

**DATA SET 402A
TRANSMITTER
TEST PROCEDURES**

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1. GENERAL

1.01 This section contains the test procedures to be used on Data Set 402A at time of installation and on repair visits. Before proceeding with any tests of the data set, verify the following:

- (a) Data loop has been tested and meets requirements as specified in the section entitled Data Systems—DATA-PHONE® Service, Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501).
- (b) Telephone portion of installation meets standard dc talk, signaling, and supervision requirements.
- (c) Data set strapping options agree with service order.



*Take necessary steps to ensure customer is not billed for test calls. Refer to the section entitled **Crediting Charges on Test Calls (010-250-001)**.*

1.02 This section is reissued for the following reasons:

- (a) To provide local interface tests using the 901B and 914B Data Test Sets (DTS)
- (b) To provide an improved end-to-Data Test Center (DTC) interface test using the 901B DTS
- (c) To provide an improved end-to-DTC interface test using the 914B DTS.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Tests contained in this section are divided into two parts. Part 2 contains tests to be performed at the time of installation and Part 3 contains tests to be performed during maintenance visits.

2. INSTALLATION TEST PROCEDURES

2.01 Tests contained in this part should be performed immediately after the data set has been installed to ensure that the installation is ready to be placed in service. In addition to these tests, the installer should whenever possible observe to assure that data can be transmitted and/or received using the business machines and data sets at both the near- and far-end data terminals.

2.02 Although these tests are primarily for use at time of installation, consideration should be given to their use during maintenance visits if the nature of the trouble indicates that this type of test would be useful. The tests to be performed will be determined by the type of test equipment available.

A. Ground Noise Test (901B Data Test Set)

2.03 This test should be performed to detect noise resulting from improper grounding arrangements. This noise may be a source of data errors. The interface test adapter provides a connection point for the 6A impulse counter.

2.04 The following test equipment is required for this test:

6A impulse counter, or equivalent

901B DTS test adapter

2.05 Test Procedure:

STEP	PROCEDURE
1	Establish test connections and perform test as shown in Fig. 1. <i>Requirement:</i> There should be no counts noted in a 15-minute period. <i>Remedial Action:</i> Should any counts be noted in a 15-minute period, grounding arrangements must be improved as described in the section entitled Data Set 402A Transmitter—Installation and Connection (594-016-200).
2	Remove all test connections and restore equipment to normal operating conditions.

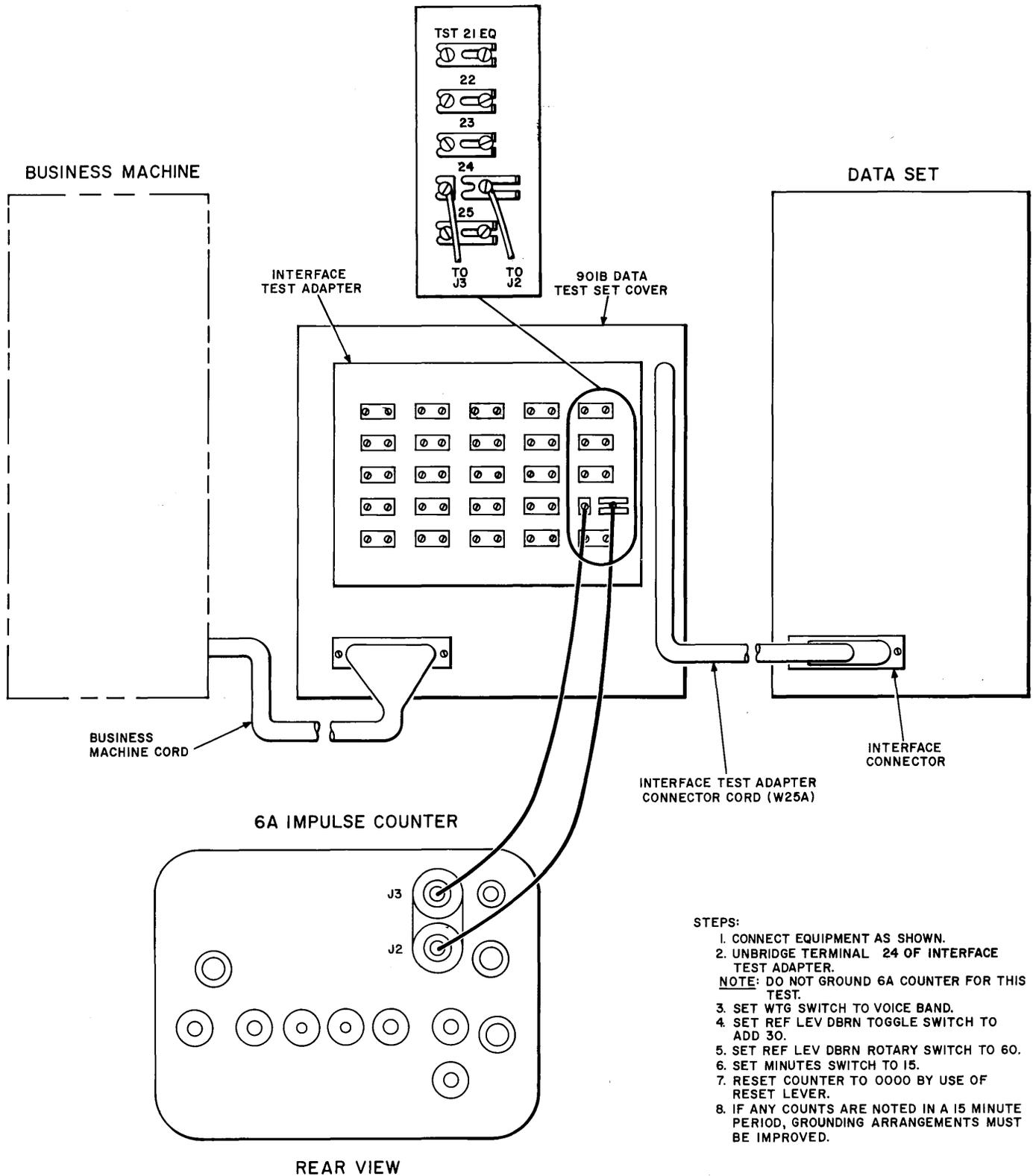


Fig. 1—Ground Noise Test Using 6A Impulse Counter and 901B Data Test Set Adapter

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B. Ground Noise Test (914B Data Test Set)

2.06 This test should be performed to detect noise resulting from improper grounding arrangements. This noise may be a source of data errors. The A and B selector switches on the 914B DTS provide a connection point for the 6A impulse counter.

2.07 The following test equipment is required for this test:

6A impulse counter, or equivalent

914B DTS.

2.08 Test Procedure:

STEP	PROCEDURE
1	<p>Establish test connections and perform test as shown in Fig. 2.</p> <p>Requirement: There should be no counts noted in a 15-minute period.</p> <p>Remedial Action: Should any counts be noted in a 15-minute period, grounding arrangements must be improved as described in the section entitled Data Set 402A-Type Transmitter—Installation and Connection (594-016-200).</p>
2	Remove all test connections and restore equipment to normal operating conditions.

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C. Power Supply Test (KS-14510 or KS-16979-L1 Volt-Ohm-Milliammeter)

2.09 The following procedure tests Data Set 402A power supply output voltage using a KS-14510 or KS-16979-L1 volt-ohm-milliammeter (VOM).

2.10 Test Procedure:

STEP	PROCEDURE
1	Remove the data set cover.
2	Connect the data set power cord to a 120-volt 60-Hz outlet, equipped with a 2012B transformer.
3	Take the data set handset off-hook and pull up the data key.
4	Using the VOM, place the red (+) lead on CPS-1 terminal G and the black lead on CPS-1 terminal V (see Fig. 3 for terminal location). The meter should indicate not less than 20 volts dc.
5	Remove all test connections and restore equipment to normal operating conditions.

D. Power Supply Test (914B Data Test Set)

2.11 The following procedure tests Data Set 402A-type power supply output voltage using the 914B DTS.

2.12 Test Procedure:

STEP	PROCEDURE
1	Remove the data set cover.
2	Connect both the data set power cord and the 914B power cord to 120-volt 60-Hz outlets. (The data set outlet must be equipped with a 2012B transformer.)
3	Take the data set handset off-hook and pull up the data key.
4	Operate the 914B switches and controls as follows: POWER switch—momentarily operate POLARITY switch—set to REV FUNCTION switch—set to VOLT/OHM EXT RANGE switch—set to DCV/30

STEP	PROCEDURE
5	Connect the red (+) and black (-) test leads furnished with the test set to the respective 914B METER INPUT terminals.
6	Place the red lead on CPS-1 terminal V and the black lead on CPS-1 terminal G (see Fig. 3 for terminal location.) The meter should indicate not less than 20 volts dc.
7	Remove all test connections and restore equipment to normal operating conditions.

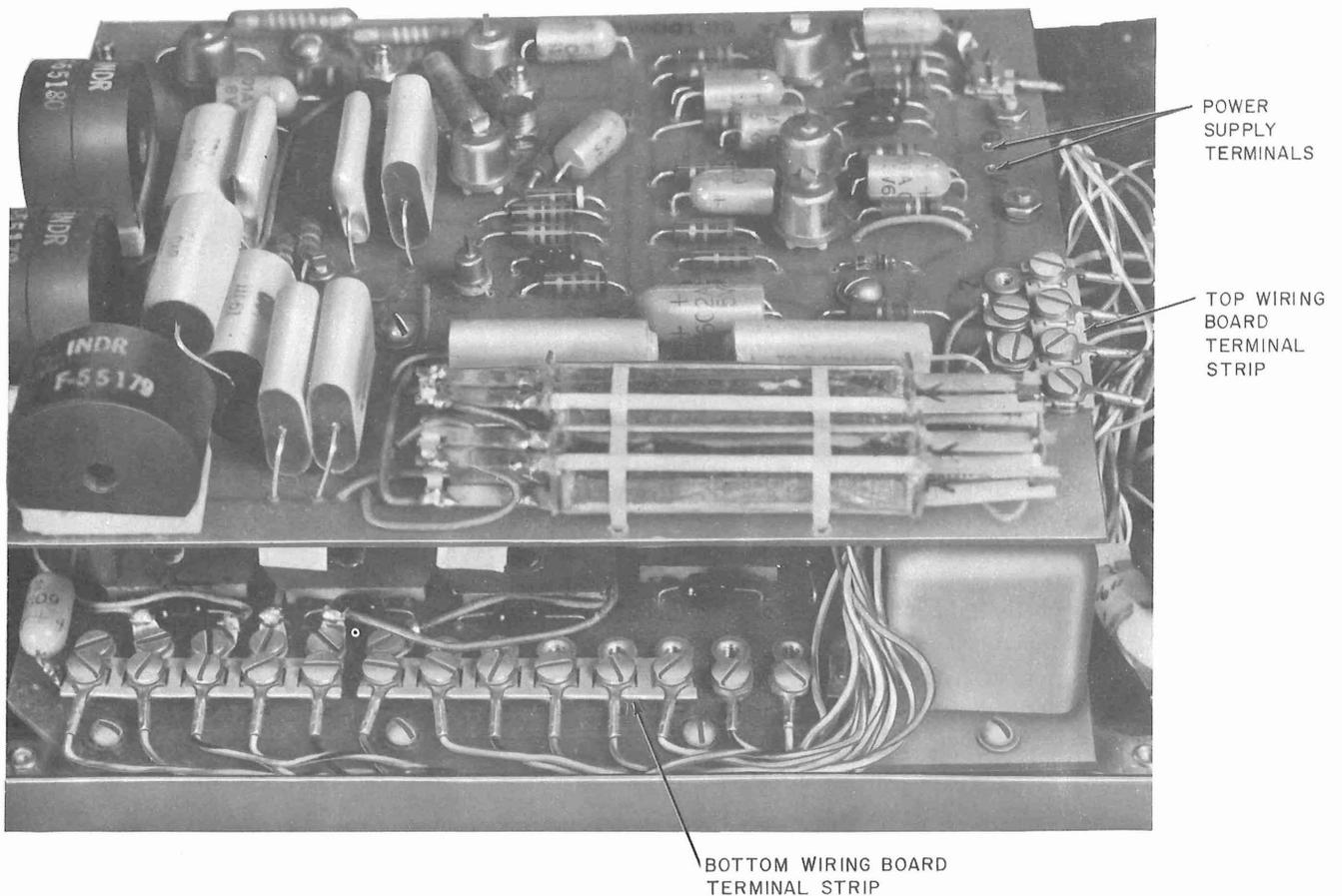


Fig. 3—Data Set 402A—Terminal Location

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E. Local Interface Test (901B Data Test Set)

2.13 This test verifies that that voice-frequency data signals are generated in response to signals applied to the customer interface.

2.14 The following test equipment is required for this test:

901B DTS

1011-type handset, or equivalent

2.15 Test Procedure:

STEP	PROCEDURE
1	Set the 901B DTS controls as follows: SELECTOR switch to 8 A TEST switch to 11 B TEST switch to OFF Toggle switch to ATT
2	Connect the data set interface cord to the interface test adapter.
3	Connect the 901B test set to the interface test adapter.
4	Disconnect tip and ring (green and red) data set mounting cord leads from the telephone line at the connecting block.
5	Lift telephone handset and pull up data key.
6	Connect the 1011-type handset across red and green data set mounting cord leads. Requirement: Multiple tone should be heard in the 1011-type handset. (These are the eight data channels and the timing space frequencies.)
7	Move the 1011-type handset to terminals C and D of the 901B DTS. Set the 1011-type handset key to MON.
8	Set the A TEST switch to position 2. An 800-Hz tone should be heard in the 1011-type handset (channel 1 space frequency).
9	Set the A TEST switch successively through positions 2 through 10. Requirement: Tones ascending in frequency should be heard in handset.
10	Disconnect all test equipment and restore to normal operating conditions.

F. Local Interface Test (914B Data Test Set)

2.16 This test verifies that voice-frequency data signals are generated in response to signals applied to the customer interface.

2.17 The following test equipment is required for this test:

914B DTS

2.18 Test Procedure:

STEP	PROCEDURE																								
1	Establish test connections and set 914B controls as shown in Fig. 4.																								
2	Program the 914B matrix by inserting shorting pins (red) as shown in Fig. 4.																								
3	Operate (depress) all A interface selector switches.																								
4	Connect a strap between TP1 and TP2 on the 914B.																								
5	Temporarily disconnect tip and ring (red and green) data set mounting cord leads from the telephone line at the connecting block.																								
6	Operate the 914B POWER switch.																								
7	Lift telephone handset and pull up data key.																								
8	Set FUNCTION switch to SPKR.																								
	Requirement: Multiple tones should be heard in the 914B loudspeaker. (These are the eight data channels and the timing channel space frequencies).																								
9	Insert nine additional shorting pins (red) in 914B matrix as follows:																								
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	Requirement: Each space tone should increase in frequency as each pin is inserted, until the nine frequencies and timing channel are set to the marking condition.																								
10	Disconnect all test equipment and restore to normal operating condition.																								

3. MAINTENANCE TEST PROCEDURES

3.01 Tests contained in this part are intended to be used as troubleshooting aids during maintenance visits. Use of the interface test should enable the tester to isolate the trouble to either the business machine or data set. Dynamic tests permit end-to-end testing of a data system allowing performance evaluation of the data set using the normal transmission facility. However, this test is so time-consuming it should only be performed as a last resort. A dynamic test to the serving data test center (DTC) from the remote data station will normally provide the degree of confidence needed. The tests to be performed will be determined by the kind of trouble encountered and the type of test equipment available. Data sets found to be defective should be tagged to indicate the nature of the trouble and returned to the Western Electric Company Distributing Houses for repair.

3.02 Detailed instructions are provided for the Telco employee in the left column. A summary of associated actions performed at the DTC is

shown in the right column to provide coordination and minimize testing time.

A. Interface Test with Data Test Center (901B Data Test Set)

3.03 This test verifies the accuracy of data signals sent from the data set in response to signals applied to the customer interface. The interface response to answer-back signals is also checked.

3.04 The following test equipment is required for this test:

901B DTS

1011-type handset, or equivalent

KS-14510 or KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent.

3.05 Test Procedure:

STEP	DATA STATION	DATA TEST CENTER
1	At 901B DTS— Set SELECTOR switch to 8. Set A TEST switch to 11. Set B TEST switch to OFF. Set toggle switch to ATT.	
2	Using telephone portion of data set, call <i>servicing</i> DTC and request DTC to perform an interface test, Section 668-104-520.	
3	Hang up.	DTC operator conditions test equipment to perform test.

Data Channels Test

4	When data station bell rings, lift handset and pull up data set data key. Allow DTC 5 minutes to perform level and frequency measurements.	DTC calls data station and checks space and timing channels using BFD method.
5	After 5-minute interval, depress data key. Requirement: Voice communication satisfactory.	DTC goes to talk mode and reports result of space frequencies test.

STEP	DATA STATION	DATA TEST CENTER
6	Arrange time interval required for DTC to measure each mark frequency. <i>Note:</i> Each data channel and the timing channel is placed in the marking condition as the A TEST switch is rotated through positions 2 through 9.	
7	Pull up data key.	DTC goes to test mode.
8	Set B TEST switch to 1.	
9	Rotate the A TEST switch through position 2 through 9, leaving the switch in each position for the time arranged in Step 6.	DTC checks mark frequency of the eight data and timing channels using BFD method.
10	Depress data key.	DTC goes to talk mode and reports results of mark frequencies test.
Answer-back Test		
11	At 901B DTS— Set SELECTOR switch to 8. Set A TEST switch to 12. Set B TEST switch to 2. Set toggle switch to UNATT.	DTC prepares to send 1152-Hz rest tone for specified time.
12	Condition VOM to read resistance (X10,000 scale)	
13	Connect VOM test leads to terminals C and D of 901B DTS. <i>Requirement:</i> VOM indicates 300,000 ohms.	
14	Set 1011-type handset key to MON.	
15	Connect handset across data line tip and ring.	
16	Pull up data key. <i>Requirement:</i> 1152 Hz heard in handset. VOM indication remains at 300,000 ohms.	DTC sends 1152 Hz.
17	Depress data key and report result of rest tone test.	DTC goes to talk mode and records results of rest tone test.

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STEP	DATA STATION	DATA TEST CENTER
18	<p>Pull up data key.</p> <p>Requirement: When 1017 Hz heard in handset, VOM indicates 200,000 ohms. When 2025 Hz heard in handset, VOM indicates 100,000 ohms. When 1785 Hz heard in handset, VOM indicates 0 ohms.</p>	DTC goes to test mode and sends 30 seconds each of 1017 Hz, 2025 Hz, and 1785 Hz.
19	Depress data key and report results of the answer-back channel tests.	DTC goes to talk mode and records results of answer-back tests.
20	Disconnect all test equipment and restore to normal operating conditions.	

B. Interface Test With Data Test Center (914B Data Test Set)

3.06 This test verifies the accuracy of voice-frequency data signals transmitted in response to signals applied to the customer interface. The interface response to answer-back is also checked.

3.07 The test equipment required for this test is as follows:

914B DTS



Test set switches not shown on the test connection diagram (Fig. 4) or not mentioned in text are not required for the test. Lamp indications not called for in the test are not pertinent and may be disregarded. Before making any test connections, ensure that all programming pins are removed from the 914B matrix. Insert only those pins shown in the test connection diagram (Fig. 4).

3.08 Test Procedure:

STEP	DATA STATION	DATA TEST CENTER
1	Establish test connections and set 914B controls as shown in Fig. 4.	
2	Program the 914B matrix by inserting shorting pins (red) as shown in Fig. 4.	
3	Operate (depress) all A interface selector switches.	
4	Connect a strap between TP1 and TP2 on the 914B.	
5	Operate 914B POWER switch.	
6	Using telephone portion of data set, call serving DTC and request DTC to perform interface test, Section 668-104-520.	
7	Hang up.	DTC operator conditions test equipment to perform test.

STEP	DATA STATION	DATA TEST CENTER																								
Data Channels Test																										
8	When data station bell rings, lift handset and pull up data key. Allow DTC 5 minutes to perform frequency and level measurements.	DTC calls data station and checks space frequencies and timing channel level using BFD method.																								
9	After 5-minute interval, depress data key.	DTC goes to talk mode and reports results of space frequencies test.																								
10	Request DTC to measure the nine mark frequencies.																									
11	Pull up data key.	DTC goes to test mode.																								
12	Insert nine additional shorting pins (red) in 914B matrix as follows:	DTC checks mark frequencies and timing channel using BFD method.																								
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13	After 5-minute interval, depress data key.	DTC goes to talk mode and reports results of mark frequencies test.																								
Answer-Back Test																										
14	Remove strap placed in Step 4 and strap TP2 and TP3.																									
15	Pull up data key.	DTC goes to test mode and sends 1152 Hz.																								
16	Set FUNCTION switch to SPKR.																									
	Requirement: 1152 Hz heard in 914B loudspeaker. DS1 remains off. DS2 remains off.																									
17	Depress data key and report results of rest tone test.	DTC goes to talk mode and records results of rest tone test.																								

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STEP	DATA STATION	DATA TEST CENTER
18	<p>Pull up data set data key.</p> <p>Requirement: When 1017 Hz heard in 914B loudspeaker, DS1 lights, DS2 remains extinguished. When 2025 Hz is heard in 914B loudspeaker, DS1 extinguishes, DS2 lights. When 1785 Hz heard in 914B loudspeaker, DS1 lights, DS2 remains lighted.</p>	DTC goes to test mode and sends 30 second each of 1017 Hz, 2025 Hz, and 1785 Hz.
19	Depress data key and report results of the three answer-back channels test.	DTC goes to talk mode and records results of answer-back channels test.
20	End of test. Disconnect all test equipment and restore to normal operating conditions.	

C. Dynamic Test (914B Data Test Set)

3.11 The following test equipment is required for this test:

914B DTS (2 required)

3.09 The dynamic test should be made only when it is necessary to identify facility troubles which the data set has been occasionally experiencing over a period of time. This test is made using two data stations remote from each other (end-to-end). A DTC equipped for testing Data Sets 402-type may act as a substitute for the receiving station during the test, if it can be assured that the suspected faulty facilities will be encountered. A number of calls may be required to obtain a connection involving the suspected faulty facility.



Test set switches not shown on the test connection diagram (Fig. 6) or not mentioned in text are not required for the test. Lamp indications not mentioned are not pertinent to the test and may be disregarded. Before making any test connections, ensure that all programming pins are removed from the 914B matrix. Insert only those pins shown in the test connection diagram (Fig. 6).

3.10 Figure 5 shows the type of overall arrangement to be made when performing an end-to-end test. The attendant at the transmit station establishes communications between the two stations by using the telephone portion of the data set.

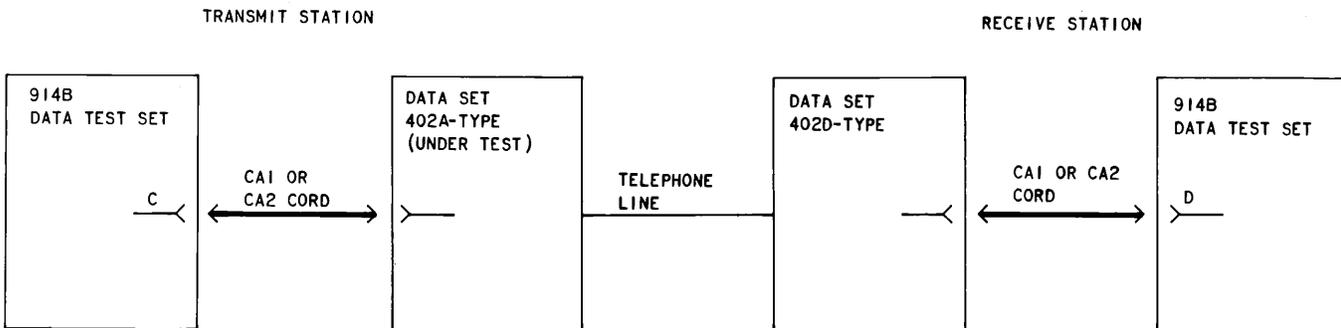


Fig. 5—Dynamic Test of Data Sets 402A and 402D-Type Using 914B Data Test Sets

3.12 Test Procedure:

STEP	TRANSMIT (Data Set 402A)	RECEIVE (Data Set 402D)
1	Establish test connections and set switches as shown in Fig. 6.	Establish test connections and set switches as shown in Fig. 6.
2	Program the 914B DTS matrix as shown in Fig. 6.	Program the 914B DTS matrix as shown in Fig. 6.
3	Operate POWER switch on 914B DTS.	Operate POWER switch on 914B DTS.
4	Establish communications as explained in 3.10.	Establish communications as explained in 3.10.
5	Pull up data key on Data Set 402A. On 914B DTS, strap TP1 and TP2.	Depress data set DATA key (goes into data mode). Set S4 switch on 914B DTS to ON.
6	5 seconds after data key is pulled up, set TEST MODE switch to ALL RDM.	Note when DS1 on 914B DTS lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate display counter RESET switch.
7	Transmit data for 6 minutes.	Time data reception 5 minutes and observe and record any errors displayed on 914B DTS counter.
8	After 6-minute transmission at the 914B DTS, remove strap placed in Step 5 and strap TP2 and TP3. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHAS switch to ADV.	When DS1 extinguishes, set S2 switch to ON and S4 switch to OFF. (This sends answer-back A to the transmitting station.)
9	When DS1 lights and DS2 extinguishes (indicates completion of first error test), remove strap placed in Step 8 and strap TP1 and TP2. After 5 seconds, set TEST MODE switch to ALL RDM.	Set S4 switch to ON and S2 switch to OFF. Note when DS1 lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate counter display RESET switch.
10	Transmit data for 6 minutes (second error test).	Time data reception 5 minutes. Observe and record any errors displayed on 914B DTS counter.
11	After 6-minute transmission, remove strap placed in Step 10 and strap TP2 and TP3. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHAS switch to RET.	When DS1 extinguishes, set S3 switch to ON and S4 to OFF. (This sends answer-back B to the transmitting station.)
12	When DS2 lights and DS1 extinguishes, remove strap placed in Step 11 and strap TP1 and TP2. After 5 seconds, set TEST MODE switch to ALL RDM.	Set S4 switch on ON and S3 switch to OFF. When DS1 lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate counter display RESET switch.
13	Transmit data for 6 minutes (third error test).	Time data reception 5 minutes. Observe and record any errors displayed on 914B DTS counter.

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STEP	TRANSMIT (Data Set 402A)	RECEIVE (Data Set 402D)
14	After 6-minutes transmission, remove strap placed in Step 12 and strap TP2 and TP3.	When DS1 extinguishes, set S2 and S3 switches to ON (sends answer-back AB) and S4 switch to OFF.
15	When both DS1 and DS2 light, depress DATA key on data set. <i>Note:</i> If the data set is operating within the margin of error rate (less than 3 errors in the three 5-minute runs), the test may be considered complete. If this margin is exceeded, the data set should be tested in each of the following modes to determine which channels are defective and should be replaced. Testing individual channels Dotting on all channels Dotting on all channels except channel being tested.	Establish voice communication between stations using the telephone portion of the data set. Inform the transmitting station of any errors recorded in the three tests.

3.13 If the data set performance indicates that further testing is required, proceed as follows:

(a) **Testing individual channels:** Perform the test exactly as it is written in 3.12 through 3.13, with the following exception:

- At the receive station, set the TEST MODE switch to the CHAN number of the channel to be tested. Each of the eight channels should be tested for the three error test methods.

Note: When searching for the channel or channels causing the errors, the receiving station will step through each CHAN 1 through 8 position allowing only enough time to determine that the channel is not causing errors. This test may also be performed when the transmitted signal is a dotting signal. In this case in 3.12 (6), (9), and (12), the TEST MODE switch should be set to DOT, and the WORD LENGTH switch at the receive station should be set to DOT.

(b) **Dotting on all channels:** Perform the test exactly as it is written in 3.12 through 3.13 with the following exceptions:

- In 3.12 (6), (9), and (12), set the TEST MODE switch at the transmitting station to ALL DOT. The WORD LENGTH switch at the receiving station should be set to DOT during the three error tests. Individual channels may be tested using the dotting signal on all channels as previously explained.

(c) **Dotting on all channels except channel being tested (used to detect code sensitivity):** Perform the test exactly as it is written in 3.12 through 3.13 with the following exception:

- In 3.12 (6), (9), and (12), set the TEST MODE switch at the transmitting station to the channel number to be tested. The receiving station should set the TEST MODE switch to the same channel number as the transmitting station.

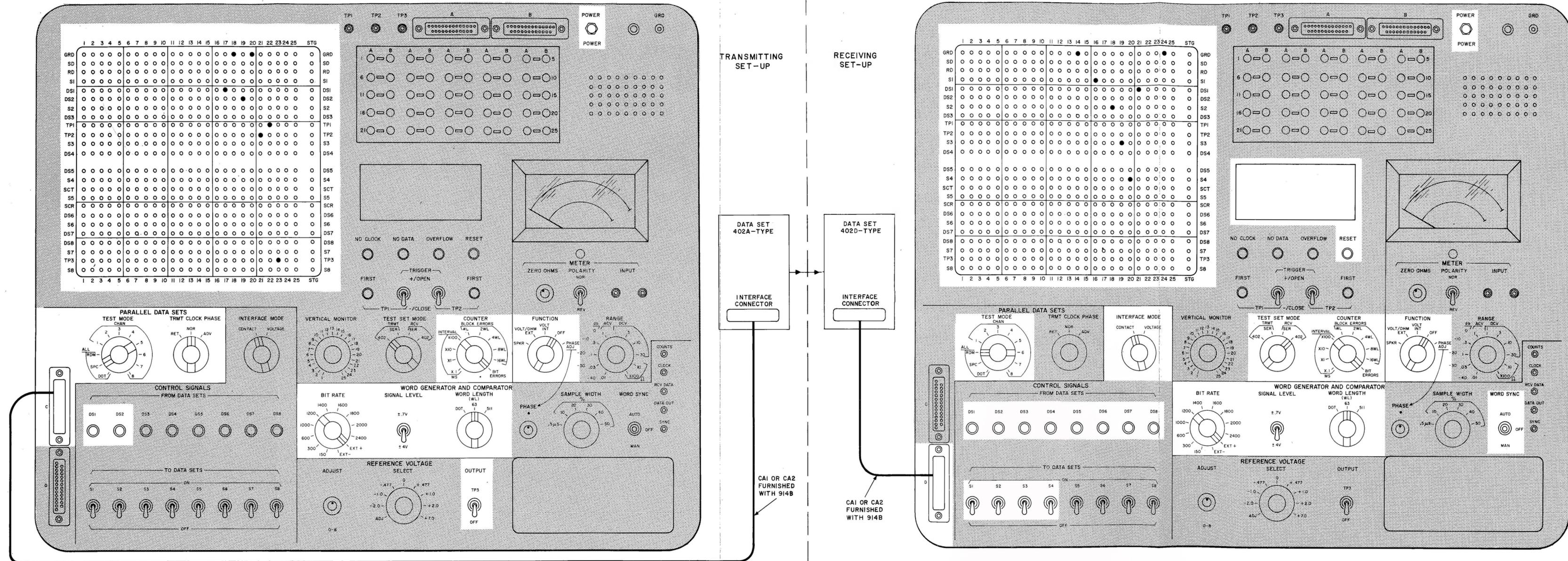


Fig. 6—Dynamic Test Using 914B Data Test Set—Test Connection Diagram