

**DATA SET 109H-TYPE  
USED IN A DATA LINE CONCENTRATOR SYSTEM  
TEST PROCEDURES**

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provides an operational test of the system. For additional information on testing the Data Line Concentrator as a system, refer to the BSP entitled 10-Type Data Line Concentrator System (DLCS)—Maintenance Procedures (591-810-300).

**1.03** All tests used in this section can be used independently since each test is complete and does not depend upon the results or performance of any preceding test. Some of the tests given in this practice overlap and thereby provide more than one method of checking the data equipment. When this is the case, the test to be used is left to the discretion of the telephone craft employee and depends on the available test equipment. Due to this overlap, not all of the tests will be required or needed; therefore, only those tests necessary to locate a trouble condition should be made.

**1.04** A suggested sequence of testing, to locate or isolate a trouble condition, is given in the section entitled Data Set 109H-Type—Used in a Data Line Concentrator System—Maintenance Procedures (591-037-301). By using the sequence of testing recommended by the maintenance section, unnecessary testing can be avoided.

**1.05** In order to perform the following tests, a telephone company employee will have to be dispatched to the station. In some cases, a double dispatch is necessary when assistance is required at the concentrator- or trunk-side station.

**1. GENERAL**

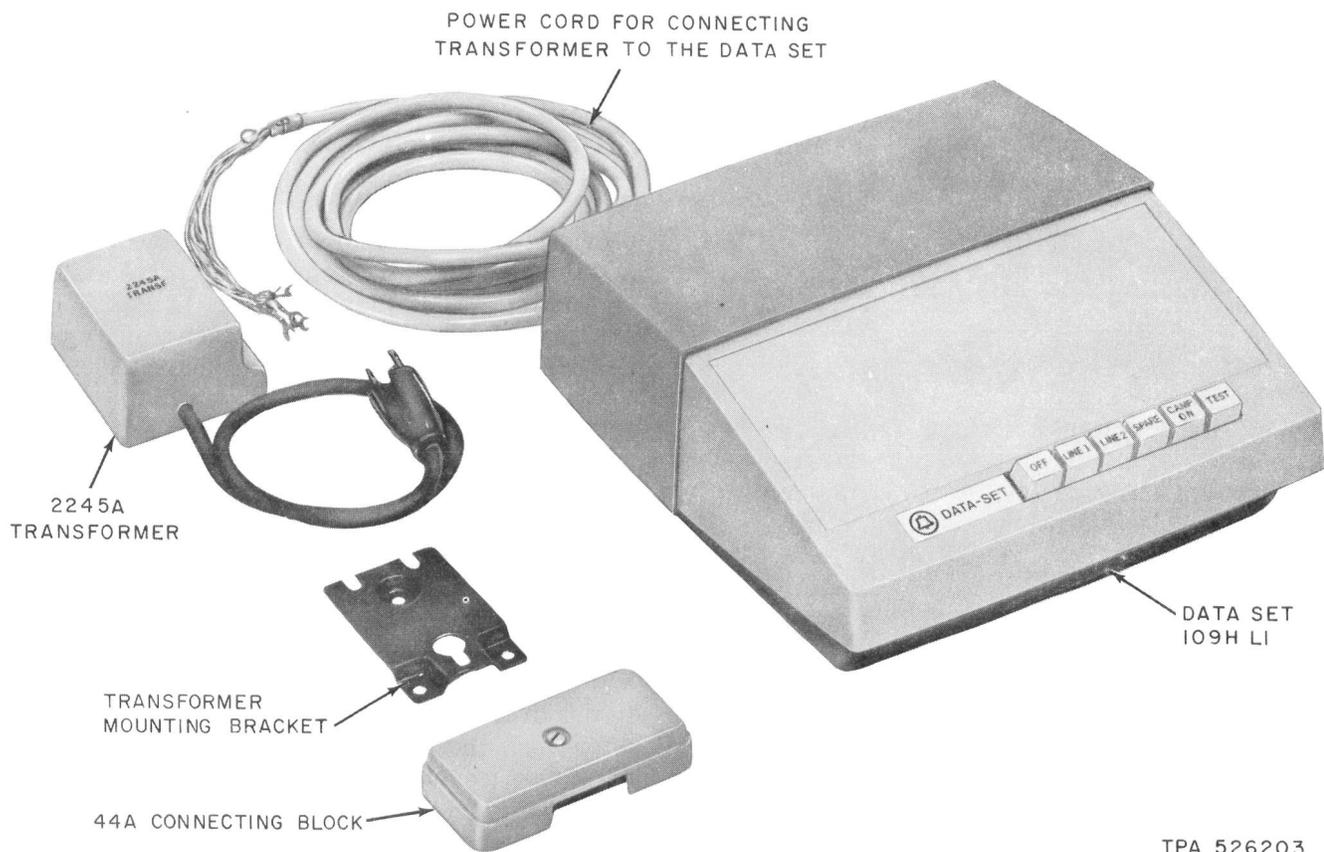
**1.01** This practice provides information on testing the Data Set 109H-type (Fig. 1) when it is used as part of the Data Line Concentrator System. The test procedures are designed to verify that the data set is operative and to aid in locating and clearing a trouble condition.

**1.02** These test procedures are not intended as a test of the business machine or customer-provided terminal (CPT). When it is necessary to make a check of the CPT, the customer should be requested to verify that his equipment is operating properly. No attempt is made to verify that the operation of the concentrator or trunk-side equipment is acceptable, except for a loop-back test which

**2. TEST EQUIPMENT**

**2.01** In addition to the normal maintenance tools and equipment carried by craft employees, the following equipment will be required to perform the tests given in this section.

- 911A Data Test Set (DTS) (J-79911A)
- 901B-L3 Data Test Set cover (used as an interface test adapter)



TPA 526203

Fig. 1—Data Set 109H-L1

- KS-14510-L1 volt-ohm-milliammeter or equivalent
- W1AD cord, 4 feet 7 inches long, equipped with one 35 cord tip and one 27 Mueller test clip with 29 Mueller insulator, black (used for connection of the interface test adapter and 911A DTS), or equivalent
- W1BB cord, 2 feet long, equipped with one KS-19531-L2 connector and one 30 Mueller test clip with No. 32 insulator (used for connection of the interface test adapter to the 911A DTS), or equivalent—2 required.

### 3. TEST PROCEDURES

#### LINE RESISTANCE MEASUREMENTS AND TEST

**Note:** The line current test can be substituted for the following line resistance test. Since

it is not necessary to perform both tests, the test used is left to the discretion of the telephone craft employee.

**3.01** This test checks the resistance of the line from the Data Set 109H to the 10-type concentrator or, in the case of remote service, to the hub data set. Information is provided in this test to determine if a change in line resistance is appreciable, thereby requiring corrective action. This test will also indicate that the line is not shorted or open.

**3.02** Measure the line resistance as follows.

**Note:** This procedure requires a telephone company employee at the concentrator or, in the case of remote service, at the hub data set to complete the test.

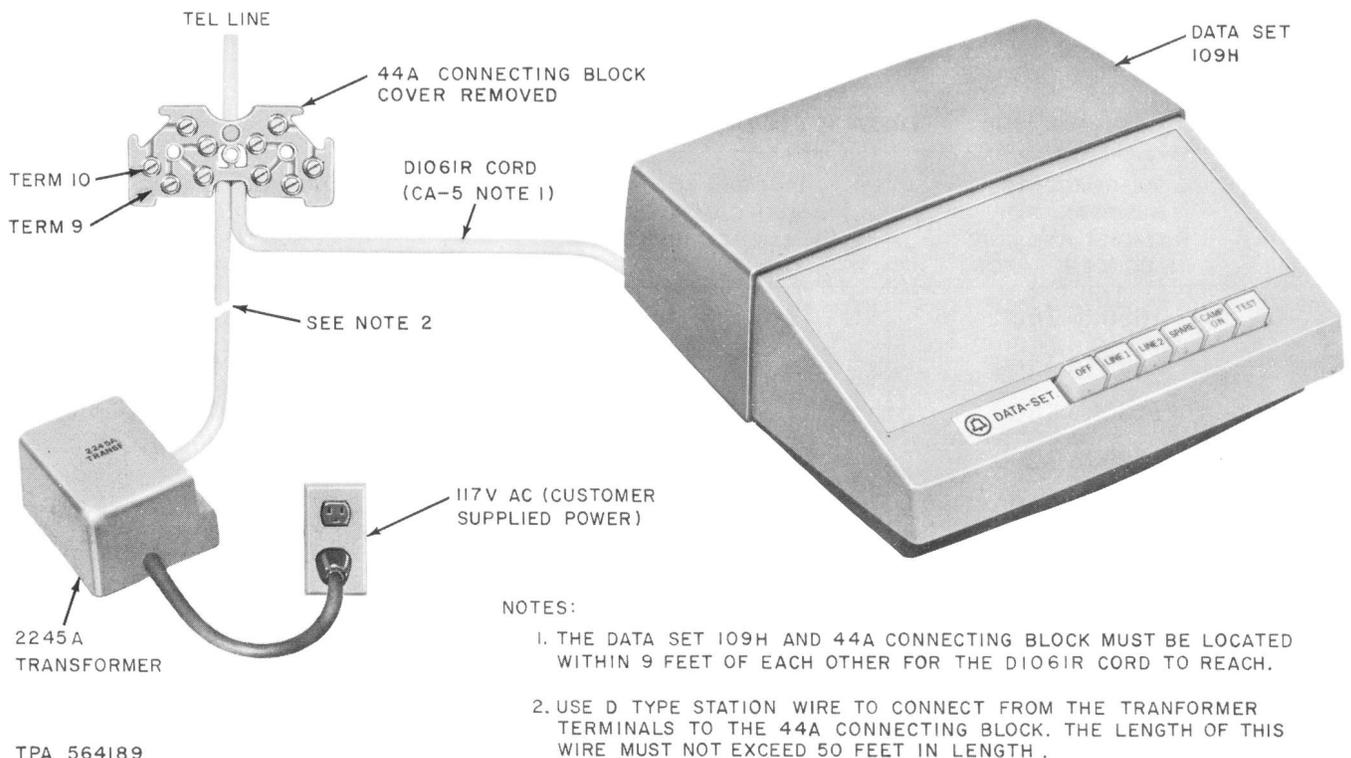
- (1) Obtain access to the data set line terminal connections by removing the cover on the 44A connecting block. The line connections are made to terminals 9 and 10 (Fig. 2).
- (2) Establish voice communications with the telephone company employee at the concentrator or for remote service, at the hub.
- (3) Request that the line be shorted at the concentrator.
- (4) Remove one side of the line from the data set terminal block (44A connecting block).
- (5) Use a KS-14510-L5 volt-ohm-milliammeter or equivalent to measure the line resistance.
- (6) Record the resistance measured in (5).

**Note:** If an open indication was obtained in the previous steps, verify that the line is shorted at the far end. An open indication with the line shorted indicates that the line has gone open and must be replaced. If line

resistance has decreased, a short circuit condition should be suspected. To check for a short, both ends of the line will have to be disconnected. The line should then be open when tested unless a short exists.

- (7) Compare the measured resistance with the resistance shown on the line order or circuit order card. If the resistance has not changed an appreciable amount, the line can be considered acceptable. See the following note for a definition of an appreciable change.

**Note:** An appreciable change in resistance is any amount that causes the total resistance between Data Sets 109-type to exceed a nominal 2000 ohms (2500 ohms for extended range HDX). The Data Set 109H line pads may be adjusted to compensate for changes in line resistance (refer to Section 591-037-201). If the change in resistance cannot be compensated for by adjustment of the line pads, the line will have to be repaired or replaced.



**Fig. 2—Typical Data Set 109H-Type Installation Showing The Line Terminals of The 44A Connecting Block**

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**3.03** After completion of the preceding test, request that the line be reconnected or the short removed from the far end and that the data set be restored to operating condition at this time.

**3.04** When the line has to be replaced, refer to the section entitled Data Set 109H-Type—Used in a Data Line Concentrator System—Installation and Connections (591-037-201) for information on setting the line pad resistance.



***Make sure the polarity of the line has not been reversed at the data set or concentrator.***

**3.05** An alternate procedure that does not require a telephone company employee at the concentrator verifies the pad and line resistance by measuring the camp-on signal current. This method can be used only when a camp-on signal can be obtained from the concentrator.

- (2) Connect a KS-14510-L5 volt-ohm-milliammeter (or equivalent) in series with the line.
- (3) Set the KS-14510-L5 volt-ohm-milliammeter to measure milliamps.
- (4) Operate the LINE 1 key.
- (5) Record the indicated loop current (if meter deflects down-scale, reverse the polarity of meter to obtain current reading).
- (6) Determine the combined resistance of the data set pads and the line from the service order and/or circuit order layout card.
- (7) Compare the camp-on current measured in (5) with the value given by Table A. An out-of-limit value indicates either a change in line resistance or abnormal signal from the data set. Either of these conditions will require corrective action be taken to clear the trouble condition.
- (8) Disconnect all test equipment and restore the line and data set to service.

- (1) Remove the cover of the 44A connecting block to obtain access to the line terminals (terminals 9 and 10, Fig. 2).

**TABLE A**

**DATA SET LOOP CURRENT ADJUSTMENTS**

APPROXIMATE RESISTANCE OF DATA SET AND LINE TO CONCENTRATOR	LINE PAD ADJUSTMENT WITH CAMP-ON SIGNAL LOOP CURRENT (mA)	LINE PAD ADJUSTMENT WITH SHORT CIRCUIT AT CONCENTRATOR LOOP CURRENT (mA)
1650 to 1500	1.6 to 1.8	2.2 to 2.4
1550 to 1400	1.7 to 1.85	2.3 to 2.5
1450 to 1300	1.75 to 2.0	2.4 to 2.7
1350 to 1200	1.85 to 2.1	2.6 to 2.9
1250 to 1100	2.0 to 2.2	2.8 to 3.1
1150 to 1000	2.1 to 2.4	3.0 to 3.3
1050 to 900	2.25 to 2.55	3.2 to 3.6
950 to 800	2.4 to 2.75	3.4 to 3.9
850 to 700	2.6 to 3.0	3.7 to 4.3
750 to 600	2.85 to 3.3	4.1 to 4.8
650 to 500	3.1 to 3.7	4.5 to 5.4
550 to 400	3.5 to 4.2	5.0 to 6.2

**LINE CURRENT TEST**

**Note:** The line resistance test and voltage test can be substituted for the following line current test. Since it is not necessary to perform each test, the line current test is provided as an alternate method of testing the data set and line.

**3.06** This test checks the ability of the data set to provide an acceptable request for service to the concentrator or a signal to the hub data set and associated transmission equipment.

**3.07** In order to evaluate the line current test and thereby determine if the data set is operating properly, the line must have been proved good by previous testing. When the line is known good, failure of this test indicates a probable malfunction of the data set.

**3.08** Perform the following steps to make a line current test.

**Note:** The following procedure requires a telephone company employee at the local station and the concentrator (or for remote service, at the hub).

- (1) Remove the cover from the 44A connecting block to gain access to the line terminals (terminals 9 and 10, Fig. 2).
- (2) Connect a KS-14510-L5 volt-ohm-milliammeter (or equivalent) in series with the line.
- (3) Set the KS-14510-L5 volt-ohm-milliammeter to measure milliamps.
- (4) Establish voice communication with the telephone company employee at the concentrator and request that the line for the station under test be shorted.
- (5) Operate the LINE 1 key.
- (6) Record the indicated loop current. If the meter deflects down-scale, reverse the polarity of the meter to read the current.
- (7) Determine the combined resistance of the data set pads and line. The line resistance can be obtained from the service order or the line can be shorted and the resistance measured.

(8) Compare the loop current measured in (6) with the value given in Table A. An out-of-limit value indicates either a change in line resistance or an abnormal data set signal.

(9) Restore the line and data set to operating condition.

**VOLTAGE TEST**

**3.09** The voltage test checks the ability of the data set to provide an acceptable mark and space voltage. Perform the following steps to check the data set mark and space voltage.

- (1) Remove the cover from the 44A connecting block to gain access to the line terminals.
- (2) Open the line by removing one side of the line from the terminal block (with terminal 9 or 10, Fig. 2).
- (3) Connect the positive lead of the KS-14510-L5 volt-ohm-milliammeter (or equivalent) to terminal 10 and the negative lead to terminal 9, and set the meter to measure voltage.
- (4) Operate the LINE 1 key and have a mark signal provided by the terminal equipment. The marking voltage should be from 4.0 to 4.6 volts.

**Note:** Spacing voltage is opposite in polarity to a mark therefore the meter polarity must be changed to measure the spacing voltage.

- (5) With a space signal provided by the terminal equipment, the spacing voltage should be between 12.0 and 14.0 volts and opposite in polarity to a mark.
- (6) After a check of the mark and space voltages indicate the station is operating properly, the line is reconnected, and the station is placed in operation.

**STATION TEST****Slicing Level Test**

**3.10** The slicing level of the data set and the ability of the data set to recognize the

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marking and spacing signals can be checked as follows:

- (1) Verify that the data set is conditioned for space crossover shift (Refer to 591-037-201).
- (2) Remove one side of the line from the 44A connecting block (terminal 9 or 10 shown by Fig. 2).
- (3) Depress the LINE 1 key.
- (4) The CAMP-ON lamp should light when the LINE 1 key is depressed.

**Note:** With an open line the mark from the data set is seen as a space due to the crossover shift, thereby causing the CAMP-ON lamp to light. With the data set conditioned for mark crossover shift, the CAMP-ON lamp will remain off.

### Loop Around Test

**3.11** A loop around test of the data set can be performed by establishing a connection with another FDX Data Set 109-type. The data set being tested will operate the LINE 1 key and TEST key at the same time. This will loop back the data set so any signal sent to the station can be received and retransmitted back for the sending location to monitor. This method of testing checks the data set independently of the operation of the CPT.

### LOOP-BACK DISTORTION TEST USING THE DATA SET TEST KEY AND 911A DATA TEST SET

**3.12** The Data Set 109H is equipped with a TEST key that provides for loop-around testing.

This test can only be made from a trunk-side data station after a connection is forced at the concentrator. Due to the difficulty of making this test, it is performed only when it is necessary to check the overall system by a loop-back distortion test.

**3.13** When the line data set is placed in the test mode, the following conditions exist.

- The send circuits of the CPT are isolated from the data set.
- The data set is conditioned for full-duplex operation to enable loop-back testing.
- The data set is conditioned to receive the incoming signal, loop it through the data set, and retransmit the signal to the line.
- The CPT will receive the incoming signal.

**Note:** The loop-back test procedure requires three telephone company employees since an employee will be required at the line station, concentrator, and trunk station. When making a test on a remote installation, the loop-back test can be made at the hub or transmission facility; however, a complete system loop-back from the trunk station to the line-side station tests all the associated system components and is therefore a more complete test. Initiation and coordination of the test procedure will be the responsibility of the telephone company employee at the trunk-side data station.

STEP	ACTION	VERIFICATION
1	At the 27A1 Data Unit associated with the trunk-side data set being used for this test, the following action must be taken. Disconnect the customer-provided terminal (CPT) interface cable from the connector of the data set.	
2	Make the connections indicated in Fig. 3.	
3	Operate the controls on the TEST SENTENCE GENERATOR section of the 911A DTS as indicated in Table B.	

STEP	ACTION	VERIFICATION
4	Operate the controls on the DISTORTION MEASURING SET section of the 911A DTS as indicated in Table C.	<b>Note:</b> When performing this test, take the proper steps to ensure the customer is not billed for test calls. Refer to the section entitled Crediting Charges on Test Calls (010-250-001).

TABLE B

## 911B DATA TEST SET – CONTROL SETTINGS

CONTROL	SETTING
BIAS	0
DIST 5%	0
DIST 1%	0
BAUDS	Rate provided by terminal equipment (Note)
CODE	Code used by terminal equipment
OUTPUT	EIA
AUTO-MAN-STEP	MAN
All other	OFF

**Note:** Next higher standard Bell System speed may be used.

STEP ACTION VERIFICATION

TABLE C

911C DATA TEST SET – CONTROL SETTINGS

CONTROL	SETTING
INPUT	EIA
DIST %	0
BAUDS	Rate provided by terminal equipment (Note)
CODE	Code used by terminal equipment
PK-PIP	PK
PARITY	OFF
POLARITY	+
FILTER	OUT

*Note:* Next higher standard Bell System speed may be used.

- 5 Operate the POWER switch on the 911A DTS to the ON position. POWER lamp lights on the 911A DTS.
- 6 Using a nearby telephone, call the line station and inform the station that the trunk station has performed the operations required for making this test. *Note:* The telephone company employee at the concentrator must be instructed to force the test call to the trunk station used for this test. (Refer to Sections 591-811-500 and 591-811-501.)
- 7 Initiate a call from the line station being tested by depressing the LINE 1 key. The LINE 1 key lights.
- 8 At the line station while holding the LINE 1 key depressed, depress the TEST key. The LINE 1 key remains lighted and the TEST key lights. The TTY will now receive incoming signals from the line. *Note:* The trunk-side data set is now looped back through the line-side data set providing for an end-to-end test. This test must be made from the trunk-side data station using the 911A DTS as indicated in the following steps.
- 9 At the trunk station, set the AUTO. MAN. STEP switch to AUTO. This switch is located

STEP	ACTION	VERIFICATION
	on the TEST SENTENCE GENERATOR (TSG) section of the 911A DTS.	
10	Operate both of the RESET switches. There is a RESET switch on both the TSG and the distortion measuring set (DMS).	At the line station end, the test message (FOX...) should be received error free. The measured distortion should not exceed 15 percent.
11	Disconnect all test equipment and return all stations to service.	
<b>3.14</b>	The telephone company employee at the trunk station should inform the line station of the results of this test and the percentage distortion that was measured. If the distortion exceeds 15 percent request assistance in clearing the trouble through proper lines of authority.	<ul style="list-style-type: none"> <li>● 10-Type Data Line Concentrator System (DLCS)—Description (591-810-100)</li> <li>● 10-Type Data Line Concentrator System (DLCS)—Maintenance (591-810-300)</li> <li>● 10-Type Data Line Concentrator (591-811-Series).</li> </ul>
<b>3.15</b>	System operation may be checked by operating the line station to verify that it will connect, send, and receive. A test sentence such as "FOX" can be used to check the trunk station and customer equipment receiving capability.	
<b>4. REFERENCES</b>		
<b>4.01</b>	For additional information on the Data Set 109H-type and the associated Data Line Concentrator System, refer to the following:	
	<ul style="list-style-type: none"> <li>● SD- &amp; CD-1D220-01—Data Systems Station Data Set 109H-type</li> </ul>	

TRUNK STATION CONNECTIONS

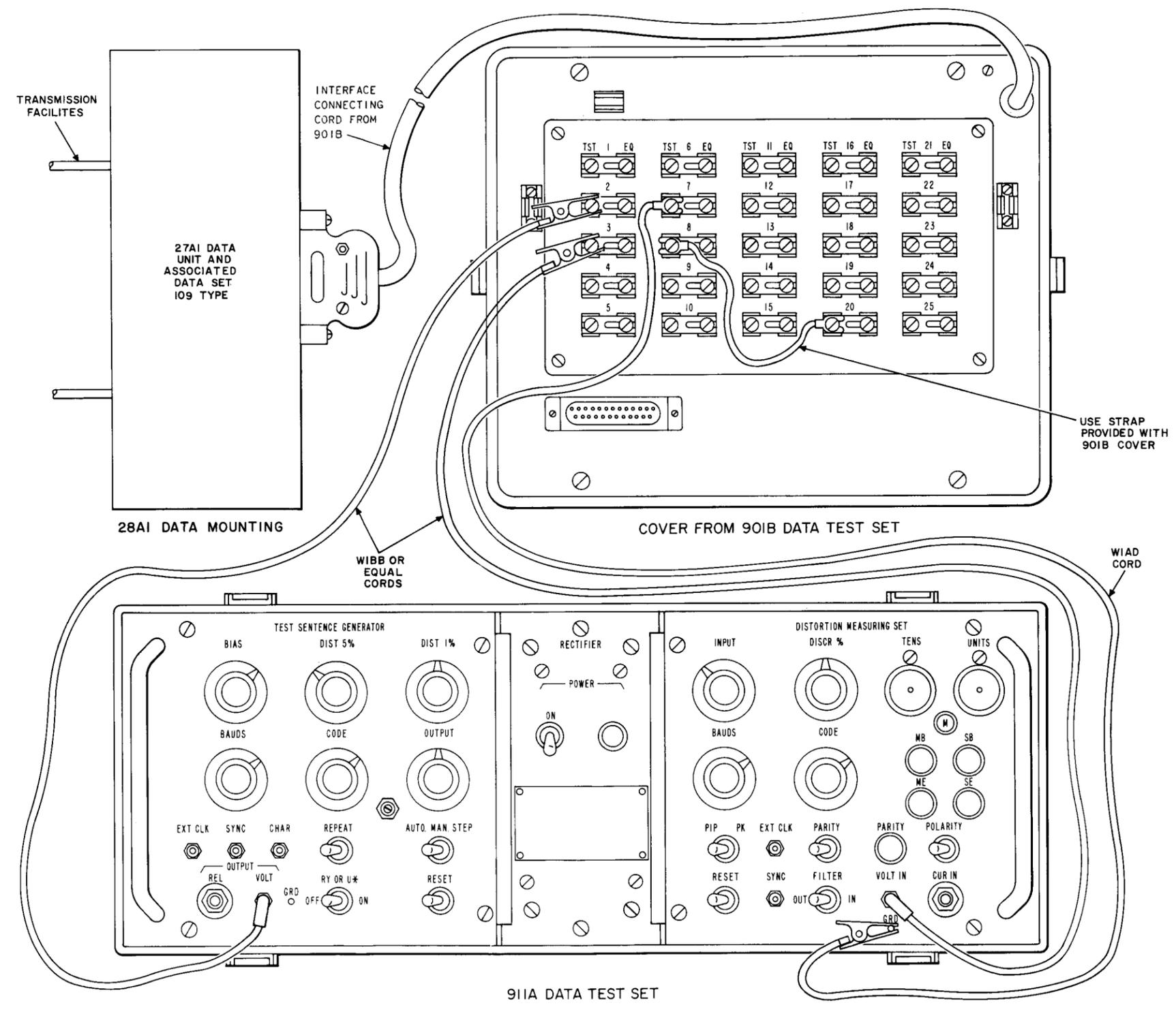


Fig. 3—Loop-Back Distortion Test Using The Data Set Test Key and a 911A Data Test Set