

**DATA SET 109E-TYPE
SINGLE PRIVATE LINE STATION
USING DATA AUXILIARY SET 820D-TYPE
TEST PROCEDURES**

	CONTENTS	PAGE
1. GENERAL	1
2. APPARATUS	2
3. METHODS	2
A. Power Supply Test	2
B. Loop Resistance Test	4
C. Loop Current Test	4
D. Data Set Voltage Test	5
E. Circuit Pack Exchange Procedure	5
F. Loop-Back Test (Station-to-Station Arrangement)	6
G. Loop-Back Test (Station-to-Hub Arrangement)	10
H. End-to-End Test	10

1. GENERAL

1.01 This section describes suggested test procedures to be used when troubleshooting Data Set 109E-type Single Private Line Station using Data Auxiliary Set 820D-type.

1.02 A data station, as described in this section, consists of Data Set 109E-type, AR17 circuit pack, and Data Auxiliary Set (DAS) 820D-type, exclusive of any Bell System- or customer-provided terminal (CPT) equipment. Procedures for testing the data station terminal equipment may be obtained from the customer or from the appropriate Field Maintenance Practice (FMP).

1.03 Individual components such as circuit packs, cords, etc, are tested by the overall performance of the data station. Only the 18A power supply and transmission line are tested separately.

1.04 Tests covered in this section are:

A. Power Supply Test: This test measures the +24V and -24V from the DAS power supply.

B. Loop Resistance Test: This test measures resistance values of the transmission loop.

C. Loop Current Test: This test verifies that the loop current is acceptable when both the local and remote stations are in the marking condition.

D. Data Set Voltage Test: This test verifies that the data set is applying a proper marking voltage to the transmission loop.

E. Circuit Pack Exchange Procedure: This test verifies the operation of the data station and eliminates the data set and AR17 circuit pack as the source of trouble.



In order to perform Tests C, F, G, and H, it is necessary to have the remote station (station-to-station arrangement) or local station (station-to-hub arrangement) installed.

F. Loop-Back Test (Station-to-Station Arrangement): This test checks the distortion level of a data set loop in the station-to-station arrangement. It also checks the ability to transmit and receive data in the full-duplex (FDX) mode.

SECTION 591-036-502

G. Loop-Back Test (Station-to-Hub Arrangement):

This test checks the distortion level of a data set loop in the station-to-hub arrangement and the ability to transmit and receive data in the FDX mode of operation.

H. End-to-End Test:

This test verifies proper transmission and receiving capabilities of a station-to-station arrangement.

1.05 These tests should be performed in accordance with the maintenance philosophy and troubleshooting procedure outlined in the section entitled Data Set 109E-Type—Single Private Line Station—Using Data Auxiliary Set 820D-Type—Maintenance Procedures (591-036-302).

1.06 Each test outlined in this section may be performed separately or in conjunction with other test procedures to verify station operation or to locate a trouble condition. Successful completion of the preceding test is not a prerequisite for the following test to be valid unless otherwise indicated in this section.

1.07 A letter, *a, b, c*, etc, is added to the step number in Part 3 of this section to indicate an action which may or may not be required, depending on local conditions. The condition under which a lettered step should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a given test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 Test apparatus required for each individual test may be found in Table A. The number in parenthesis following each item of Table A refers to one of the following descriptive paragraphs.

STEP	ACTION	VERIFICATION
-------------	---------------	---------------------

A. Power Supply Test

- 1 Visually inspect the power source for the DAS or TTY and ensure that power is properly connected to the data station.
- 2 Remove DAS cover or gain access to the DAS.

2.02 The 911A Data Test Set is the J79911A DTS (Section 103-813-100).

2.03 The interface test adapter is a 901B-L3 DTS which is the cover of the 901B DTS (Section 107-100-100).

2.04 KS-20538-L1 volt-ohm-milliammeter, or equivalent (Section 100-502-101).

2.05 Data Set 109E-type, spare (Section 591-036-100).

2.06 AR17 circuit pack, spare.

2.07 2W6A cord, 10 feet long, equipped with one 310 plug and two alligator clip ends with insulator, green. This cord will plug into the OUTPUT REL jack only (used for current interface).

2.08 2W7A cord, 9 feet 6 inches long, equipped with one 347-type plug and two alligator clip ends with insulator, green. This cord will plug into the CUR IN. JACK only (used for current interface).

2.09 W1AD cord, 4 feet 7 inches long, equipped with one 35 cord tip and one 27 Mueller test clip with insulator, black (used for EIA interface).

2.10 W1BB cord, 2 feet long, equipped with one KS-19531-L2 plug and one Mueller No. 30 test clip with one 32 Mueller insulator, black (used for EIA interface).

3. METHODS

3.01 The following test procedures are suggested to test Data Set 109E-type Single Private Line Station. These suggested procedures are to be used in conjunction with Section 591-036-302.

TABLE A
DATA SET 109E-TYPE TEST EQUIPMENT

APPARATUS	TEST A	TEST B	TEST C	TEST D	TEST E	TEST F		TEST G	TEST H	
						LOCAL STATION	REMOTE STATION		LOCAL STATION	REMOTE STATION
911A Data Test Set (2.02)	—	—	—	—	—	1 ea	—	SEE	1 ea	1 ea
Interface Test Adapter (2.02)	—	—	—	1 ea	—	1 ea	—		1 ea	1 ea
Meter (2.04)	1 ea	1 ea	1 ea	1 ea	—	—	—		—	—
Data Set 109E Type (2.05)	—	—	—	—	1 ea	—	—		—	—
AR17 Circuit Pack (2.06)	—	—	—	—	1 ea	—	—	NOTE	—	—
Cord (2.07) <i>Note 1</i>	—	—	—	—	—	1 ea	—		1 ea	1 ea
Cord (2.08) <i>Note 1</i>	—	—	—	—	—	1 ea	—		1 ea	1 ea
Cord (2.09) <i>Note 2</i>	—	—	—	1 ea	—	1 ea	—		1 ea	1 ea
Cord (2.10) <i>Note 2</i>	—	—	—	—	—	2 ea	—	3	1 ea	1 ea

Note 1: Used for current interface only.

Note 2: Used for EIA interface only.

Note 3: All equipment required for this test is supplied by the hub performing the test.

STEP	ACTION	VERIFICATION
3	Condition VOM to measure +24V dc.	
4	Connect the + lead of VOM to TB1 terminal 25.	
5	Connect the — lead of VOM to TB1 terminal 24.	Meter indicates +21 to +27V dc.
6	Disconnect VOM leads.	
7	Connect the + lead of VOM to TB1 terminal 24.	
8	Connect the — lead of VOM to TB1 terminal 26.	Meter indicates +21 to +27V dc.
9	Disconnect VOM leads.	
10	End of test.	

SECTION 591-036-502

STEP	ACTION	VERIFICATION
B. Loop Resistance Test		
1	Instruct the hub or remote station to disconnect, and tag the incoming transmission loop.	
2a	If the system is a station-to-station arrangement— At the remote station— Instruct the telephone company (TELCo) employee to short the incoming transmission leads.	
3a	Condition the VOM to measure resistance (R X 1K scale).	
4a	Connect the leads of the VOM to the incoming transmission leads.	Meter indicates resistance value of loop per circuit layout record card.
		<i>Note:</i> If the loop resistance has changed appreciably from the resistance shown on the circuit layout record card, refer to Section 591-036-202 and reset the line pads of the data set as required. An appreciable change is a change that requires compensation by adjusting the line pads or repairing the transmission loop.
5b	If the system is a station-to-hub arrangement— At the local station— Short the transmission leads.	
6b	Instruct the hub to measure the resistance of the loop.	Meter indicates resistance of loop per circuit layout record card (See note of Step 4a).
7	Being careful to observe proper polarity, reconnect all transmission leads.	
8	End of test.	

C. Loop Current Test



The local and remote stations must be connected and in the marking condition to perform the following test.

- 1 Condition VOM to measure 12 mA dc.
- 2 Disconnect the transmission lead from TB1 terminal 1 of DAS.
- 3 Connect the negative (–) lead of VOM to TB1 terminal 1 of the DAS.

STEP	ACTION	VERIFICATION
4	Connect the positive (+) lead of VOM to the disconnected transmission lead.	Meter indicates +3.0 to +3.2 mA dc.
5	Disconnect VOM leads and connect transmission lead to terminal 1 on DAS.	
6	End of test.	

D. Data Set Voltage Test

1	Remove cover of DAS or gain access to Data Set 109E-type.	
2	Condition VOM to measure 12V dc.	
3	Connect the positive (+) lead of VOM to test point (TP) 10 of Data Set 109E-type.	
4	Connect the negative (–) lead of VOM to TP11 of Data Set 109E-type.	Meter indicates +4.0 to +4.6V dc.
5	Disconnect VOM leads.	
6	Disconnect the CPT interface cable from J3 of the DAS.	
7	Plug the end of the interface test adapter connector cord into J3 of the DAS.	
8	Connect the cord tip end of the W1AD cord to terminal 9 of the interface test adapter.	
9	Connect the test clip end to terminal 2 of the interface test adapter.	
10	Condition VOM to measure 60V dc.	
11	Connect the –VOM lead to TP10 of Data Set 109E-type.	
12	Connect the +VOM lead to TP11 of Data Set 109E-type.	Meter indicates +12.0 to +14.0V dc.
13	End of test; Disconnect test leads and return station to service.	

E. Circuit Pack Exchange Procedure

1	Remove cover or gain access to the DAS.
---	---

SECTION 591-036-502

STEP	ACTION	VERIFICATION
2	Remove the AR17 circuit pack, replace the circuit pack with the good spare, and set all the proper options.	Station operation is normal. <i>Note:</i> If station operation is <i>not</i> normal, proceed to Step 3.
3	Replace the old AR17 circuit pack in the DAS.	
4	Remove Data Set 109E-type and replace it with a spare that is known to be good, set the proper options, and adjust to proper line pad resistance.	Station operation is normal. <i>Note:</i> If station operation is <i>not</i> normal, proceed to Step 5.
5	Remove the AR17 circuit pack and again replace it with the good spare.	Station operation is normal. <i>Note:</i> If station operation is <i>not</i> normal, proceed to Step 6.
6	Replace both the old Data Set 109E-type and the AR17 circuit pack. <i>Note:</i> If station operation is <i>not</i> normal, request aid from the immediate supervisor.	
7	End of test.	

F. Loop-Back Test (Station-to-Station Arrangement)

Local Data Station

- 1 Disconnect the CPT interface cable from J3 of the DAS.
- 2 Plug the end of the interface test adapter connector cord into J3 of DAS.
- 3 Ensure all shorting bars of the interface test adapter are closed.
- 4a If the data station is arranged for **EIA** interface—
Connect the spade-tip end of W1AD cord to terminal 7 of interface test adapter.
- 5a Connect the alligator clip end of the first W1BB cord to terminal 2 of the interface test adapter.
- 6a Connect the alligator clip end of the second W1BB cord to terminal 3 of interface test adapter.

STEP

ACTION

VERIFICATION

TABLE D
CURRENT INTERFACE SETTINGS OF TSG*

CONTROL	SETTING
BIAS	0
DIST 5%	0
DIST 1%	0
BAUDS	Rate provided by terminal equipment
CODE	Code used by terminal equipment
OUTPUT	REL
AUTO. MAN. STEP	MAN.
All other	OFF

*Part of 911A DTS

TABLE E
CURRENT INTERFACE SETTINGS OF DMS*

CONTROL	SETTING
INPUT	REL
DIST %	0
BAUDS	Rate provided by terminal equipment
CODE	Code used by terminal equipment
AUTO. PK PIP	PK
PARITY	OFF
POLARITY	+
FILTER	OUT

*Part of 911A DTS

SECTION 591-036-502

STEP	ACTION	VERIFICATION
21	Apply power to the 911A DTS, set the AUTO. MAN. STEP switch to AUTO., and operate the RESET keys of the Distortion Measuring Set (DMS) and the Test Set Generator (TSG).	
22	Move the AUTO. PK PIP switch to PIP, then back to PK.	DMS indicates less than 10 percent distortion. <i>Note:</i> If the data station is arranged for current interface— TTY repeatedly prints out "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 1234567890 TESTING" error free. (Each test message will be preceded by two carriage returns, a rubout character, and a line feed.)
23	Operate the RESET key of the DMS and repeat Step 22.	See verification of Step 22.
24	Remove power from 911A DTS and disconnect all test leads.	
25	End of test; return station to normal operation.	

G. Loop-Back Test (Station-to-Hub Arrangement)

1	At the <i>hub</i> Instruct the hub operator to measure distortion in a loop-back test to the station.	
2	Call the local station and request the attendant to operate the TEST key of the DAS 820D-type.	
3	At the <i>hub</i> — DMS indicates 15 percent or less distortion.	
4	At the <i>hub</i> — Repeat test.	Indication on DMS remains 15 percent or less distortion.
5	End of test.	

H. End-to-End Test

Local Station End

1	Disconnect the CPT interface cable from J3 of DAS.
2	At the interface test adapter— Connect the plug of the interface test adapter connector cable to J3 of DAS.
3	Ensure all shorting bars are closed.

STEP	ACTION	VERIFICATION
4a	If the data station is arranged for current interface— At the interface test adapter— Open shorting bar on terminal 2.	
5a	Connect the CPT interface cable to the jack of the interface test adapter.	
6a	Connect the alligator clip end of 2W6A cord to terminal EQ 2.	
7a	Connect the other alligator clip end of the 2W6A cord to terminal 10.	
8a	At the 911A DTS— Connect the plug of 2W6A cord to OUTPUT REL jack of TSG.	
9a	Operate the controls in accordance with Table D of Test F.	
10b	If the local station is arranged for EIA interface— At the interface test adapter— Connect the alligator clip end of W1BB cord to terminal 2.	
11b	Connect the alligator clip end of W1AD cord to terminal 7.	
12b	At the 911A DTS— Plug the terminal end of W1BB cord into OUTPUT VOLT jack.	
13b	Connect the alligator clip end of W1AD cord to the ground post adjacent to the OUTPUT VOLT jack.	
14b	Operate the controls in accordance with Table B of test F.	
<i>Remote Station End</i>		
15	At the DAS— Disconnect the CPT interface cable from J3 of DAS.	
16	Connect the plug of the interface test adapter connector cord to J3 of DAS.	
17	Ensure all shorting bars are closed.	

SECTION 591-036-502

STEP	ACTION	VERIFICATION
18a	If the data station is arranged for current interface— At the interface test adapter— Connect the plug of CPT interface cable to jack on interface test adapter.	
19a	Open shorting bar on terminal 3.	
20a	Connect one alligator clip end of 2W7A cord to terminal TST 3.	
21a	Connect the other alligator clip end of 2W7A cord to terminal EQ 3.	
22a	At the 911A DTS— Connect the plug of 2W7A cord to CUR IN. jack of DMS.	
23a	Operate controls of DTS in accordance with Table E of Test F.	
24b	If data station is arranged for EIA interface— At the interface test adapter— Connect alligator clip end of W1AD cord to terminal 7.	
25b	Connect alligator clip end of W1BB cord to terminal 3.	
26b	At the 911A DTS— Connect the other alligator clip end of the W1AD cord to the ground post adjacent to the VOLT IN. jack.	
27b	Plug the terminal end of the W1BB cord into the VOLT IN. jack.	
28b	Operate the controls in accordance with Table C of Test F.	
29	Apply power to 911A DTS, set the AUTO. MAN. STEP switch to AUTO., and operate the RESET key of the DMS.	
30	At the <i>local station</i> — Apply power to the 911A DTS, set the AUTO. MAN. STEP switch to AUTO., and operate the RESET key of TSG.	
31	At the <i>remote station</i> — Move the AUTO. PK PIP switch to PIP, then to PK.	At the remote station— DMS indicates less than 10 percent distortion.

STEP	ACTION	VERIFICATION
		<p><i>Note:</i> If the system is arranged for current interface— TTY will print "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 1234567890 TESTING" error free. (Each test message will be preceded by two carriage returns, a rubout character, and a line feed.)</p>
32	Operate the RESET key of DMS and repeat Step 31.	Same as verification of Step 31.
33	Remove power from both 911A DTSs.	
34	At the <i>remote station</i> — Perform Steps 4a through 14b.	
35	Apply power to 911A DTS, set the AUTO. MAN. STEP switch to AUTO., and operate the RESET switch of the TSG.	
36	At the <i>local station</i> — Perform Steps 18a through 28b.	
37	Apply power to 911A DTS, set the AUTO. MAN. STEP switch to AUTO. and operate the RESET switch of the DMS.	
38	Move the AUTO. PK PIP switch to PIP, then to PK.	DMS indicates less than 10 percent distortion.
39	Operate the RESET key of the DMS and repeat Step 38.	DMS indication remains less than 10 percent distortion.
40c	If 911A DTS is not used at the remote station— At the local station— Perform Steps 18a through 28b.	
41c	Apply power to 911A DTS, set the AUTO. MAN. STEP switch to AUTO., and operate the RESET switch of DMS.	
42c	At the <i>remote station</i> — Repeatedly transmit RU or Y*.	At the local station— DMS indicates 15 percent distortion.
43c	Operate the RESET key of DMS and repeat Step 42c.	DMS indication remains less than 15 percent distortion.
44c	At the <i>local station</i> — Remove power from 911A DTS	
45c	Perform Steps 4a through 14b.	

SECTION 591-036-502

STEP	ACTION	VERIFICATION
46c	Apply power to 911A DTS, set the AUTO. MAN. STEP switch to AUTO., and operate the RESET key of TSG.	At the remote station— TTY repeatedly prints out "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK 1234567890 TESTING" error free. (Each test message will be preceded by two carriage returns, a rubout character, and a line feed.)
47c	Remove power from 911A DTS.	
48	Disconnect all test leads at the local and remote stations and restore the stations to service.	

3.02 The following table summarizes the Loop-Back and End-to-End tests outlined in this section and is to be used as an aid to the telephone employee. The tests are described in detail in the parts F, G, H of METHODS (Part 3.)

SUMMARIZING TABLE

TYPE OF TEST	TEST NO.	DESCRIPTION	TRANSMISSION FORMAT	TRANSMITTED DISTORTION	ACCEPTABLE DISTORTION
LOOP BACK	F	Loop back at remote station with 911A DTS at the local station (a) Lettered steps for EIA interface (b) Lettered steps for CURRENT interface	FOX	0 PERCENT	Less than 10 percent
LOOP BACK	G	Loop back at local station with 911A DTS at hub	FOX	0 PERCENT	Less than 15 percent
END TO END	H	Local station to remote station with 911A DTS at both ends (a) Lettered steps for CURRENT interface (b) Lettered steps for EIA interface (c) Lettered steps for TTY at remote station instead of 911A DTS.	FOX	0 PERCENT	Less than 10 percent

NOTE: Transmission format and distortion requirements c lettered steps are as follows.

- | | | | |
|-----------------------------------|----------------------|-----------|----------------------|
| • Local station to remote station | FOX | 0 Percent | Error free fox |
| • Remote station to local station | Reversals (U* or RV) | 0 Percent | Less than 15 percent |

TRANSMITTING STATION

RECEIVING STATION

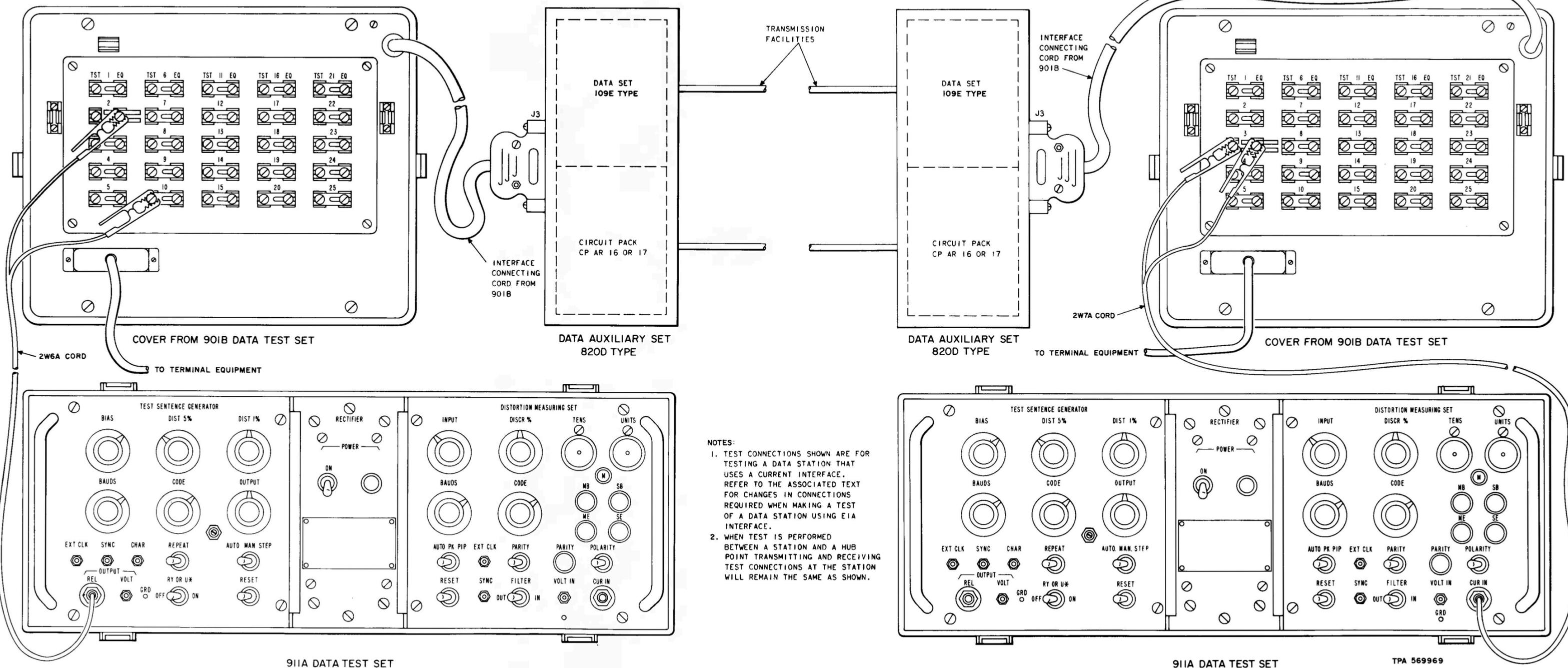


Fig. 1—End-to-End Test Using 911A Data Test Sets