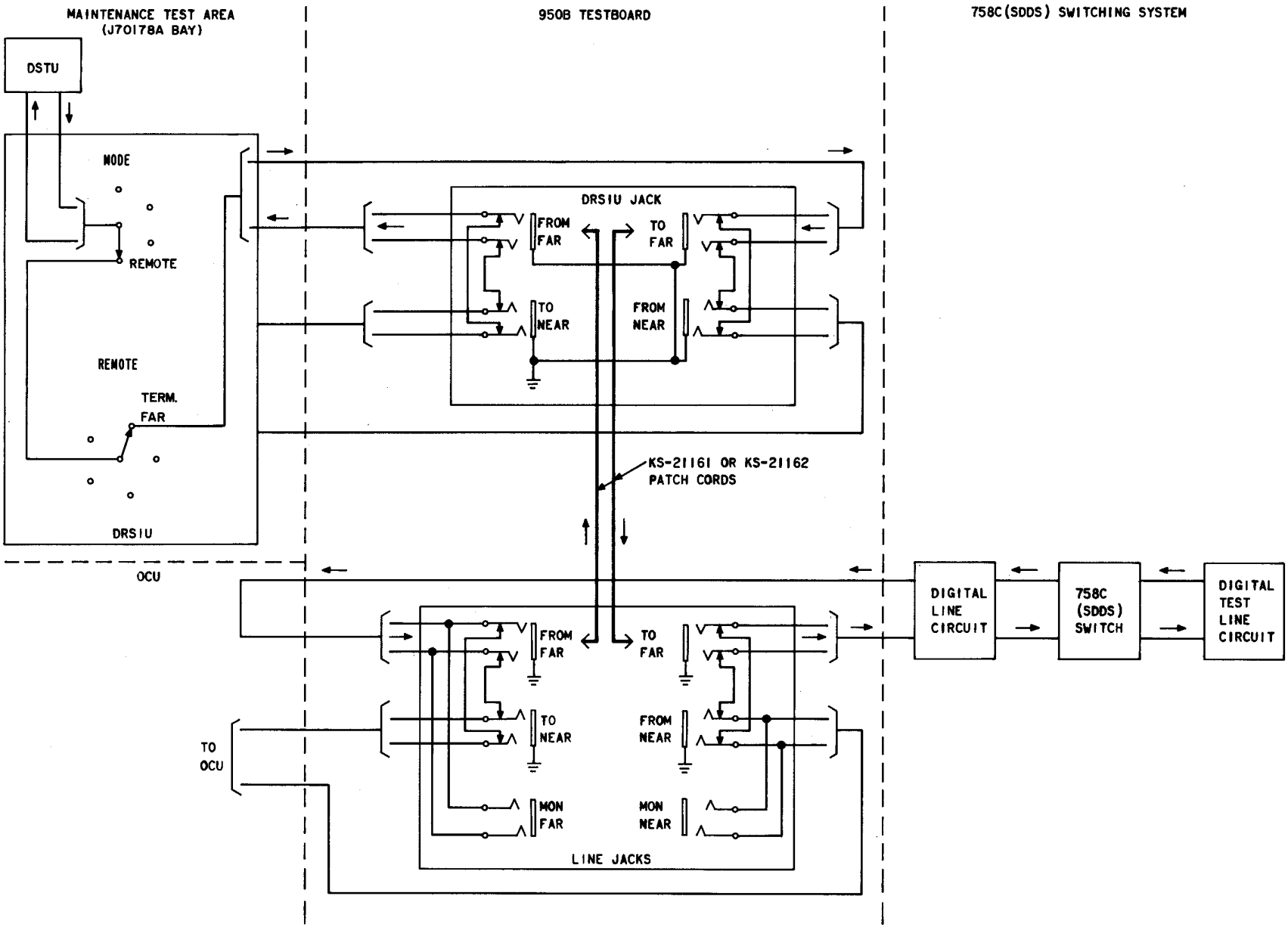


Fig. 1—Call to Originating Digital Line Circuit

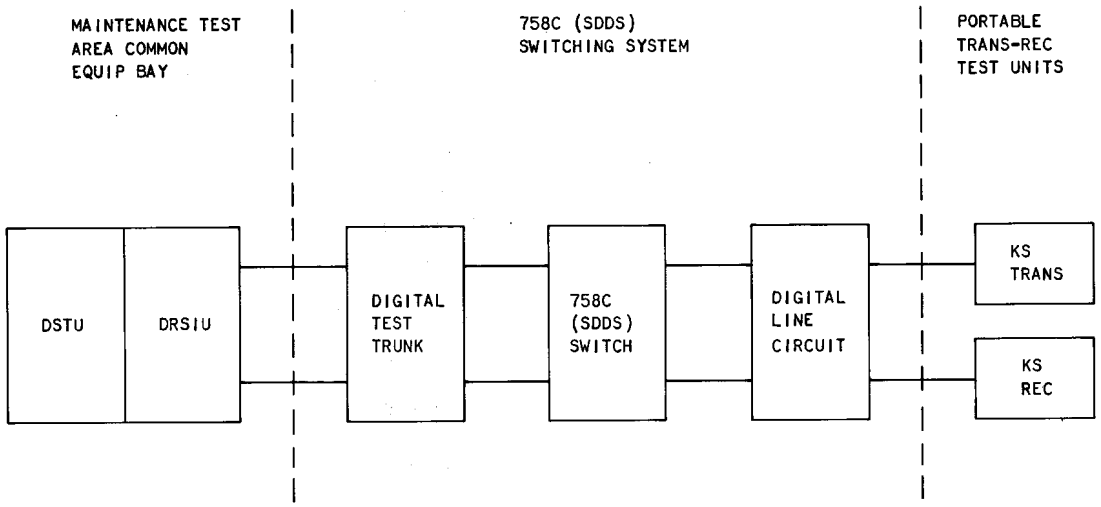


Fig. 2—Call to Terminating Digital Line Circuit

of Tests A and E and the digital test line and dial tone speed measuring circuit tests) is arranged to prevent redundancy of setup procedure information. When the tests are performed at random ***or*** in order, the setup procedure in Part 4 must be performed up to the step required to start a specific test. For instance, Test B starts with Step 6; therefore the preparation for Test B must be performed through Step 5. Similarly, Test I starts with Step 9, and preparation for Test I must be performed through Step 8.

3.05 When a test fails, refer to the appropriate test in the trouble diagnostic section (Part 6) for possible cause of failure. Trouble conditions are generally isolated by circuit pack (CP) substitution. To prevent CP damage when isolating troubles, proceed as follows:

- ***CP Removal***

  (1) Pull the circuit board release lever at the lower edge of the CP forward to disengage the CP from the connector at the back of the shelf.

  (2) Grasp the CP and pull it straight out from the line unit.

- ***CP Installation***

  (3) Align the CP in the proper slot (see designation strip and Fig. 3), and, holding the release lever operated, push it straight back until the CP is fully seated in the shelf; then release the lever and ensure that the CP is locked in place.

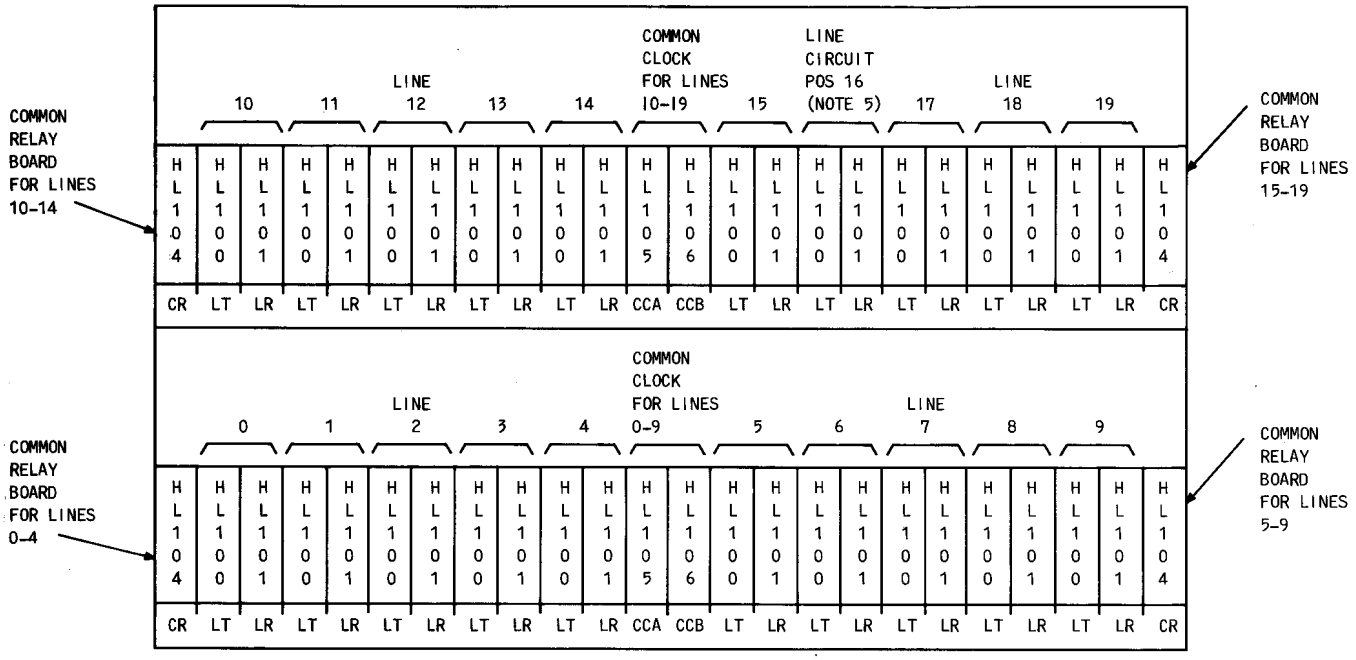
3.06 When a CP appears to be defective (ie, a replacement CP clears the alarm or fault), ***exchange the replacement CP with the removed CP to ensure that the original CP is defective.*** If the fault, alarm, or trouble does not recur, leave the original CP in place.

3.07 When substituting CPs to isolate a trouble and the replacement CP ***does not*** clear the trouble, ***do not*** leave the replacement CP in place. ***Put the original CP back in the unit.***

In all cases, when the substitution of CPs clears the alarm or fault, or when the trouble comes clear, note the actions on a trouble memo for future reference.

3.08 Ensure that defective CPs are not intermixed with normal replacement stock. Occasions may arise when a CP is questionable; it may be intermittently causing trouble or alarms. When this is suspected, the questionable CP should be replaced.

3.09 Each CP definitely identified as defective or fault-causing should be tagged and returned for repair per established local procedures.



NOTES:

1. ONE HL100 AND ONE HL101 IS REQUIRED FOR EACH DIGITAL LINE CIRCUIT. MAXIMUM CAPACITY -10 PER SHELF -20 PER UNIT.
2. ONE HL104 IS REQUIRED FOR EVERY FIVE CIRCUITS. EACH HL104 PROVIDES COMMON RELAYS FOR THE FIVE LINE CIRCUITS ADJACENT TO IT.
3. ONE HL105 AND ONE HL106 IS REQUIRED FOR EACH SHELF. THE HL105, HL106 PAIR PROVIDES TIMING FOR THE 10 DIGITAL LINE CIRCUITS IN THE SAME SHELF.
4. ONE HL107 IS REQUIRED FOR EACH DIGITAL TEST LINE CIRCUIT. HL107 REPLACES ONE HL100 AND HL101 PAIR, AND MAY BE PROVIDED IN ANY LINE CIRCUIT POSITION, IN THE LOCATION USUALLY OCCUPIED BY HL100.
5. HL100 AND HL101 IN LINE CIRCUIT POSITION 16 MAY BE REPLACED BY ONE HL108 TO PROVIDE A DIAL TONE SPEED MEASURING CIRCUIT, IN THE LOCATION USUALLY OCCUPIED BY HL100.

CIRCUIT PACK SWITCH SETTINGS FOR LINE SERVICE OPTIONS				
CP NO.	SCREW SWITCH DESIGNATION	SCREW POSITION		SERVICE OPTION
		OPEN	CLOSED	
HL100	S1		✓	TERMINATE ONLY
		✓		ORIGINATE AND TERMINATE
	S2		✓	GROUP HUNTING PROVIDED
		✓		GROUP HUNTING NOT PROVIDED
HL101	S1		✓	9.6 KB/S DATA RATE
		✓		56 KB/S DATA RATE
	DIP SWITCH DESIGNATION	ROCKER POSITION		
		OFF	ON	
HL104	S1		✓	GROUP HUNTING PROVIDED
		✓		GROUP HUNTING NOT PROVIDED

Fig. 3—Digital Line Unit—Equipped for 20 Digital Line Circuits

Caution: When returning CPs for repair or replacement, exercise care in handling to avoid damage. If possible, original shipping cartons should be used for storage and transportation or returning to the Service Center.

3.10 The call progress code and the signaling code symbols appearing on the alphanumeric display on the DSTU are defined in Table A.

3.11 The VERIFICATION column shows the LEDs lighted and the alphanumeric display when the operation of all keys and buttons of each individual step in the ACTION column is completed. ***Ignore any indications with the exception of those which are specifically called out.***

4. PREPARATION

STEP	ACTION	VERIFICATION
	DIGITAL LINE CIRCUIT	
	Tests B, C, D, F, G, and H—Originating Line Circuit	
	Note: Before making any tests, wait until the line circuit under test is idle, then insert dummy plugs into the TO NEAR and FROM NEAR jacks of the line circuit under test at the 950B testboard.	
1	At the 950B testboard (using KS-21161 or KS-21162 patch cords)— Patch the line circuit jacks of the circuit under test to the DRSIU access jacks. ***Patch the TO FAR to the TO FAR and the FROM FAR to the FROM FAR.*** (See Fig. 1 for test arrangement.)	
2	Complete self-test procedures of the digital signaling test unit (DSTU) and digital register-sender interface unit (DRSIU) described in Section 107-602-100, Digital Signaling Test Unit, and Section 551-563-305, Digital Register-Sender Interface Unit.	
3	Operate switch controls on the DRSIU as follows: MODE to REMOTE REMOTE to TERM. FAR. DATA RATE to 56 or 9.6.	
4	Compare the line circuit under test with the office records to ascertain that the screw and DIP switches are set for the correct line circuit service options (see Fig. 3).	
5	At DSTU— (1) Set DATA RATE switch to 56 or appropriate speed rate.	

TABLE A

DSTU DISPLAY SYMBOLS

DISPLAY	MEANING
	CALL PROGRESS CODES
00	Ringing at far end.
10	Busy line at any point.
11	Two consecutive NOT READY characters detected from a terminating line.
20	Time-out. No decoder-marker is assigned, or fails to complete functions within 7 seconds for any reason.
21	Busy trunk at any point.
30	Illegal code, vacant code, nonexistent number, nonallowed trunk or line dialed, or parity error received at switch.
	SIGNALING CODES
<	Abnormal station condition (ASC).
)	Control mode extended (CME) — Preamble for ACK and call progress codes toward calling customer. Ring toward called station.
+	Data mode extension (DME).
F	Acknowledge (ACK) — Returned by switch to indicate correct number of dialed digits without parity error have been received.
G	Station alert (remote ringing).
S	Station test alert (BEL TEST).
I	Unblind originating trunk or line circuit.
K	Reverse T and R of terminating trunk or line.
O	Drop trunk.
U	Nonacknowledge — Returned by switch to indicate error in dialed digits.
L	Unassigned multiplexer channel (MUX) — Indicates trunk malfunction.
J	Channel loopback — Maintenance code.
Z	DSU loopback — Maintenance code.
[	MJU test alert — Maintenance code.
/	MJU alert — Maintenance code.
(	MJU busy — Maintenance code.
\	Test code.
,	Multiplexer out of sync — Indication of trunk malfunction.

STEP	ACTION	VERIFICATION
	(2) Set ENQ-CSA-NOT RDY switch to CSA. (3) Set TRANSMIT switch to PRECESS DATA. (4) Set RECEIVE switch to BYTE ALN. (5) Depress IDLE key. All other keys must be released at this time. (6) Depress INIT key. ***Note:*** Unless otherwise specified, all control settings specified in the ACTION column of the test will be made on the DSTU.	
	All Tests I Through N—Terminating Line Circuit ***Note:*** Before making any tests, wait until the line circuit under test is idle, then insert dummy plugs into the TO NEAR and FROM NEAR jacks of the line circuit under test at the 950B testboard.	
1	Complete self-test procedures of the digital signal test unit (DSTU) and digital register-sender interface unit (DRSIU) as described in Section 107-602-100, Digital Signal Test Unit, and Section 551-563-305, Digital Register-Sender Interface Unit.	
2	At the DRSIU— Operate control switch as follows (refer to Fig. 2 for testing arrangement): MODE to TST TRK. DATA RATE to 56 or 9.6.	
3	Compare the line circuit under test with the office records to ascertain that the screw and DIP switches are set for the correct line circuit service options. (See Fig. 3.)	
4	At DSTU— (1) Set DATA RATE switch to 56 or appropriate speed rate. (2) Set ENQ-CSA-NOT RDY switch to NOT RDY. (3) Set TRANSMIT switch to BYTE ALN/CONT. (4) Set RECEIVE switch to BYTE ALN. (5) Depress CHK DIGIT key. (6) Depress IDLE key. All other keys must be released at this time.	
5	Depress INIT key.	
6	Depress CLEAR key.	At DSTU— CONT and IDLE (LED) light.

STEP	ACTION	VERIFICATION
7	At digital line unit— Prepare portable KS-20908 receiver as follows: (1) Connect power cord to 110 VAC, 60 Hz. (2) Connect (timing) CLOCK cord to TST-1 or TST-2 at BCPA unit. ***Caution: When using the test point adapter, care must be exercised when removing it from the test points on a circuit pack faceplate. Pull straight out on the adapter to prevent damaging the adapter test point terminals.*** (3) Plug test point adapter into TP 6 and TP 7 on CP HL-100 of digital line circuit under test. (4) Connect signal cord between receiver and test point adapter. (5) Connect sleeve lead of test point adapter into TP 12 on CP HL-100 of the digital line circuit under test. (6) Operate power switch ON. (7) Set INPUT switch to BIPOLAR. (8) Set DATA RATE switch to 56 or appropriate speed rate. (9) Set CHANNEL switch to SINGLE. (10) Depress TERMINATE key. ***Note:*** Unless otherwise specified, all control settings specified in the ACTION column of the tests will be made on the DSTU.	At receiver— CLOCK and TERM. (LED) light.
8	At digital line unit— Prepare portable KS-20909 transmitter as follows: (1) Connect power cord to 110 VAC, 60 Hz. (2) Connect (timing) CLOCK cord to TST-1 or TST-2 at BCPA panel. (3) Plug test point adapter into TP 4 and TP 5 on CP HL-100 of digital line circuit under test. (4) Operate power switch ON. (5) Set MODE switch to REPEAT. (6) Set FUNCTION switch to BYTE ENCODER. (7) Set DATA RATE switch to 56 or appropriate speed rate. (8) Set OUTPUT switch to BIPOLAR. (9) Set BYTE ENCODER switches to all 1s in first 7 bits and zero (0) in the 8th bit (IDLE control code).	At transmitter— CLOCK (LED) lights.

5. METHOD

STEP	ACTION	VERIFICATION
	DIGITAL LINE UNIT CLOCK ALARM	
	A. Digital Line Unit Clock Alarm—Failure and Transfer	
	 ***Testing of the major clock alarm must be done at the time of installation only. Removing one or both HL-105 and HL-106 circuit packs (CP) on shelf A and B simultaneously will cause a major alarm with the loss of clock to the line unit, with resulting adverse service reaction unless all associated lines were previously made busy. Verify that all lines in the shelf under test are made busy before performing tests for the following minor clock alarms.***	
1	At digital line unit, shelf A (lower shelf)— Remove clock CP HL-106.	At digital line unit, shelf A— CLK ALM LED lights on CP HL-105. At BAPT or BCPA unit— Minor alarm activated.
2	Reinsert clock CP HL-106.	At digital line unit, shelf A, BAPT, or BCPA unit— All minor alarms retired. CLK ALM LED extinguished on CP HL-105.
3	At digital line unit, shelf B (upper shelf)— Remove clock CP HL-106.	At digital line unit, shelf B— CLK ALM LED lights on CP HL-105. At BAPT or BCPA unit— Minor alarm activated.
4	Reinsert clock CP HL-106.	At digital line unit, shelf B, BAPT, or BCPA unit— All minor alarms retired. CLK ALM LED extinguished on CP HL-105.
	Caution: Steps 5, 6, 7, and 8 of the following test are to be performed only at time of installation. They must never be performed after the system is in service. ***Note:*** Before performing Steps 5, 6, 7, and 8, notify all persons normally responsible for responding to major alarm conditions.	
5	At digital line unit, shelf A (lower shelf)— Remove clock CP HL-106.	At digital line unit, shelf A— CLK ALM LED lights on CP HL-105.

STEP	ACTION	VERIFICATION
		At BAPT or BCPA unit— Minor alarm activated. MN aisle pilot lamp, if provided, lights. At minor alarm extension, if provided— Audible alarm sounds.
6	At digital line unit, shelf B (upper shelf)— Remove clock CP HL-106.	At digital line unit, shelf B— CLK ALM LED lights on CP HL-105. At BAPT or BCPA unit— Major alarm activated. Minor alarm retired. MJ aisle pilot lamp, if provided, lights. MN aisle pilot lamp, if provided, extinguished. At major alarm extension, if provided— Audible alarm sounds. At minor alarm extension, if provided— Audible alarm silenced.
7	At digital line unit, shelf A— Replace clock CP HL-106.	At digital line unit, shelf A— CLK ALM LED extinguished on CP HL-105. At BCPA or BAPT unit— Major alarm retired. Minor alarm activated. At aisle pilot lamp, if provided— MJ pilot lamp extinguished. MN pilot lamp lights. At alarm extension, if provided— Major audible alarm silenced. Minor audible alarm sounds.
8	At digital line unit, shelf B— Replace clock CP HL-106.	At digital line unit, shelf B— CLK ALM LED extinguished on CP HL-105. At BCPA or BAPT unit and, if provided, at aisle pilot lamps and/or alarm extension— All alarms retired.

DIGITAL LINE CIRCUIT

B. Originating Call—Connection to Digital Test Line Circuit From Digital Line Circuit

Note: Perform PREPARATION for Test B through Step 5.

6	Verify that IDLE key is depressed.	
7	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.

STEP	ACTION	VERIFICATION
Originate Call to Digital Test Line		
	Note: Steps 8, 9, and 10 must be performed in rapid sequence to prevent time-out.	
8	Release IDLE key.	
9	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
10	Key 7-digit office code and test line number followed by ETB.	On DSTU— Display momentarily reads)F followed by ***Data*** mode display. ***Note:*** A ***Data*** mode display is shown as :::: over the full screen.
11	Set TRANSMIT switch to BYTE ALN/DATA.	
12	Depress CLEAR key.	On DSTU— DATA and CSA (LED) light.
13	Digital test line is in loopback mode. Key random digits (eg, 7654321) on key pad.	On DSTU— Display reads same digits as those keyed on the key pad.
14	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	
C. Originating Line Disconnects by Receiving IDLE From Station—Digital Line Circuit		
	Note: Perform PREPARATION for Test C through Step 5.	
6	Verify that IDLE key is depressed.	
7	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
Originate Call to Digital Test Line		
	Note: Steps 8, 9, and 10 must be performed in rapid sequence to prevent time-out.	
8	Release IDLE key.	
9	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.

STEP	ACTION	VERIFICATION
10	Key 7-digit office code and test line number followed by ETB.	On DSTU— Display momentarily reads)F followed by ***Data*** mode display. ***Note:*** A ***Data*** mode display is shown as :::: over the full screen display.
11	Set TRANSMIT switch to BYTE ALN/DATA.	
12	Depress CLEAR key.	On DSTU— DATA and CSA (LED) light.
13	Set TRANSMIT switch to PREC DATA.	
14	Depress IDLE key.	
15	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
16	Key random digits on key pad.	***No*** alphanumeric display character will be shown, indicating disconnect.
17	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	

D. Originating Line Disconnects by Receiving NOT RDY From Station—Digital Line Circuit

Note: Perform PREPARATION for Test D through Step 5.

6	Verify that IDLE key is depressed.	
7	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.

Originate Call to Digital Test Line

Note: Steps 8, 9, and 10 must be performed in rapid sequence to prevent time-out.

8	Release IDLE key.	
9	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
10	Key 7-digit office code and test line number followed by ETB.	On DSTU— Display momentarily reads)F followed by ***Data*** mode display.

STEP	ACTION	VERIFICATION
		Note: A ***Data*** mode display is shown as :::: over the full screen display.
11	Set TRANSMIT switch to BYTE ALN/DATA.	
12	Depress CLEAR key.	On DSTU— DATA and CSA (LED) light.
13	Set TRANSMIT switch to BYTE ALN/CONT.	
14	Set ENQ-CSA-NOT RDY to NOT RDY.	
15	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
16	Key random digits on key pad.	***No*** alphanumeric display character will be shown, indicating disconnect.
17	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	

E. Originating Line Disconnects by Receiving Abnormal Station Code (ASC) From Station—Digital Line Circuit

Note: Before making test, wait until the line circuit under test is idle, then insert dummy plugs into the TO NEAR and FROM NEAR jacks of the line circuit under test at the 950B testbord.

1	Complete self-test procedure of the digital signaling test unit (DSTU) and digital register-sender interface unit (DRSIU) described in Section 107-602-100, Digital Signaling Test Unit, and Section 551-563-305, Digital Register-Sender Interface Unit.	
2	At common equipment bay— Prepare portable KS-20908 receiver as follows: (1) Connect power cord to 110 VAC, 60 Hz. (2) Connect (timing) clock cord to TST-1 or TST-2 at BCPA unit panel. (3) Connect input cord (receiver) into LOGIC LEVEL OUTPUT jack on DRSIU. (4) Operate power switch ON. (5) Set INPUT switch to LOGIC NEAR. (6) Set DATA RATE switch to 56 or appropriate speed rate. (7) Set CHANNEL switch to SINGLE.	At receiver— CLOCK (LED) lights.

STEP	ACTION	VERIFICATION
3	At common equipment bay— Prepare portable KS-20909 transmitter as follows: (1) Connect power cord to 110 VAC, 60 Hz. (2) Connect (timing) CLOCK cord to TST-1 or TST-2 at BCPA unit panel. (3) Connect output cord (transmitter) to LOGIC LEVEL INPUT jack on DRSIU. (4) Operate power switch ON. (5) Set MODE switch to REPEAT. (6) Set FUNCTION switch to BYTE ENCODER. (7) Set DATA RATE switch to 56 or appropriate speed rate. (8) Set OUTPUT switch to LOGIC NEAR. (9) Set BYTE ENCODER switches 1 through 8, respectively, 00011110 (ASC control code).	
4	At 950B testboard (using KS-21161 or KS-21162 patch cords)— Patch the line circuit jacks of the circuit under test to the DRSIU access jacks. ***Patch the TO FAR to the TO FAR and the FROM FAR to the FROM FAR.*** (See Fig. 1 for test arrangement.)	
5	Operate switch controls on DRSIU as follows: MODE to REMOTE REMOTE to TERM. FAR.	
6	At DSTU— (1) Set DATA RATE switch to 56 or appropriate speed rate. (2) Set ENQ-CSA-NOT RDY switch to CSA. (3) Set TRANSMIT switch to PRECESS DATA. (4) Set RECEIVE switch to BYTE ALN. (5) Depress IDLE key. All other keys must be released at this time. (6) Depress INIT key. (7) Depress CLEAR key. ***Note:*** Steps 6, 7, and 8 must be performed in rapid sequence (within 20 seconds).	On DSTU— CONT and IDLE (LED) light.
7	Release IDLE key.	
8	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
9	Key 7-digit office code and test line number followed by ETB.	On DSTU— Display momentarily reads)F followed by ***Data*** mode display.

STEP	ACTION	VERIFICATION
		Note: A ***Data*** mode display is shown as :::: over the full screen display.
10	At DSTU— Depress EXT DATA key.	At KS-20908 receiver— CONTROL CODE-IDLE CODE (LED) lights. (This indicates line circuit has returned to idle condition.)
11	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	

F. Originating Call to Check Call Progress Code Indications—Digital Line Circuit

Note: Perform PREPARATION for Test F through Step 5.

6	Verify that IDLE key is depressed.	
7	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
	Note: Steps 8, 9, and 10 must be done in rapid sequence to prevent time-out.	
8	Release IDLE key.	
9	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
10	Key four random digits, then depress ETB key.	On DSTU— Display reads repeated)30 (invalid code).
11	Depress IDLE key.	
12	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
13	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	

G. Originating Call From a Terminate Only—Digital Line Circuit

Note: Perform PREPARATION for Test G through Step 5.

6	Verify that IDLE key is depressed.	
7	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.

STEP	ACTION	VERIFICATION
8	Release IDLE key.	On DSTU— CONT and IDLE (LED) remain lighted; CSA ***does not*** light.
9	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	

H. Originating Call to Digital Line Circuit—Load Control Test

Note: Perform PREPARATION for Test H through Step 5.

6	On back of line unit— Using clip lead, ground IN terminal of LD relay.	On line unit— LD relay operated. (Operation of LD relay cannot be observed, it must be verified by listening for operation.)
7	Verify that IDLE key is depressed.	
8	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
9	Release IDLE key.	On DSTU— CONT and CSA (LED) light.
	Note: Steps 10, 11, and 12 must be performed in rapid sequence.	
10	Depress IDLE key.	
11	Depress CLEAR key.	On DSTU— CONT and IDLE (LED) light.
12	Release IDLE key.	On DSTU— CSA (LED) does not light for approximately 6 seconds after IDLE key was depressed in Step 10. CSA (LED) then lights after approximately 6 seconds.
13	Depress CLEAR key.	
14	Remove clip lead (placed in Step 6) on IN terminal of LD relay to ground.	
15	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard.	

STEP	ACTION	VERIFICATION
I. Terminating Call—Connection and Answer—Digital Line Circuit		
	Note: Perform PREPARATION for Test I through Step 8.	
Connection		
9	Set ENQ-CSA-NOT RDY switch to ENQ.	
10	Depress CLEAR key.	ON DSTU— CONT and CSA (LED) light.
11	Key class-of-service 111, one route digit (1), 7-digit office code and station number of digital line circuit under test, followed by ETB.	On DSTU— Display momentarily reads F followed by repeated)00 (remote ring). ***Note:*** Disregard II display, if shown.
12	Depress RESET button.	On DSTU— CONT and CSA (LED) light. At KS-20908 receiver— The following BYTE PATTERN (LED) lights if data rate speed is: 56 k/b—1, 2, 5, and 6 (LED) light. Subrate—2, 5, and 7 (LED) light. ***Note:*** This indicated alerting signal to station.
Answer		
13	At KS-20909 transmitter— Operate all eight BYTE ENCODER switches to the 1 position.	
14	At DSTU— Depress CLEAR key.	On DSTU— DATA and IDLE (LED) light. ***Note:*** This verified that station can answer incoming call.
15	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard and KS-20908 and KS-20909 receiver and transmitter.	
J. Terminating Call—Disconnect by Going Control Mode Idle		
	Note: Perform PREPARATION for Test J through Step 8.	

STEP	ACTION	VERIFICATION
Connection		
9	Set ENQ-CSA-NOT RDY swith to ENQ.	
10	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
11	Key class-of-service 111, one route digit (1), 7-digit office code and station number of digital line circuit under test, followed by ETB.	On DSTU— Display momentarily reads F followed by repeated)00 (remote ring). ***Note:*** Disregard II display, if shown.
12	Depress RESET button.	On DSTU— CONT and CSA (LED) light. At KS-20908 receiver— The following BYTE PATTERN (LED) lights if data rate speed is: 56 k/b—1, 2, 5, and 7 (LED) light. Subrate—2, 5, and 7 (LED) light. ***Note:*** This indicated alerting signal to position.
Answer		
13	At KS-20909 transmitter— Operate all eight BYTE ENCODER switches to the 1 position.	
14	At DSTU— Depress CLEAR key.	On DSTU— DATA and IDLE (LED) light. ***Note:*** This verifies that station can answer incoming call.
15	At KS-20909 transmitter— Operate BYTE ENCODER switch bit 8 to the 0 position (idle code).	At KS-20908 receiver— CONTROL CODE-IDLE CODE (LED) lights.
16	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard and KS-20908 and KS-20909 receiver and transmitter.	

K. Terminating Call—Disconnect on Receipt of Not Ready (From Switch)

Note: Perform PREPARATION for Test K through Step 8.

STEP	ACTION	VERIFICATION
Connection		
9	Set ENQ-CSA-NOT RDY switch to ENQ.	
10	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
11	Key class-of-service 111, one route digit (1), 7-digit office code and station number of digital line circuit under test, followed by ETB.	On DSTU— Display momentarily reads F followed by repeated)00 (remote ring). ***Note:*** Disregard II display, if shown.
12	Depress RESET button.	On DSTU— CONT and CSA (LED) light. At KS-20908 receiver— The following BYTE PATTERN (LED) lights if data rate speed is: 56 k/b—1, 2, 5, and 7 (LED) light. Subrate—2, 5, and 7 (LED) light. ***Note:*** This indicates alerting signal to station.
Answer		
13	At KS-20909 transmitter— Operate all eight BYTE ENCODER switches to the 1 position.	
14	At DSTU— Depress CLEAR key.	On DSTU— DATA and IDLE (LED) light. ***Note:*** This verifies that station can answer incoming call.
15	At DSTU— Set ENQ-CSA-NOT RDY switch to NOT RDY.	At KS-20908 receiver— CONTROL CODE-IDLE CODE (LED) lights.
16	If not further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard and KS-20908 and KS-20909 receiver and transmitter.	

L. Originating or Terminating Call—Disconnect on Receipt of NUL (From Switch)

Note: Perform PREPARATION for Test L through Step 8.

Connection		
9	Set ENQ-CSA-NOT RDY switch to ENQ.	

STEP	ACTION	VERIFICATION
10	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
11	Key class-of-service 111, one route digit (1), 7-digit office code and station number of digital line circuit under test, then depress ETB key.	On DSTU— Display momentarily reads F followed by repeated)00 (remote ring). ***Note:*** Disregard II display, if shown.
12	Depress RESET button.	On DSTU— CONT and CSA (LED) light. At KS-20908 receiver— The following BYTE PATTERN (LED) lights if data rate speed is: 56 k/b—1, 2, 5, and 7 (LED) light. Subrate—2, 5, and 7 (LED) light. ***Note:*** This indicates alerting signal to station.
Answer		
13	At KS-20909 transmitter— Operate BYTE ENCODER switch bit 8 to the 1 position.	
14	At DSTU— Depress CLEAR key.	On DSTU— DATA and IDLE (LED) light. ***Note:*** This verifies that station can answer incoming call.
15	At DRSIU— Set MODE switch to DSTU.	On KS-20908 receiver— CONTROL CODE-IDLE CODE (LED) lights.
16	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard and KS-20908 and KS-20909 receiver and transmitter.	

M. Terminating Call—Digital Line Circuit Tests Busy

	Note: Perform PREPARATION for Test M through Step 8.	
9	On KS-20909— Set BYTE ENCODER switch bit 8 to position 1.	
10	At DSTU— Set ENQ-CSA-NOT RDY switch to ENQ. Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.

STEP	ACTION	VERIFICATION
11	Key class-of-service 111, one route digit (1), 999 office code, and 4-digit station number of line under test, followed by ETB.	On DSTU— Display momentarily reads F followed by repeated)10 (station busy code).
12	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard and KS-20908 and KS-20909 receiver and transmitter.	

N. Terminating Call—Digital Line Circuit Responds to Test Code

Note: Perform PREPARATION for Test N through Step 8.

Connection

9	Set ENQ-CSA-NOT RDY switch to ENQ.	
10	Depress CLEAR key.	On DSTU— CONT and CSA (LED) light.
11	Key class-of-service 555, one route digit (1), 7-digit office code, and station number of digital line circuit under test, followed by ETB.	On DSTU— Display reads F. CONT and IDLE (LED) light. ***Note:*** Disregard II display, if shown.
12	Depress RESET button.	On DSTU— CONT and IDLE (LED) light. At KS-20908 receiver— The following BYTE PATTERN (LED) lights if data rate speed is: 56 k/b—1, 2, 5, and 6 (LED) light. Subrate—2, 5, and 7 (LED) light. ***Note:*** This indicates idle signal from station.

Answer

13	At KS-20909 transmitter— Operate the eight BYTE ENCODER switches to the following positions (SYN control code): b_1 b_2 b_3 b_4 b_5 b_6 b_7 b_8 0 0 1 1 0 1 0 0	
14	On DSTU— Depress CLEAR key.	On DSTU— CONT and SYN (LED) light. ***Note:*** This verifies that line circuit is in the test mode.

STEP	ACTION	VERIFICATION
15	If no further testing is required, restore all switches and remove all patch cords and dummy plugs at 950B testboard and KS-20808 and KS-20809 receiver and transmitter.	
DIGITAL TEST LINE CIRCUIT		
1	Complete self-test procedures of digital signaling test unit (DSTU) and digital register-sender interface unit (DRSIU) described in Section 107-602-100, Digital Signaling Test Unit, and Section 551-563-305, Digital Register-Sender Interface Unit.	
2	Operate switch controls on DRSIU as follows: MODE to TST TRK DATA RATE to 56 or appropriate speed rate.	
3	At DSTU— (1) Set ENQ-CSA-NOT RDY switch to NOT RDY. (2) Depress INIT key. (3) Depress CLEAR key. (4) Depress CHK DIGIT key.	On DSTU— CONT and IDLE (LED) light.
4	Set ENQ-CSA-NOT RDY switch to ENQ.	On DSTU— CSA, CONT, and IDLE (LED) light. Display reads L.
Originate Call to Digital Test Line		
5	Key eleven digits on key pad, 000 (class of service), 0 (route), XXX (office code), and YYYY (test line number), followed by ETB.	On DSTU— CSA, IDLE, and ETB (LED) light. Display momentarily reads F followed by)00 --- 00II.
6	Set TRANSMIT switch to BYTE ALN/DATA.	
7	Depress CLEAR key.	On DSTU— ENQ and DATA (LED) light.
8	Digital test line is in loopback mode. Key random digits (eg, 7654321) on key pad.	On DSTU— Display reads same digits as those keyed on key pad.
9	On DSTU— Set MODE switch to DSTU.	BUSY LED on CP HL-107 extinguished, inicating test line release and circuit restored to normal.

STEP	ACTION	VERIFICATION

DIAL TONE SPEED MEASURING CIRCUIT

This test must be conducted during a light office load on the system since an entire vertical group will be taken out of service. To reduce the outage time, it is recommended that the test be read through and thoroughly understood before being performed.

1 In the line unit where the dial tone speed measuring circuit is to be inserted, verify that the strap, located on the rear of the digital line unit on TS 1 between terminals 47 and 48, has been cut and that CP HL-101 is removed. (See following note.)

Note: The line circuit location (line 16) on the line unit in which the dial tone speed measuring circuit appears must be modified per SD-73095 (Note 217), Issue 1.

2 Remove dial tone speed measuring circuit board CP HL-108 inserted in place of CP HL-100, in line circuit location 16 on digital line unit.

3 On circuit board CP HL-108—
(1) Set recycle time switch S3 (rocker-type switch) to desired time. (Recycle time interval can vary from 9.5 to 121.5 seconds in 16-second increments.) (Refer to Table B and Note 1 in VERIFICATION column.)
(2) Set speed interval switch S2 (rocker-type switch) to desired time. (Time can vary from 1 to 8 seconds in 1-second increments.) (Refer to Table C and Note 2 in VERIFICATION column.)

Note 1: The recycle interval timer determines the number of times each test is to be conducted.

Note 2: The speed interval timer determines the time allowed for the decoder-marker to connect a digital register-sender to the dial tone speed circuit. The speed interval is included within the recycle time interval. For a description of the operation of the dial tone speed measuring circuit refer to Section 981-664-101.

4 Reinsert dial tone speed measuring circuit board CP HL-108 into location 16 on digital line unit, in slot usually occupied by CP HL-100.

Originating Call

5 At decoder-marker connector bay—
Block nonoperated VGS- relay associated with vertical group containing dial tone speed circuit under test.

Note: Before performing Step 6, coordinate the test with the centralized Traffic Engineer

STEP	ACTION	VERIFICATION
	so that any data input into the pollable data terminal can be ignored.	
6	At digital line unit— Operate start switch S1 located on upper part of faceplate of dial tone speed measuring circuit board (line circuit 16).	At traffic register location, when provided— (a) Observe that T message register has scored, indicating test has been made. (b) Observe that D message register has scored, indicating number of times register-sender failed to connect. (c) Observe register scores on D register against time set on switch and number of tests conducted (T register) against time set on switch. Refer to Tables B and C. When T and D message registers are not provided— KS-14510 volt-ohm-milliammeter, or equivalent, may be used to observe ground on T and D leads on terminal strip at rear of line unit as follows: (a) Observe momentary ground on T lead on pin 36 of TS 1 on rear of line unit, indicating test has been made. (b) Observe momentary grounds on D lead on pin 35 of TS 1 on rear of line unit, indicating number of times register-sender failed to connect. (c) Observe number of momentary grounds on D lead against time set on switch and number of momentary grounds on T lead against time set on switch. Refer to Tables B and C.
7	At digital line unit— Release start switch S1 on faceplate of dial tone speed measuring circuit board.	
8	At decoder-marker connector bay— Remove blocking tool (placed in Step 5) from VGS- relay. ***Note:*** The S2A, S2B, and S2C switches must be in the position indicated to obtain the desired speed interval.	

TABLE B

RECYCLE INTERVAL IN SECONDS	SWITCH S3A	SWITCH S3B	SWITCH S3C
9.5	Released	Released	Released
25.5	Operated	Released	Released
41.5	Released	Operated	Released
57.5	Operated	Operated	Released
73.5	Released	Released	Operated
89.5	Operated	Released	Operated
105.5	Released	Operated	Operated
121.5	Operated	Operated	Operated

Note: The S3A, S3B, and S3C switches must be in the position indicated to obtain the desired recycle interval.

TABLE C

SPEED INTERVAL IN SECONDS	SWITCH S2A	SWITCH S2B	SWITCH S2C
1	Released	Released	Released
2	Operated	Released	Released
3	Released	Operated	Released
4	Operated	Operated	Released
5	Released	Released	Operated
6	Operated	Released	Operated
7	Released	Operated	Operated
8	Operated	Operated	Operated

Note: The S2A, S2B, and S2C switches must be in the position indicated to obtain the desired speed interval.

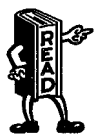
6. LINE CIRCUIT TROUBLE DIAGNOSIS

6.01 Troubleshooting the line circuit is simplified by the use of trouble indicators on specific circuit packs (CP) and of a centralized point to receive alarms. These serve to indicate the bay containing trouble, and to notify the office of the severity of the alarm condition.

6.02 After the defective equipment has been located, troubleshooting is further simplified by use of the CP replacement method.

6.03 If the tests described in Part 5 fail to meet requirements, or if a specific trouble is encountered or suspected (eg, originating line circuit will not disconnect by receiving IDLE from station), the diagnostic troubleshooting procedures shown in Table D may be performed.

6.04 When substituting CPs (as shown in Table D) to isolate a trouble and the replacement CP ***does not*** clear the trouble, ***do not*** leave the replacement CP in place. ***Put the original CP back in the unit.***



In all cases, when the substitution of CPs clears the alarm or fault, or when the trouble comes clear, note the actions on a trouble memo for future reference.

6.05 Table D shows the tests, the failures, and the probable line CPs or other digital circuits that have a relationship to the failure. The information provided in Table D aids in isolating possible troubles by changing out CPs only. These CPs are listed as the probable trouble cause and not necessarily grouped in the order in which they must be changed.

6.06 If a trouble condition cannot be cleared by the procedures outlined in Table D, and the associated SDDS equipment has been found to be functioning properly, a careful check of wiring and cabling should be made.

6.07 When the procedures outlined in this section fail to clear the line circuit trouble, the aid of Data Technical (DATEC) Support should be requested through lines of supervision.

6.08 Section 010-521-100 describes the objectives and operation of DATEC Support. The primary objective of DATEC Support is to improve data communications services by bringing data service problems to the attention of technical personnel through the use of mandatory escalation procedures. Section 010-521-101 lists the DATEC Support Designees in all the Bell System associated companies and Long Lines areas.

Exercise caution when changing out CPs HL-104, HL-105, and HL-106 in order to minimize service interruptions on lines not directly associated with the line in trouble. The proper method of changing out these CPs is outlined in 6.09, 6.10, and 6.11.

6.09 ***HL-104—Common Relay CP:*** This CP provides the relay circuitry for five line circuits (Fig. 3). This CP should not be removed from the line unit ***until all associated lines are in the idle state*** (ie, the OFF-HOOK LEDs on the faceplates of the HL-100 CPs are extinguished). This CP should be replaced only after CPs HL-100 and HL-101 of the affected line circuit have been replaced and the trouble is still present.

6.10 When the affected circuit in CP HL-104 is determined to be defective and the CP must be replaced, ***tests must be performed to ascertain that the other four relay circuits in the replacement CP are operative.*** Perform all of Test B and perform Test I through Step 11 for the other four line circuits associated with the replacement CP.

Before making these tests, follow local procedures to obtain customer approval or to notify the customer that the affected line is being taken out of service.

6.11 ***HL-105 and HL-106—Common Clock CPs:*** These CPs provide the timing circuitry for all ten line circuits in an associated shelf (Fig. 3). These CPs should not be removed from the line unit ***until all associated lines are in the idle state.*** These CPs should be replaced only when ***the clock alarms are present or after CPs HL-100, HL-101, and HL-104 have been replaced and the trouble has not been cleared.***

TABLE D

DIGITAL LINE CIRCUIT – TROUBLE DIAGNOSIS

TEST	STEP NO.	INDICATED FAILURE (NO LED OR IMPROPER DISPLAY)	CIRCUIT PACK
A. Digital Line Unit Clock Alarm—Failure and Transfer	All	CLK ALM LED on HL-105	HL-105, HL-106
B. Originating Call—Connection to Digital Test Line Circuit From Digital Line Circuit	7	CONT and IDLE LED	HL-100,* HL-101,* HL-105, HL-106
	9	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	10	)F followed by repetitive ::::	HL-100,* HL-101,* or inoperative digital register-sender or digital test line
	12	DATA and CSA LED	
C. Originating Line Disconnects by Receiving Idle From Station—Digital Line Circuit	7	CONT and IDLE LED	HL-101*
	9	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	10	)F followed by repetitive ::::	HL-100,* HL-101,* or inoperative digital register-sender or digital test line
	12	DATA and CSA LED	
	15	CONT and IDLE LED	HL-100,* HL-101*
	16	No alphanumeric display	Faulty test equipment
D. Originating Line Disconnects by Receiving Not Ready From Station – Digital Line Circuit	7	CONT and IDLE LED	HL-101*
	9	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	10	)F followed by repetitive ::::	HL-100,* HL-101,* or inoperative digital register-sender or digital test line
	12	DATA and CSA LED	
	15	CONT and IDLE LED	HL-100,* HL-101*
	16	No alphanumeric display	Faulty test equipment

*When trouble is supsected in these CPs, verify that the screw and/or DIP switches are in the correct option position as shown in Fig. 3. When replacing these CPs with a substitute, set the screw and/or DIP switches on the substitute CP to the correct option position as shown in Fig. 3.

TABLE D (Cont)

DIGITAL LINE CIRCUIT – TROUBLE DIAGNOSIS

TEST	STEP NO.	INDICATED FAILURE (NO LED OR IMPROPER DISPLAY)	CIRCUIT PACK
E. Originating Line Disconnects by Receiving Abnormal Station Code (ASC) From Station—Digital Line Circuit	6	CONT and IDLE LED	HL-101,* HL-105, HL-106
	8	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	9	)F followed by repetitive ::::	HL-100,* HL-101,* or inoperative digital register-sender or digital test line
	10	Control code—IDLE CODE LED (on KS-20908 receiver)	HL-100,* HL-101*
F. Originating Call to Check Call Progress Code Indications—Digital Line Circuit	7	CONT and IDLE LED	HL-101,* HL-105, HL-106
	9	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	10	Repetitive)30 (invalid code)	HL-100,* HL-101,* or inoperative digital register-sender
	12	CONT and IDLE LED	HL-100,* HL-101*
G. Originating Call From Terminate Only Digital Line Circuit	7	CONT and IDLE LED	HL-101,* HL-105, HL-106
	8	CONT and IDLE LED; No CSA LED	HL-100*
H. Originating Call to Digital Line Circuit—Load Control Test	6	LD relay does not operate	Faulty LD relay, incorrect wiring, or open fuse in line position 10 or 11
	8	CONT and IDLE LED	HL-101,* HL-105, HL-106
	10	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	11	)F followed by repetitive)10 (station busy)	HL-100,* HL-101,* or inoperative digital register-sender
	13	CONT and IDLE LED	HL-101,* HL-105, HL-106
	14	CONT and CSA LED	HL-100,* HL-101,* HL-104*
	16	CONT and IDLE LED	HL-101,* HL-105, HL-106
	17	CONT and IDLE LED, then CSA after approximately 6 seconds	HL-100,* HL-101,* or blown or missing —48 volt fuse in line position 10 or 11

*When trouble is supsected in these CPs, verify that the screw and/or DIP switches are in the correct option position as shown in Fig. 3. When replacing these CPs with a substitute, set the screw and/or DIP switches on the substitute CP to the correct option position as shown in Fig. 3.

TABLE D (Cont)

DIGITAL LINE CIRCUIT – TROUBLE DIAGNOSIS

TEST	STEP NO.	INDICATED FAILURE (NO LED OR IMPROPER DISPLAY)	CIRCUIT PACK
I. Terminating Call—Connection and Answer—Digital Line Circuit	10	CONT and CSA LED	Digital trunk circuit used for test trunk may be defective. See Section 551-562-500 for trunk tests.
	11	F followed by repetitive)00 (remote ring)	HL-100,* HL-101,* HL-104,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	12	56 Kb/s — BYTE PATTERN LEDs 1, 2, 5, 7 or subrate — BYTE PATTERN LEDs 2, 5, 7 (on KS-20908 receiver)	HL-100,* HL-101,* HL-104,* HL-105, HL-106
	14	DATA and IDLE LED	HL-100,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
J. Terminating Call—Disconnect by Going Control Mode—Idle	10	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
	11	F followed by repetitive)00 (remote ring)	HL-100,* HL-101,* HL-104,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	12	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
		56 Kb/s — BYTE PATTERN LEDs 1, 2, 5, 7 or subrate — BYTE PATTERN LEDs 2, 5, 7 (on KS-20908 receiver)	HL-100,* HL-101,* HL-104,* HL-105, HL-106
	14	DATA and IDLE LED	HL-100,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests
	15	Control code—IDLE CODE LED (on KS-20908 receiver)	HL-100,* HL-101*

*When trouble is supsected in these CPs, verify that the screw and/or DIP switches are in the correct option position as shown in Fig. 3. When replacing these CPs with a substitute, set the screw and/or DIP switches on the substitute CP to the correct option position as shown in Fig. 3.

TABLE D (Cont)

DIGITAL LINE CIRCUIT – TROUBLE DIAGNOSIS

TEST	STEP NO.	INDICATED FAILURE (NO LED OR IMPROPER DISPLAY)	CIRCUIT PACK
K. Terminating Call—Disconnect by Going Not Ready	10	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
	11	F followed by repetitive)00 (remote ring)	HL-100,* HL-101,* HL-104,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	12	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
		56 Kb/s — BYTE PATTERN LEDs 1, 2, 5, 7 or subrate — BYTE PATTERN LEDs 2, 5, 7 (on KS-20908 receiver)	HL-100,* HL-101,* HL-104,* HL-105, HL-106
	14	DATA and IDLE LED	HL-100,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	15	Control code—IDLE CODE LED (on KS-20908 receiver)	HL-100,* HL-101*
L. Originating or Terminating Call—Disconnect on Receipt of NUL (From Switch)	10	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
	11	F followed by repetitive)00 (remote ring)	HL-100,* HL-101,* HL-104,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	12	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
		56 Kb/s — BYTE PATTERN LEDs 1, 2, 5, 7 or subrate — BYTE PATTERN LEDs 2, 5, 7 (on KS-20908 receiver)	HL-100,* HL-101,* HL-104,* HL-105, HL-106

*When trouble is supsected in these CPs, verify that the screw and/or DIP switches are in the correct option position as shown in Fig. 3. When replacing these CPs with a substitute, set the screw and/or DIP switches on the substitute CP to the correct option position as shown in Fig. 3.

TABLE D (Cont)

DIGITAL LINE CIRCUIT – TROUBLE DIAGNOSIS

TEST	STEP NO.	INDICATED FAILURE (NO LED OR IMPROPER DISPLAY)	CIRCUIT PACK
L. Originating or Terminating Call—Disconnect on Receipt of NUL (From Switch) (Cont)	14	DATA and IDLE LED	HL-100,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	15	Control code—IDLE CODE LED (on KS-20908 receiver)	HL-100,* HL-101*
M. Terminating Call—Digital Line Circuit Tests Busy	10	CONT and CSA LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
	11	F followed by repetitive)10 (station busy)	HL-100,* HL-104,* inoperative digital register-sender, or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
N. Terminating Call—Digital Line Circuit Responds to Test Code	10	CONT and CSA LED	Digital trunk circuit used for test trunk may be defective. See Section 551-562-500 for trunk tests.
	11	CONT and IDLE LED — Display reads F	HL-100,* HL-101,* HL-104,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	12	56 Kb/s — BYTE PATTERN LEDs 1, 2, 5, 7, or subrate — BYTE PATTERN LEDs 2, 5, 7 (on KS-20908 receiver)	HL-100,* HL-101,* HL-104,* HL-105, HL-106
	14	CONT and SYN LEDs	HL-100,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
Digital Test Line Circuit	3	CONT and IDLE LED	Digital trunk circuit used for test trunk defective. See Section 551-562-500 for trunk tests.
	4	CONT, CSA, and IDLE LED and repetitive L	
	5	CSA, IDLE, and ETB LED and F followed by repetitive)00II	HL-107, HL-104,* or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.

*When trouble is supsected in these CPs, verify that the screw and/or DIP switches are in the correct option position as shown in Fig. 3. When replacing these CPs with a substitute, set the screw and/or DIP switches on the substitute CP to the correct option position as shown in Fig. 3.

TABLE D (Cont)

DIGITAL LINE CIRCUIT – TROUBLE DIAGNOSIS

TEST	STEP NO.	INDICATED FAILURE (NO LED OR IMPROPER DISPLAY)	CIRCUIT PACK
Digital Test Line Circuit (Cont)	7	DATA and ENQ LED	HL-107, or trunk used for test trunk defective. See Section 551-562-500 for trunk tests.
	8	Keyed digits on display	HL-107
	9	BUSY LED on faceplate of HL-107 extinguishes	
Dial Tone Speed Measuring Circuit	6	TMR register DMR register	HL-108

*When trouble is supsected in these CPs, verify that the screw and/or DIP switches are in the correct option position as shown in Fig. 3. When replacing these CPs with a substitute, set the screw and/or DIP switches on the substitute CP to the correct option position as shown in Fig. 3.