DATA SET 402D-TYPE
RECEIVER
TEST PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section covers test procedures applicable at time of installation and on repair visits.

1.02 This section is reissued to provide improved end-to-DTC interface tests. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Before proceeding with any test of the data set, verify the following:

(a) That the data loop has been tested and meets requirements as specified in the section entitled Data Systems—DATA-PHONE® On Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchanges, and Remote Exchange Lines (314-205-501)

(b) That the telephone portion of installation meets standard dc talk, signaling, and supervision requirements

(c) That data set strapping options agree with service order.

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

1.04 Tests contained in this section are divided into two parts, as follows: Part 2, tests to be performed at the time of installation, and Part 3, tests to be performed during maintenance visits.

2. INSTALLATION TEST PROCEDURES

2.01 Tests 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 method of performing the tests will be determined by which type of test equipment is available.

A. Ground Noise Test (901B DTS)

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 test equipment required for this test is as follows:

- 6A impulse counter
- 901B DTS test adapter

2.05 ***Test Procedure:***

STEP	PROCEDURE
1	Establish test connections and perform test as shown in Fig. 1. ***Requirement:*** There should be no counts noted in a 15-minute period. ***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 402D-Type Transmitter—Installation and Connection (594-020-200).
2	Remove all test connections and restore equipment to normal operating conditions.

B. Ground Noise Test (914B DTS)

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 test equipment required for this test is as follows:

- 6A impulse counter
- 914B DTS

2.08 ***Test Procedure:***

STEP	PROCEDURE
1	Establish test connections and perform test as shown in Fig. 2. ***Requirement:*** There should be no counts noted in a 15-minute period. ***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 402D-Type Transmitter—Installation and Connection (594-020-200).
2	Remove all test connections and restore equipment to normal operating conditions.

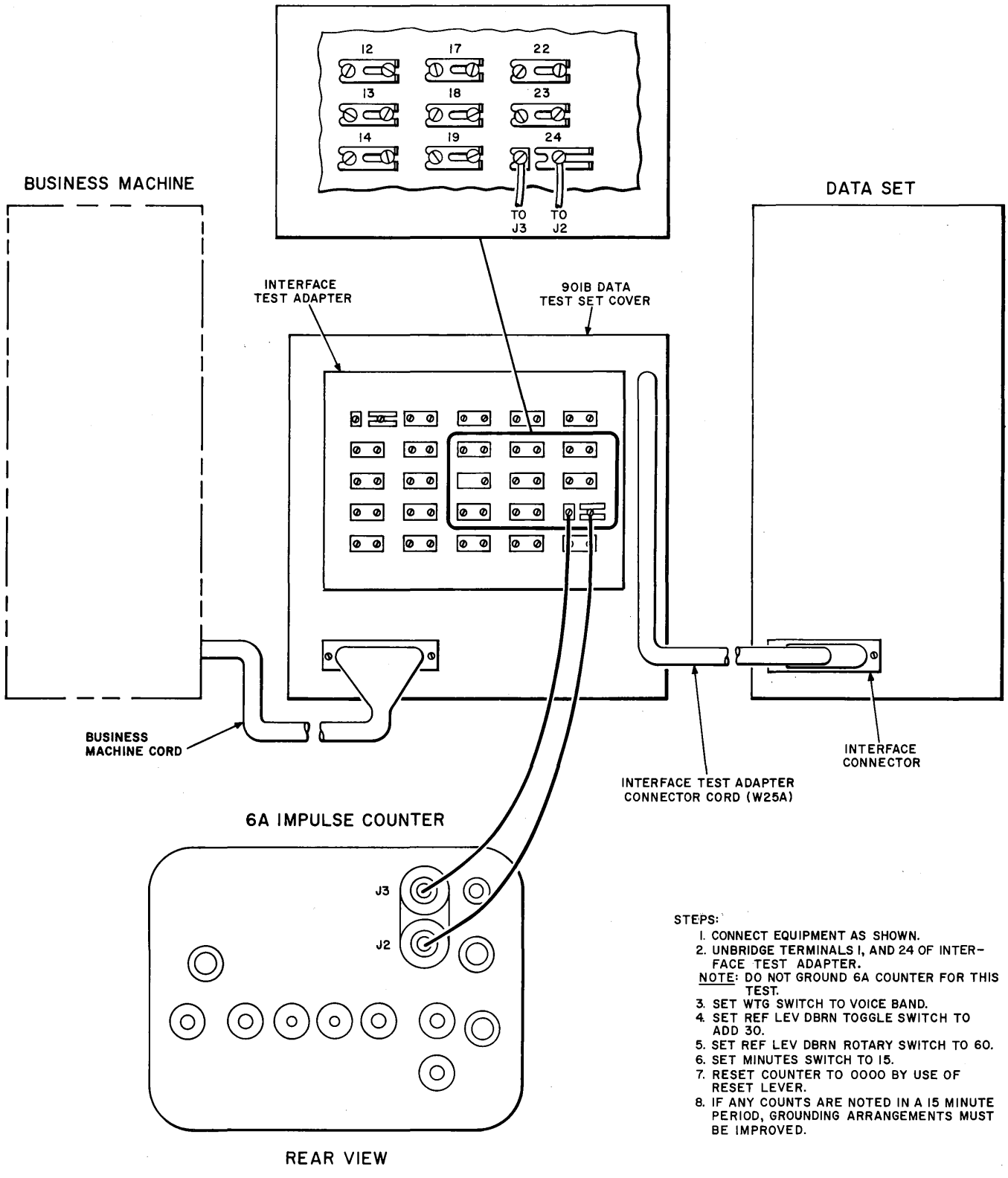

Fig. 1—Ground Noise Test Using 6A Impulse Counter and 901B Test Adpater

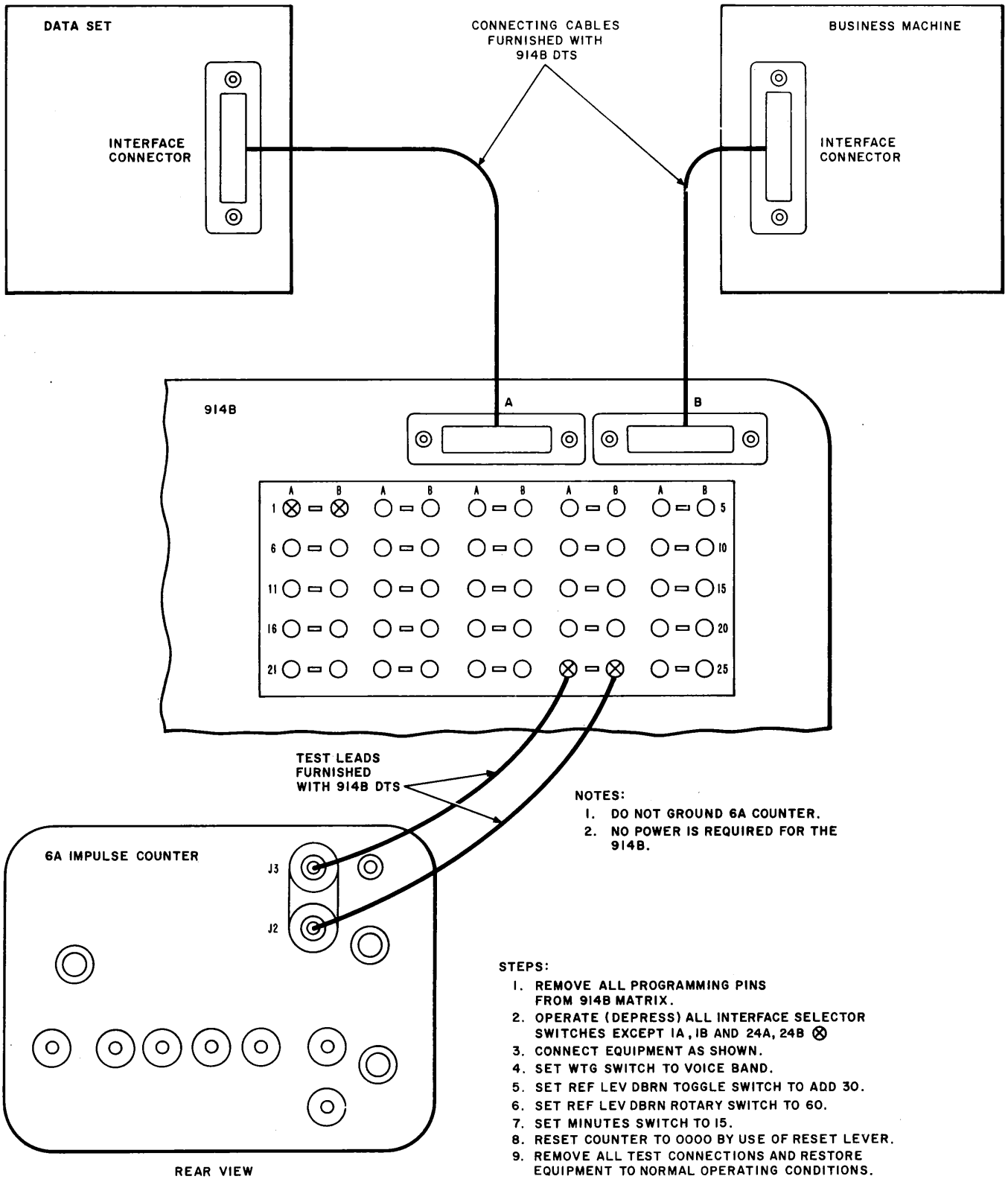

Fig. 2—Ground Noise Test Using 6A Impulse Counter and 914B Data Test Set

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

2.09 The following procedure tests Data Set 402D-type power supply output voltages using a KS-14510 or KS-16979-L1 volt-ohm-milliammeter.

2.10 ***Test Procedure:***

STEP	PROCEDURE
1	Remove the data set cover (refer to Section 594-020-100 for cover removal procedure).
2	With the data set connected to a working central office, connect a strap between leads 14 and 24 of the data set interface connector.
3	Operate TALK key [on associated Data Set 402C-type or Data Auxiliary Set (DAS) 804A], lift handset from switchhook, operate DATA key (DATA lamp should light), and place handset on-hook.
4	Using the meter, place positive lead on TB1 14 and negative lead on TB1 5. The meter should indicate from 16 to 20 dc volts.
5	Using the meter, place positive lead on TB1 3 and negative lead on TB1 14. The meter should indicate from 16 to 20 dc volts.
6	Remove all test connections and restore equipment to normal operating conditions.

D. Power Supply Test (914B DTS)

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

2.12 ***Test Procedure:***

STEP	PROCEDURE
1	Remove the data set cover (refer to Section 594-020-100 for cover removal procedure).
2	With the data set connected to a working central office, connect a strap between leads 14 and 24 of the data set interface connector.
3	Connect the 914B power cord to a 120-volt 60-Hz outlet and operate the POWER switch.
4	Connect the black and red test leads furnished with the test set to the respective INPUT terminals.
5	Set the POLARITY switch to REV, the FUNCTION switch to VOLT/OHM EXT, and the RANGE switch to DCV/30.

STEP	PROCEDURE
6	Operate TALK key (on associated Data Set 402C-type or DAS 804A), lift handset from switchhook, operate DATA key (DATA lamp should light), and place handset on-hook.
7	Place the black (−) lead on TB1 14 and the red (+) lead on TB1 5. The meter should indicate from 16 to 20 dc volts.
8	Set the POLARITY switch to NOR.
9	Place the red (+) lead on TB1 3 and the black (−) lead on TB1 14. The meter should indicate from 16 to 20 dc volts.
10	Remove all test connections and restore equipment to normal operating conditions.

E. Remote Test (DTC)

2.13 This test permits the data set to be tested from a remote data test center (DTC). The DTC is able to test the data set data and timing channels, reverse-channel and answer-back transmitter frequencies, and line control circuitry.

2.14 Since the DTC performs all testing functions, no locally provided test equipment is required.

2.15 ***Test Procedure:***

STEP	PROCEDURE
1	Place a call to the DTC in the normal manner and request a remote test. When requested to do so by the DTC, depress TEST key, hold until TEST lamp lights, and hang up. ***Note 1:*** The DTC now has complete control of the data set and can check operation of the following: • Line control of associated Data Set 402C-type or DAS 804A • Data receiver operation (both data channel and timing channel) • Answer-back transmitter frequencies • Reverse-channel transmitter frequencies (on Data Sets 402D2 and D4 only). ***Note 2:*** Table A may be used to identify the printed wiring board assembly (circuit packs) associated with the data frequency that fails to meet requirements.
2	The DTC can release the test mode after testing has been completed. ***Requirement:*** The data set should meet requirements for the DTC specified in Section 668-104-523. ***Remedial Action:*** If data set passes remote test requirements but fails interface test requirements, the internal wiring of the data set should be checked rather than the printed wiring board assemblies.

TABLE A

DATA RECEIVING FREQUENCIES

CHANNEL	MARK FREQUENCY	SPACE FREQUENCY	PRINTED WIRING BOARD ASSEMBLY DESIGNATION
1	730	800	CP2
2	900	970	CP3
3	1070	1140	CP4
4	1240	1310	CP5
Timing	1410	1480	CP11,CP12
5	1580	1650	CP6
6	1750	1820	CP7
7	1920	1990	CP8
8	2090	2160	CP9

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 tests in this part in conjunction with the remote test contained in Part 2 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. This allows evaluation of the data set performance when using the normal transmission facility. However, this test is so time consuming it should only be done as a last resort. Instead, a dynamic test to the nearest serving DTC 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 returned to the Western Electric Company distributing houses for repair. Sets should be tagged to indicate the nature of the trouble.

3.02 Detailed instructions are provided for the Telco employee in the left column of the following tests. A summary of associated actions performed at the DTC is shown in the right column to provide coordination and to minimize testing time.

A. End-to-DTC Interface Test (901B DTS)

3.03 This test verifies that the data set will produce the proper interface signal in response to voice frequency data signals transmitted from the DTC. The answer-back and reverse-channel transmitter frequencies, line control, and various service options are also checked.

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

- 901B DTS
- 1011- or 1013-type handset
- KS-14510 or KS-16979-L1 volt-ohm-milliammeter
- DTC.

3.05 ***Test Procedure:***

STEP	DATA STATION	DATA TEST CENTER
1	Disconnect business machine from data set interface connector.	
2	Connect interface test adapter (901B lid) to data set interface connector (refer to Section 107-100-100).	
3	Verify that all interface test adapter shorting clips are securely closed.	
4	If Data Set 402D-type is tested with Data Set 402C-type (transmit-receive station)— Connect a strap between terminals 17 and 24 on the interface test adapter.	

STEP	DATA STATION	DATA TEST CENTER
5	Verify that data set power cord and telephone line are connected.	
6	Lift data set handset from switchhook and depress TALK key. ***Requirements:*** TALK lamp on DAS lights. Dial tone heard in handset.	
7	Hang up. ***Requirement:*** TALK lamp extinguishes.	
	Out of Service Feature (Option V) Test	
8	Connect a strap between terminals 23 and 24 on the interface test adapter. ***Requirement:*** DATA lamp on DAS lights.	
9	Disconnect strap placed in Step 8b. ***Requirement:*** DATA lamp extinguishes.	
	Ring Indicator Test	
10	Connect a strap between terminals 14 and 24 on the interface test adapter.	
11	Condition meter to measure resistance and connect leads between terminals 11 and 22 on the interface test adapter.	
12	Dial local ringback code. ***Requirement:*** Meter indicates 0 ohm during ringing interval and open circuit during silent interval.	
13	Disconnect meter leads and allow ringing to continue.	
	Interlock Lead Test	
14	Connect meter leads between terminals 11 and 13 on interface test adapter. ***Requirement:*** Meter indicates open circuit.	

STEP	DATA STATION	DATA TEST CENTER
	Unattended Operation Test	
15	Connect a strap between terminals 15 and 24 on interface test adapter.	
	Requirements:	
	Ringing trips. DATA lamp lights. Meter indicates 0 ohm approximately 5 seconds after ringing is tripped.	
16	Disconnect strap placed in Step 10.	
17	Replace strap between terminals 14 and 24 on interface test adapter.	
	Answer-Back Transmitter Test	
18	Set handset TALK MON key to MON.	
19	Connect handset to tip and ring of telephone line at station connecting block. ***Do not set handset key to TALK during the following tests.***	
20	Using the telephone portion of the data set, call the ***serving*** DTC and request an end-to-DTC interface test of Data Set 402D-type (Section 668-104-523). Inform DTC that 901B DTS is being used and whether data set uses reverse channel (Data Set 402D2 or D4).	
21	Hang up.	DTC operator conditions test equipment to perform test.
22	When station bell rings, depress TALK key and lift handset.	DTC calls data station.
	Requirements:	
	Ringing tripped. Talk lamp lights. Voice communication satisfactory.	
23	Depress DATA key.	DTC goes to test mode and measures tones.
	Requirements:	
	DATA lamp lights. 2025 Hz heard in handset for 3 to 5 seconds followed by 1152-Hz rest tone.	

STEP	DATA STATION	DATA TEST CENTER
24	Depress TALK key. ***Requirement:*** Voice communication satisfactory.	DTC goes to talk mode and reports results of tests.
25	Connect a strap between terminals 18 and 24 on interface test adapter.	
26	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds followed by 1017-Hz tone.	DTC goes to test mode and measure answer-back A.
27	Depress TALK key.	DTC goes to talk mode and reports answer-back A test results.
28	Remove strap placed in Step 25 and connect a strap between terminals 19 and 24.	
29	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds followed by another 2025-Hz tone.	DTC goes to test mode and measures answer-back B.
30	Depress TALK key.	DTC goes to talk mode and reports answer-back B test results.
31	Connect another strap between terminals 18 and 24 (leave 19 and 24 in place).	
32	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds followed by 1785-Hz tone.	DTC goes to test mode and measures answer-back AB.
33	Depress TALK key.	DTC goes to talk mode and reports answer-back AB test results.
Mode Control Test		
34	Remove straps between terminals 18 and 24 and 19 and 24.	
35	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds followed by 1152-Hz tone.	
36	Connect a strap between terminals 20 and 24. ***Requirement:*** 1152 Hz should cease when strap is connected. Leave strap in place.	

STEP	DATA STATION	DATA TEST CENTER
37	Depress TALK key.	
	Reverse Channel (Option S, Data Set 402D2 or D4) Test	
38	Connect a strap between terminals 16 and 24 and inform DTC ready to check reverse channel.	DTC goes to test mode.
39	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds followed by 387-Hz tone.	DTC measures reverse channel tone.
40	Remove strap placed in Step 38. ***Requirement:*** 387-Hz tone ceases.	
41	Depress TALK key.	DTC goes to talk mode and reports reverse channel test results.
	Carrier Detector and All Space Test	
42	Condition meter to measure resistance (R x 10,000) and connect meter leads between terminals 11 and 21. Inform DTC ready to test carrier detector.	
43	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds. When data frequencies are heard, meter indication changes from open circuit to 0 ohm.	DTC transmits space frequencies on all channels.
44	Depress TALK key and report results of test.	DTC goes to talk mode and logs test results.
	Data Channels and Timing Test	
45	Connect meter leads between terminals 6 and 12.	
46	Inform DTC ready to test data channels. Request all space for 10 seconds.	
47	Depress DATA key. ***Requirement:*** 2025 Hz heard in handset for 3 to 5 seconds. When data tones are heard, meter indicates between 5000 and 35,000 ohms.	DTC goes to test mode and transmits all space.

STEP	DATA STATION	DATA TEST CENTER
48	Connect meter leads between terminals 2 and 11. ***Requirement:*** Meter indicates open circuit.	
49	When data tones cease, depress TALK key and inform DTC of timing channel test results.	DTC goes to talk mode.
50	Inform DTC ready to test data channels.	
51	Depress DATA key.	DTC goes to test mode.
52	Connect meter leads between terminals 2 and 11. ***Requirement:*** When data tones are heard, meter changes from open circuit to 0 ohm and remains at 0 ohm for 10 seconds. When data frequencies cease, depress TALK key.	DTC transmits space on all channels, then changes channel 1 to mark for a 10-second interval. Dotting is sent on the timing channel.
53	Inform DTC of channel 1 test results.	DTC goes to talk mode.
54	Repeat Steps 51, 52, and 53 for data channels 2 through 8 as shown in Table B.	DTC repeats procedure for remaining data channels.
55	End of test. Restore equipment to normal operating condition.	

TABLE B

CHANNEL	CONNECT METER LEADS BETWEEN TERMINALS:
2	3 and 11
3	4 and 11
4	5 and 11
5	7 and 11
6	8 and 11
7	9 and 11
8	10 and 11

B. End-to-DTC Interface Test (913A DTS)

3.06 This test verifies that the data set will produce the proper interface signal in response to voice frequency data signals transmitted from the DTC. The answer-back and reverse-channel transmitter frequencies, line control, and various service option are also checked.

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

- 913A DTS
- 902 DTS
- 903 DTS

3.08 ***Test Procedure:***

STEP	DATA STATION	DATA TEST CENTER
1	Connect test equipment for ***receive station*** as shown in Fig. 3.	
2	Verify that all test cords, power cords, and the data set telephone line are properly connected.	
3	Lift data set handset from switchhook and depress TALK key on DAS. ***Requirements:*** TALK lamp on DAS lights. Dial tone heard in handset.	
4	Place handset on switchhook. ***Requirement:*** TALK lamp extinguishes.	
5	Set 913A DTS controls as follows: PWR switch to ON MODEL switch to 402C/D MODE switch to DATA.	
	Out-of-Service Feature (Option V) Test	
6	Set OUT OF SERV switch to ON. ***Requirement:*** DATA lamp on DAS lights.	
7	Set OUT OF SERV switch to OFF. ***Requirement:*** DATA lamp extinguishes.	
	Ring Indicator Test	
8	Set 913A DTS controls as follows: MODE switch to ANS BK REMOTE OPR switch to off.	
9	Using the telephone portion of the data set, call ***serving*** DTC and request end-to-DTC interface test of Data Set 402D-type (Section 668-104-523). Inform DTC that 913A DTS is being used and whether reverse channel is used (Data Set 402D2 or D4).	
10	Place handset on switchhook.	DTC operator conditions test equipment to perform test.

STEP	DATA STATION	DATA TEST CENTER
11	When station bell rings, observe RING IND lamp on 913A DTS. ***Requirement:*** RING IND lamp lights during ringing interval.	DTC calls data station.
12	Set REMOTE OPR switch to on during silent interval. ***Requirements:*** Ringing tripped. DATA lamp on associated DAS lights. INTLK lamp on 913A DTS lights approximately 5 seconds after DATA lamp lights.	DTC measures answer tone and rest tone.
13	Depress TALK key. ***Requirements:*** TALK lamp lights. DATA lamp extinguishes. Voice communication satisfactory.	DTC goes to talk mode and reports test results.
Answer-Back Transmitter Test		
14	Inform DTC ready to send answer-back and depress DATA key.	DTC goes to test mode.
15	Set 913A DTS ANS BK A switch to on for 10 seconds, then to off.	DTC measures answer-back A (1017-Hz tone).
16	Depress TALK key.	DTC goes to talk mode and reports answer-back A test results.
17	Depress DATA key.	DTC goes to test mode.
18	Set 913A DTS ANS BK B switch to on for 10 seconds, then to off.	DTC measures answer-back B (second 2025-Hz tone).
19	Depress TALK key.	DTC goes to talk mode and reports answer-back B test results.
20	Depress DATA key.	DTC goes to test mode.
21	Set 913A DTS ANS BK A and ANS BK AB switches to on for 10 seconds, then to off.	DTC measures answer-back AB (1785-Hz tone)
22	Depress TALK key.	DTC goes to talk mode and reports answer-back AB test results.

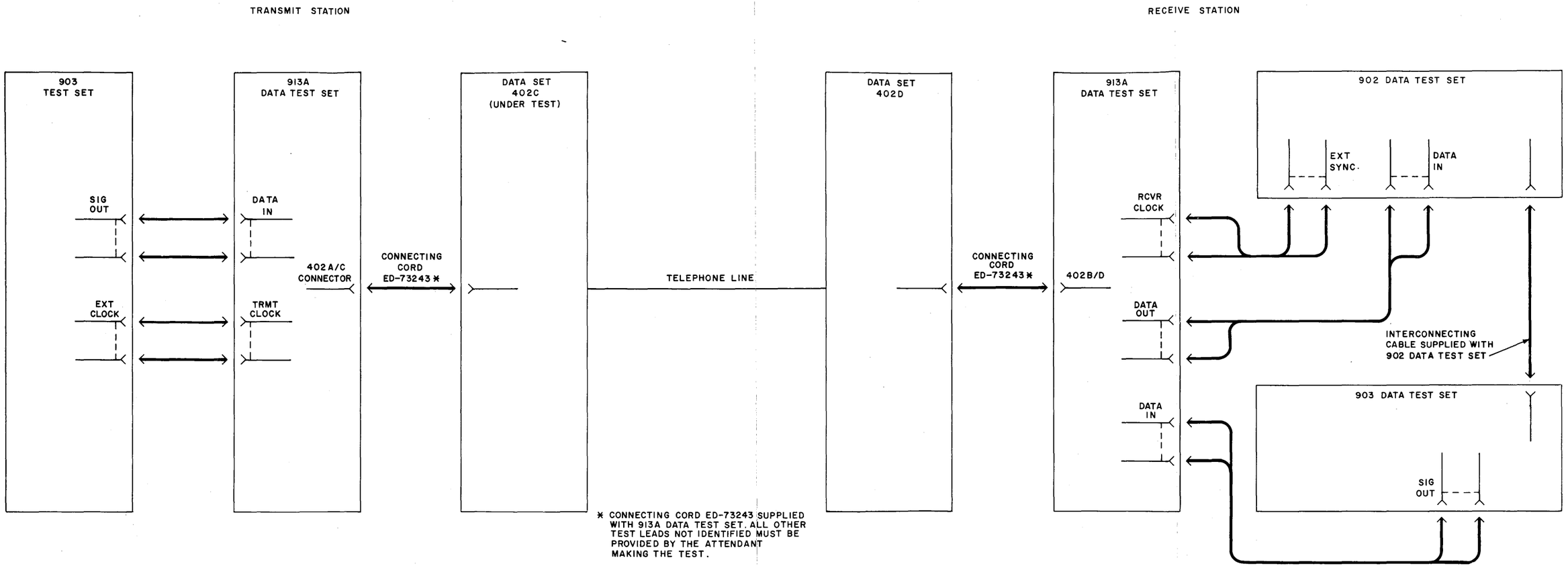

Fig. 3—Dynamic and Interface Test—Block Diagram

STEP	DATA STATION	DATA TEST CENTER
	Reverse Channel (Option S, Data Set 402D2 or D4) Test	
23	Depress DATA key.	DTC goes to test mode.
24	Set MODE switch to DATA.	
25	Set 913A DTS REV CHAN switch to on for 10 seconds, then to off.	DTC measures reverse channel (387-Hz tone).
26	Depress TALK key.	DTC goes to talk mode and reports reverse channel test results.
	Data Channel Test	
27	Set 902 DTS controls as follows: TRIGGER switch to – (negative) BIT RATE switch to EXT SYNC	
28	Set 903 DTS controls as follows: ON OFF switch to ON BIT RATE switch to EXT CLOCK RANDOM DOT switch to DOT. ***Note:*** The following test checks all data channels at once. Since the data signal is a dotting pattern and word sync is not applicable, it may be necessary to operate the RANDOM DOT switch several times to synchronize the received data with the generator signal.	
29	Set 913A DTS controls as follows: TEST MODE switch to ALL RDM.	
30	Inform DTC ready to test data channels.	
31	Depress DATA key.	DTC goes to test mode and transmits dotting signal for 1 minute.
32	Depress WORD SYNC & RESET switch on 902 DTS. ***Requirement:*** TOTAL ERRORS lamps extinguish and remain extinguished. ***Note:*** If lamps do not extinguish, set the 913A DTS TEST MODE switch to each CHAN 1 through CHAN 8 position (depress RESET switch for each channel) to locate the defective channel.	

STEP	DATA STATION	DATA TEST CENTER
33	At end of test transmission time, depress TALK key and inform DTC of test results.	DTC goes to talk mode and logs test results.
34	Depress DATA key.	
35	Operate 913A DTS REMOTE RLS switch. ***Requirement:*** DATA lamp extinguishes and data set releases from telephone line.	
36	End of tests. Disconnect all test equipment and options installed for test. Restore all equipment to normal operating condition.	

C. End-to-DTC Interface Test (914B DTS)

3.09 This test verifies that the data set will produce the proper interface signal in response to voice frequency data signals transmitted from the DTC. The answer-back and reverse-channel transmitter frequencies, line control, and various service options are also checked.

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

- 914B DTS
- DTC

Test set switches not shown on the test connection diagram (Fig. 4) or 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.

3.11 ***Test Procedure:***

STEP	DATA STATION	DATA TEST CENTER
1	Establish test connections and set 914B DTS controls as shown in Fig. 4.	
2	Program 914B matrix using shorting pins (red) as shown in Fig. 4.	
3	Operate (depress) all A interface selector switches on 914B.	
4	Operate 914B POWER switch. ***Requirements:*** 914B POWER lamp lights. DS1, DS2, DS3, and DS8 lamps extinguished. DS4 through DS7 lamps may be either lit or extinguished.	

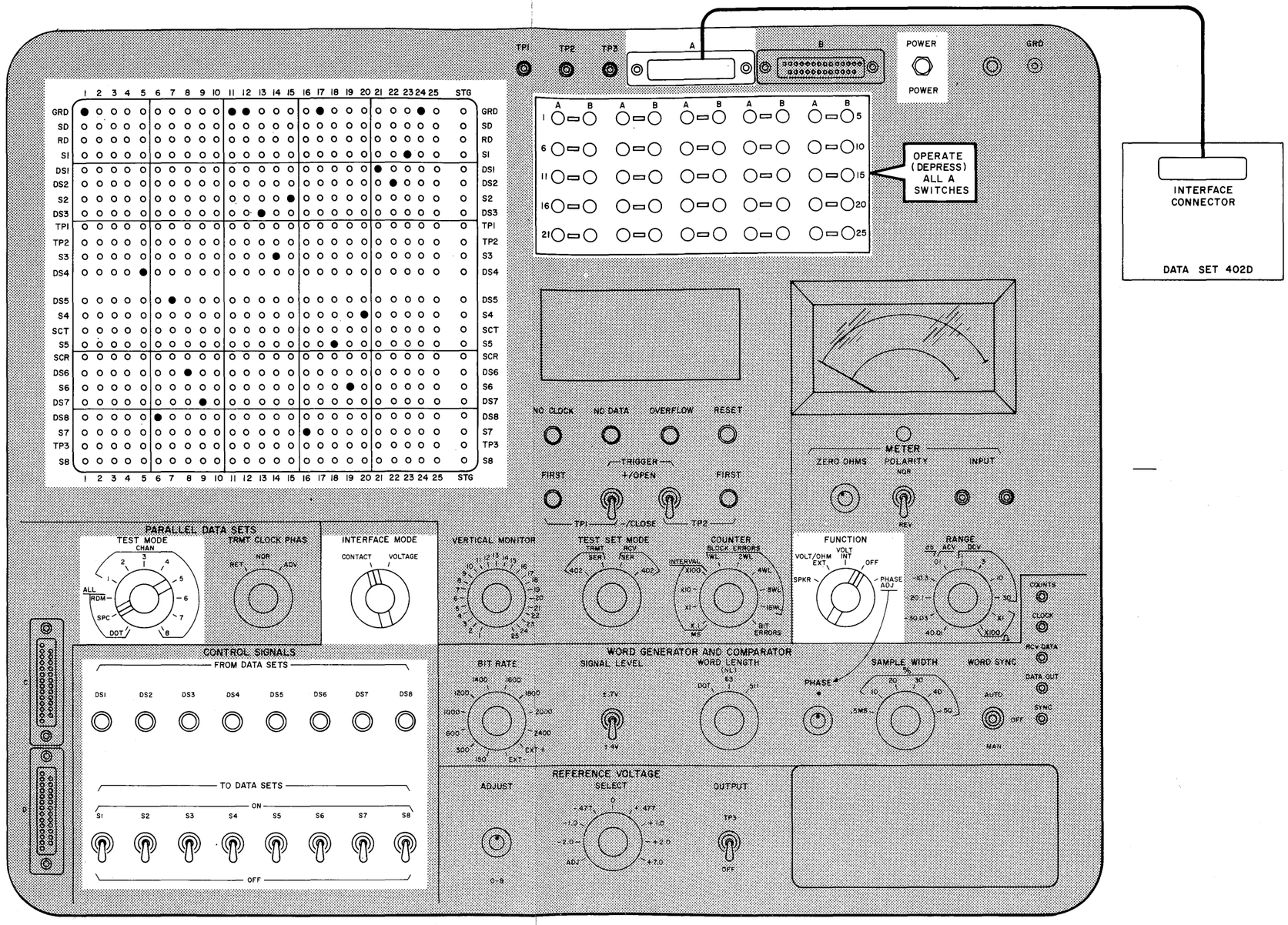

Fig. 4—Interface Test Using 914B Data Test Set—Test Connection Diagram

STEP	DATA STATION	DATA TEST CENTER
5	Lift data set handset from switchhook and depress TALK key.	
	Requirements:	
	TALK lamp on DAS lights. Dial tone heard in handset.	
6	Place handset on switchhook.	
	Requirement: TALK lamp extinguishes.	
Out of Service (Option V) Test		
7	On 914B, set S1 switch to ON.	
	Requirements:	
	DATA lamp on DAS lights. DS3 lamp on 914B lights after several seconds.	
8	Set S1 switch to OFF.	
	Requirement: DATA and DS3 lamps extinguish.	
Attended Operation (Option N Not Used) Test		
9	On 914B, set S3 switch to ON.	
10	Using telephone portion of data set, call the ***serving*** DTC and request an end-to-DTC interface test of DS 402D-type (Section 668-104-523). Inform DTC that the 914B is being used and whether reverse channel is used (DS 402D2 or DS 402D4).	
11	Place handset on switchhook and depress DATA key.	DTC operator conditions test equipment to perform test.
12	When station bell rings, depress TALK key and lift handset.	DTC calls data station.
	Requirements:	
	Ringing tripped. TALK lamp lights. Voice communication satisfactory.	

STEP	DATA STATION	DATA TEST CENTER
13	Depress DATA key on DAS. ***Requirements:*** DATA lamp lights. TALK lamp extinguished. 2025 Hz sent for 3 to 5 seconds followed by 1152-Hz rest tone.	DTC measures tones.
	Unattended Operation (Option N) Test	
14	When station bell rings, set S2 switch to on during silent interval. ***Requirements:*** DATA lamp lights. DS3 lamp on 914B lights after several seconds. 2025 Hz sent from 3 to 5 seconds followed by 1152-Hz rest tone.	DTC measures tones.
15	Depress TALK key. ***Requirements:*** TALK lamp lights. DATA lamp extinguishes. DS3 lamp extinguishes. Voice communication satisfactory.	DTC goes to talk mode and verifies test results.
	Answer-Back Transmitter Test	
16	Inform DTC ready to test answer-back and depress DATA key.	DTC goes to test mode.
17	Set S5 switch to ON for 10 seconds, then to OFF.	DTC measures answer-back A (1017-Hz) tone.
18	Depress TALK key.	DTC goes to talk mode and reports results of answer-back A test.
19	Depress DATA key.	DTC goes to test mode.
20	Set S6 switch to ON for 10 seconds, then to OFF.	DTC measures answer-back B (2025-Hz) tone.
21	Depress TALK key.	DTC goes to talk mode and reports results of answer-back B test.
22	Depress DATA key.	DTC goes to test mode.
23	Set S5 and S6 switches to ON for 10 seconds, then to OFF.	DTC measures answer-back AB (1785-Hz) tone.

STEP	DATA STATION	DATA TEST CENTER
24	Depress TALK key.	DTC goes to talk mode and reports results of answer-back AB test.
	Reverse Channel (Option S, Data Set 402D2 or D4) Test	
25	Depress DATA key.	DTC goes to test mode.
26	Set S4 switch to ON.	
27	Set S7 switch to ON for 10 seconds, then to OFF.	DTC measures reverse channel (387-Hz) tone.
28	Depress TALK key.	DTC goes to talk mode and reports results of reverse channel test.
	Data Channels Test	
29	Inform DTC ready to test data set response to all space on all channels for 3 minutes.	DTC goes to test mode.
30	Depress DATA key. ***Requirements:*** DS1 and DS3 lamps light. DS8 lights (not as brightly as DS1 and DS3). DS2, 4, 5, 6 and 7 lamps are extinguished.	DTC transmits all space on all channels for 3 minutes.
31	At end of two minutes, remove the following pins from 914B matrix:	

ROW	COLUMN
DS1	21
DS2	22
DS3	13
DS8	6

32 Replace pins as follows:

ROW	COLUMN
DS1	2
DS2	3
DS3	4
DS8	10

Requirement: Lamps DS1 through DS8 remain extinguished.

STEP	DATA STATION	DATA TEST CENTER
33	At end of test transmission, depress TALK key and inform DTC of test results. ***Note:*** When DTC goes to talk mode or when data set is placed back in data mode, any combination of lamps DS1 through DS8 may be either lit or extinguished.	DTC goes to talk mode and logs test results.
34	Inform DTC ready to test data set response to mark frequencies.	DTC goes to test mode.
35	Depress DATA key. ***Requirement:*** Lamps DS1 through DS8 light and extinguish in sequence.	DTC transmits space on all channels, then mark on all channels for 10 seconds each.
36	At end of test transmission, depress TALK key and inform DTC of test results.	DTC goes to talk mode and logs test results.
37	Depress DATA key.	
38	Set S3 switch to OFF. ***Requirements:*** Data lamp extinguishes. Data set disconnects from telephone line.	
39	End of test. Disconnect all test equipment and restore to normal operating conditions.	

D. Dynamic Test (913A DTS)

3.12 The dynamic test should be made after the remote test, but only when it is necessary to identify facility troubles which the data set has been occasionally experiencing over a period of time. The test is made using two data stations remote from each other (end-to-end).

3.13 Connections and test set control settings are given for the receive station only. A summary of what is taking place at the transmit station is also given to promote better communications between the two stations while the test is in progress.

3.14 Connect the test equipment for the receive station according to Fig. 3. Connections for the transmit station are illustrated for general information only.

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

- 913A DTS (2 required)
- 903 DTS (2 required)
- 902 DTS

3.16 Apply power to the 913A DTS and set the controls as follows:

RECEIVE (DATA SET 402D)	TRANSMIT (DATA SET 402C)
PWR switch to ON	PWR switch to ON
DATA SET switch to 402	DATA SET switch to 402
RC switch to ON (if applicable)	TRMTR CLOCK switch to 75 NOR
MODE switch to DATA	MODE switch to DATA
TEST MODE switch to ALL RDM	TEST MODE switch to ALL SPC
MODEL switch to 402C/D	MODEL switch to 402C/D
REMOTE switch to OPR	REMOTE switch to OPR

3.17 Set the 903 DTS controls as follows:

RECEIVE (DATA SET 402D)	TRANSMIT (DATA SET 402C)
BIT RATE selector switch to EXT CLOCK	BIT RATE selector switch to EXT CLOCK
TRIGGER to —	TRIGGER to +
RANDOM-DOT switch to RANDOM	RANDOM-DOT switch to RANDOM

3.18 Set the 902 DTS controls as follows:

RECEIVE (DATA SET 402D)	TRANSMIT (DATA SET 402C)
BIT RATE switch to EXT SYNC	Not applicable
TRIGGER to +	Not applicable

3.19 Communications are established between the transmit and receive stations, and both stations agree to go into the data mode of operation. If the receive station should desire to go into the talk mode before the test is completed, arrangements should be made between the two stations for the attendant at the receive station to signal the transmit station of such a request by use of the REV CHAN switch (if available).

3.20 Complete the test by performing the following procedure:

STEP	RECEIVE (402D)	TRANSMIT (402C)
1	Depress DATA key on associated DAS.	Go into the data mode and send an all random signal for 6 minutes.
2	When CARR ON lamp lights on the 913A test set, depress the RESET button on the 902 test set. Counter lamps should be extinguished.	
3	Time data reception 5 minutes and observe and record errors displayed on 902 test set counter.	
4	When 913A test set CARR ON lamp extinguishes, position the MODE switch to ANS BACK and ANS BACK A switch to on to notify transmit end of completion of the first error run.	After sending 6 minutes of data, go into answer-back mode to await receipt of answer-back A, signifying completion of first error run.

STEP	RECEIVE (402D)	TRANSMIT (402C)
5	Release ANS BACK A switch and position MODE switch on the 913A test set to DATA.	Go into data send mode and send all random signal with advanced timing for 6 minutes.
6	When CARR ON lamp lights on the 913A test set, depress the RESET button on the 902 test set. Counter lamps should be extinguished.	
7	Time data reception 5 minutes and observe and record errors displayed on 902 test set counter.	
8	When 913A test set CARR ON lamp extinguishes, position the MODE switch to ANS BACK and ANS BACK B switch to one to notify transmit end of completion of the second error run.	After sending 6 minutes of data, go into answer-back mode to await receipt of answer-back B, signifying completion of second error run.
9	Release ANS BACK B switch and position MODE switch on the 913A test set to DATA.	Go into data send mode and send all random signal with retarded timing for 6 minutes.
10	When CARR ON lamp lights on the 913A test set, depress the RESET button on the 902 test set. Counter lamps should be extinguished.	
11	Time data reception 5 minutes and observe and record errors displayed on 902 test set counter.	
12	When 913A test set CARR ON lamp extinguishes, position the MODE switch to ANS BACK and ANS BACK AB switch to on to notify transmit end of completion of the final error run.	After sending 6 minutes of data, go into answer-back mode to await receipt of answer-back AB, signifying completion of final error run.
13	After sending answer-back AB, depress TALK key on the associated DAS and verify results with the transmitting station. ***Note:*** 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: (a) Testing individual channels (b) Dotting on all channels (c) Dotting on all channels except the channel being tested.	

3.21 ***Testing Individual Channels (to Determine Channel Causing Error):*** Perform the test exactly as it is written in 3.13 through 3.20, except in 3.16 set the TEST MODE switch on the 913A Data Test Set at the 402D station to the CHAN number of the channel to be tested.

> ***Note:*** When searching for the channel causing the errors, the receiving station will step through the channels and will allow only enough time to determine that the channel is not causing errors.

3.22 ***Testing With Dotting on All Channels:*** Perform the test exactly as it is written in 3.13 through 3.20, except in 3.16 set the TEST MODE switch on the 913A test set at the 402D station to ALL DOT.

3.23 ***Testing With Dotting on All Channels Except the Channel Being Tested (to Detect Code Sensitivity):*** Perform the test exactly as it is written in 3.13 through 3.20, except in 3.16 set the TEST MODE switch on the 913A test set to the CHAN number of the channel to be tested.

E. Dynamic Test (914B DTS)

3.24 The dynamic test should be made after the remote test, but 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 with a 402 test circuit may act as a substitute for the sending 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.

3.25 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, then both stations agree to go into the data mode of operation. If the receive station should desire to go into the talk mode before the test is completed, arrangements should be made between the two stations for the attendant at the receive station to signal the transmit station of such a request by use of the reverse-channel switch (S1 to OFF on the 914B DTS).

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

- 914B DTS (2 required)

Test set switches not shown on the test connection diagram (Fig. 6) or 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).

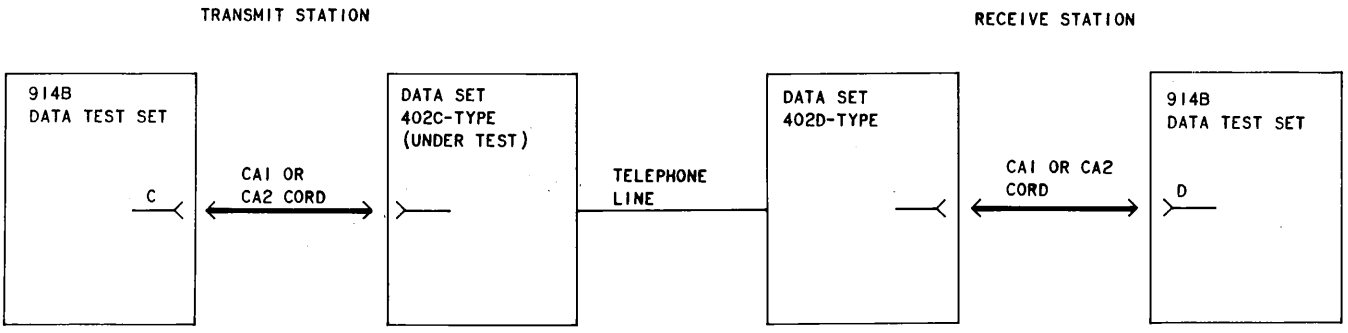

Fig. 5—Dynamic Test of Data Sets 402D- and 402C-Types Using 914B Data Test Set—Block Diagram

3.27 ***Test Procedure:***

STEP	RECEIVE (402D)	TRANSMIT (402C)
1	Establish test connections as shown in Fig. 6.	Establish test connections as shown in Fig. 6.
2	Program the 914B matrix as shown in Fig. 6.	Program the 914B 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 3.25.	Establish communications as explained in 3.25.
5	Depress data set DATA key (goes into the data mode). Set S4 switch on 914B to ON.	Depress DATA key on Data Set 402C. Set S1 switch on 914B to ON.
6	Note when DS1 on 914B lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate display counter RESET switch.	Five seconds after DATA key is depressed (or DS1 on 914B lights if reverse channel is used), set TEST MODE switch to ALL RDM.
7	Time data reception 5 minutes and observe and record any errors displayed on 914B counter.	Transmit data for 6 minutes.
8	When DS1 extinguishes, set S2 switch to ON and S4 switch to OFF. (This sends answer-back A to the transmitting station).	After 6 minutes of transmission, set S1 switch to OFF. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHAS switch to ADV.
9	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.	When DS2 lights (indicates completion of first error test), set S1 switch to ON; after 5 seconds, set TEST MODE switch to ALL RDM.
10	Time data reception 5 minutes. Observe and record any errors displayed on 914B counter.	Transmit data for 6 minutes (second error test).
11	When DS1 extinguishes, set S3 switch to ON and S4 switch to OFF. (This sends answer-back B to the transmitting station.)	After 6 minutes of transmission, set S1 switch to OFF. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHAS switch to RET.
12	SET S4 switch to ON and S3 switch to OFF. When DS1 lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate counter display RESET switch.	When DS4 lights, set S1 switch to ON. After 5 seconds, set TEST MODE switch to ALL RDM.
13	Time data reception 5 minutes. Observe and record any errors displayed on 914B counter.	Transmit data for 6 minutes (third error test).
14	When DS1 extinguishes, set S2 and S3 switches to ON (sends answer-back AB) and S4 switch to OFF.	After 6 minutes of transmission, set S1 switch to OFF.

STEP	RECEIVE (402D)	TRANSMIT (402C)
15	Establish voice communications between stations using the telephone portion of the data set. Inform the transmitting station of any errors recorded in the three tests.	When DS3 lights, depress TALK key on data set. ***Note:*** If the data set is operating within the margin or 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: (a) Testing individual channels (b) Dotting on all channels (c) Dotting on all channels except channel being tested.

3.28 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 3.27 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 tests.

Note: When searching for the channel or channels causing the error, the receiving station will step through each CHAN 1-8 position allowing only enough time to determine that the channel is not causing errors.

(b) ***Dotting on all channels:*** Perform the test exactly as it is written in 3.27 with the following exceptions:

- In 3.27 (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.

(c) ***Dotting on All Channels Except Channel Being Tested (Used to Detect Code Sensitivity):*** Perform the test exactly as it is written in 3.27 with the following exceptions:

- In 3.27 (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.

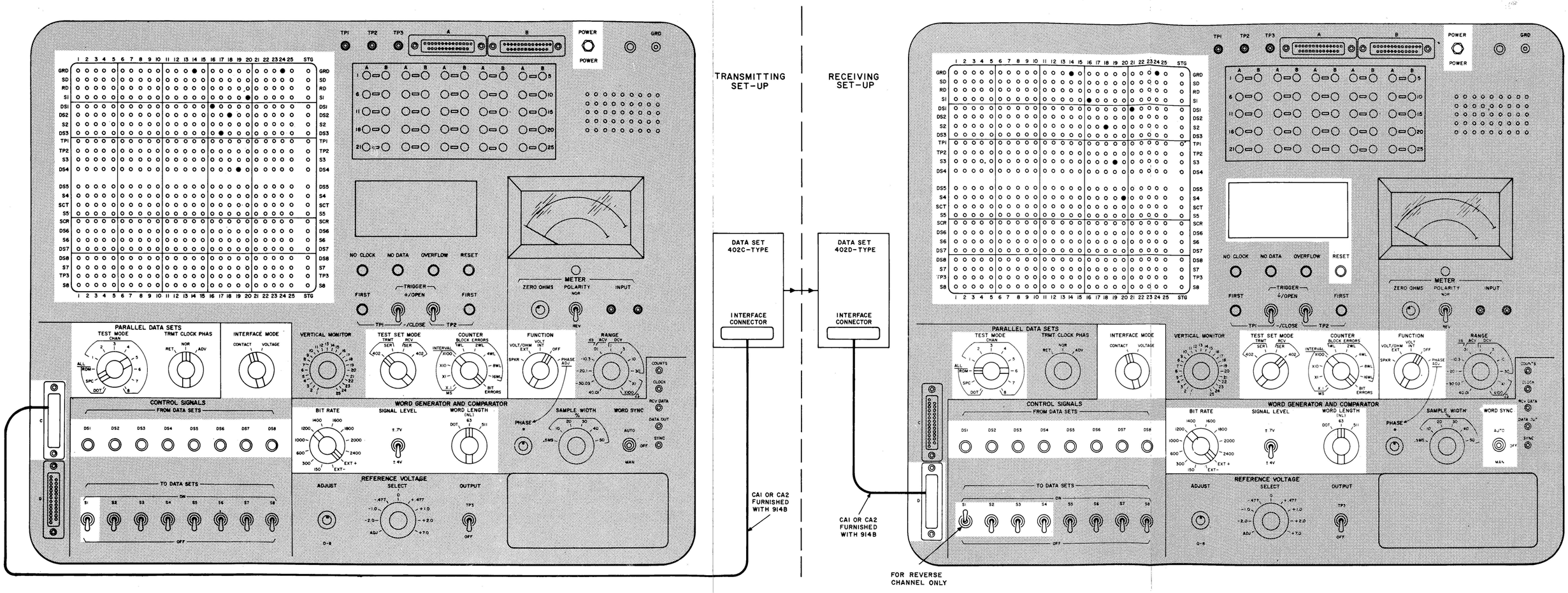

Fig. 6—Dynamic Test Using 914B Data Test Set—Test Connection Diagram