DATA SET 202D

TRANSMITTER-RECEIVER

TEST PROCEDURES

1. GENERAL

1.01 This section covers test procedures which may be used at time of installation and on repair visits.

1.02 Before proceeding with any tests of data set verify that:

Confirm that data set strapping options agree with service order.

(1) Data loop has been tested and meets requirements as specified in Section 314-205-500.

(2) Telephone portion of installation meets standard dc talk, signaling, and supervision requirements.

1.03 Fig. 1 and Table A furnish printed wiring board assembly identification information.

TABLE A

PRINTED WIRING BOARD IDENTIFICATION

Printed Wiring Board Designation (See Fig. 1)	Printed Wiring Board Function	Printed Wiring Board Assembly Number
1	Test Circuitry	A-835166
2	Modulator	A-835167
3	Carrier Detector	A-835168
4	Demodulator	A-835169
5	Miscellaneous	A-152939

1.04 The following tests are described in this section:

- Ground noise test
- Interface test
- Loop-Back test
- End-to-End test

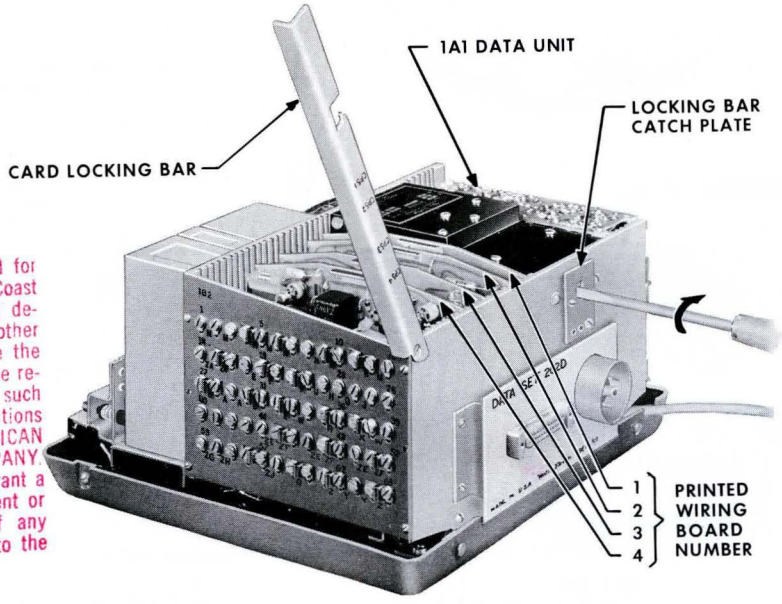


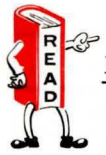
Fig. 1 - Printed Wiring Board Changeout

2. GROUND NOISE TEST

2.01 When required (see Section 592-016-200), measure the noise between the data set ground and the business machine ground using a 6A impulse counter as follows:

(1) Connect business machine ground to top IN binding post of 6A impulse counter.

(2) Connect data set ground to the bottom IN binding post of 6A impulse counter.



Do not ground 6A for this test.

(3) Set WTG switch to VOICE BAND.

(4) Set REF LEV DBRN toggle switch to ADD 30.

(5) Set REF LEV DBRN rotary switch to 60.

(6) Set MINUTES switch to 15.

(7) Reset counter to 0000 by use of RESET lever.

2.02 If any counts are noted in a 15-minute period, grounding arrangements must be improved as covered in Section 592-016-200.

3. INTERFACE TEST

3.01 The following equipment is required at the station:

- 901-Type Data Test Set (Fig. 2).

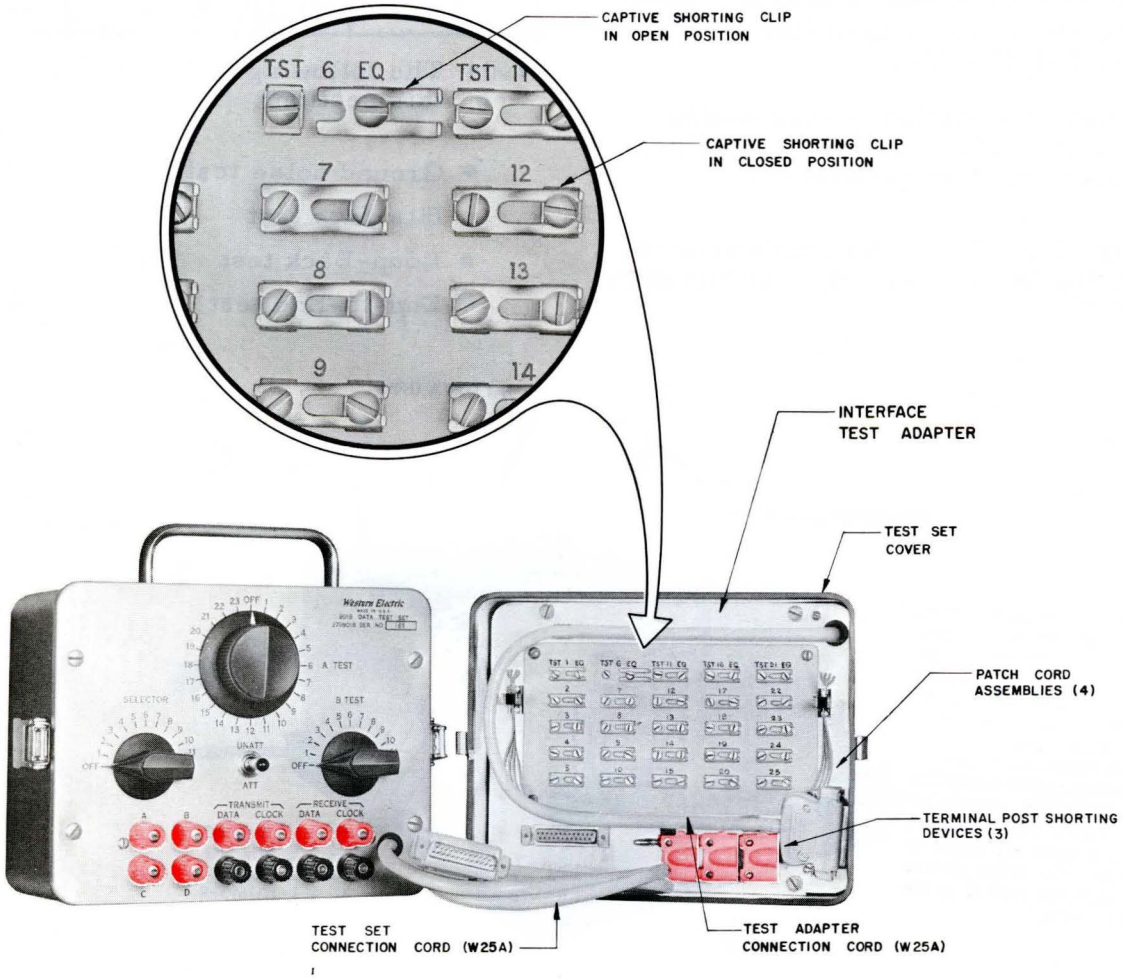


Fig. 2 - 901B Data Test Set

- Interface Test Adapter (Fig. 2).
- KS-14510, List 1 Volt-Ohm-Milliammeter or equivalent.
- 1011-Type Hand Set.

3.02 A block diagram illustrating the equipment set up for interface tests is shown in Fig. 3.

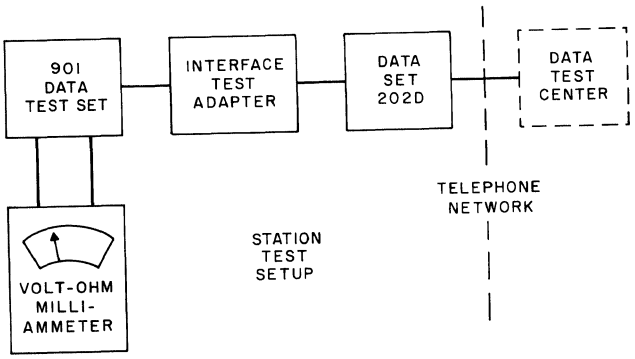


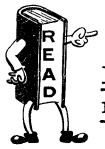
Fig. 3 - Block Diagram - Interface Test

3.03 The interface test adapter shall be arranged as shown in Fig. 4 for sets wired for voltage interface (wiring option N) and as per Fig. 5 for sets wired for 202A/B type interface (wiring option M).

Note: In order to avoid damage to data sets arranged for 202A/B type interface, it is important that the interface test adapter not be connected to data set until adapter is arranged as per Fig. 5.

3.04 Conduct interface tests with data test center as shown in Table B for sets arranged for voltage interface and as per Table C for sets arranged for 202A/B type interface.

3.05 If unable to meet test requirements, replace data set.



If data set is replaced, verify that new data set is strapped correctly.

4. LOOP-BACK TEST

4.01 Procedure:

(1) Take data auxiliary set handset off-hook, depress TALK key, and call nearest data test center.

Note: On service applications where data auxiliary set 804A type is not used, originate call on an adjacent telephone set.

(2) When instructed by data test center, depress TEST key. Hold it depressed until TEST lamp lights.

(3) Replace data auxiliary set handset on-hook.

(4) Data test center originates test call to data set. (Disregard momentary ringing of bell.)

(5) Data set is now under control of data test center.

(6) At end of test, data test center releases data set from test mode (as indicated by TEST lamp going out).

5. END-TO-END TESTS

5.01 The following test equipment is required at each station:

- 901 Data Test Set.
- Interface Test Adapter.
- 902-Type Data Test Set.
- 903-Type Data Test Set.
- 1011-Type Hand Set.

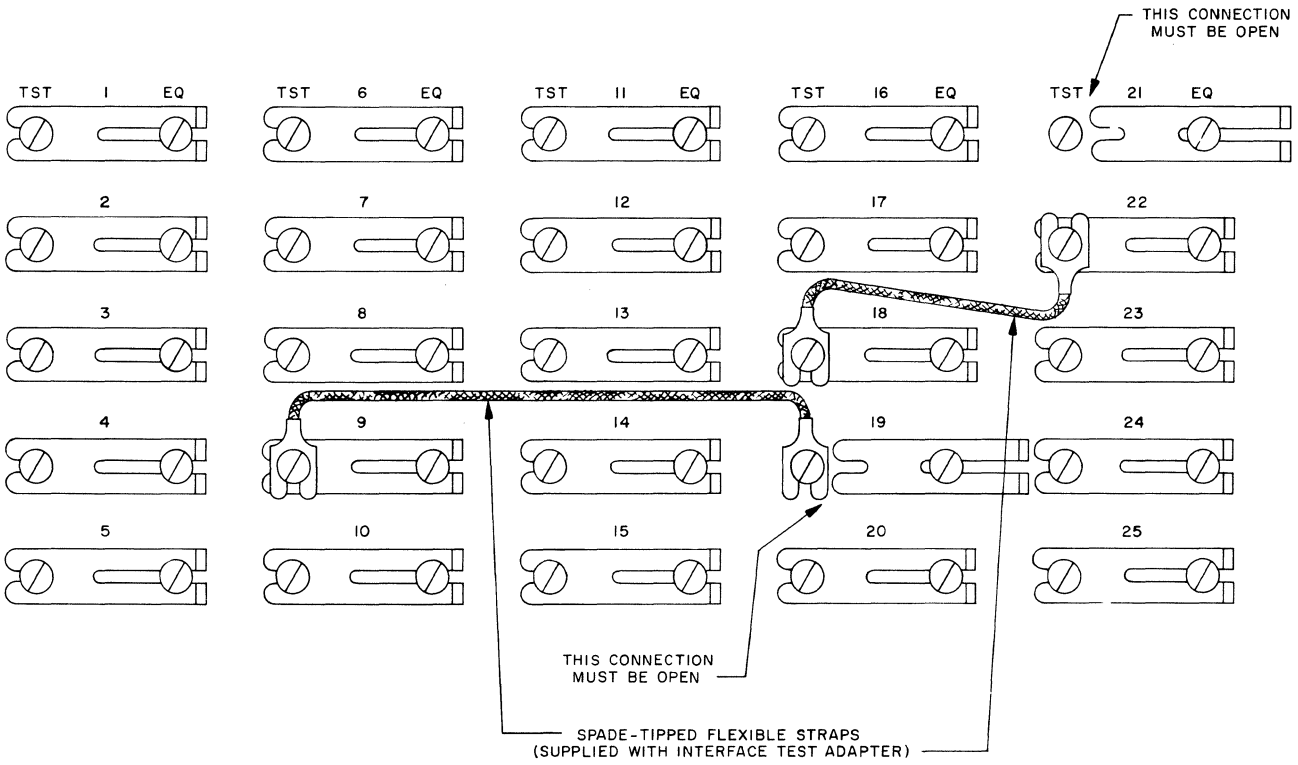


Fig. 4 - Interface Test Adapter, Connection Arrangement - Voltage Interface (Wiring Option N)

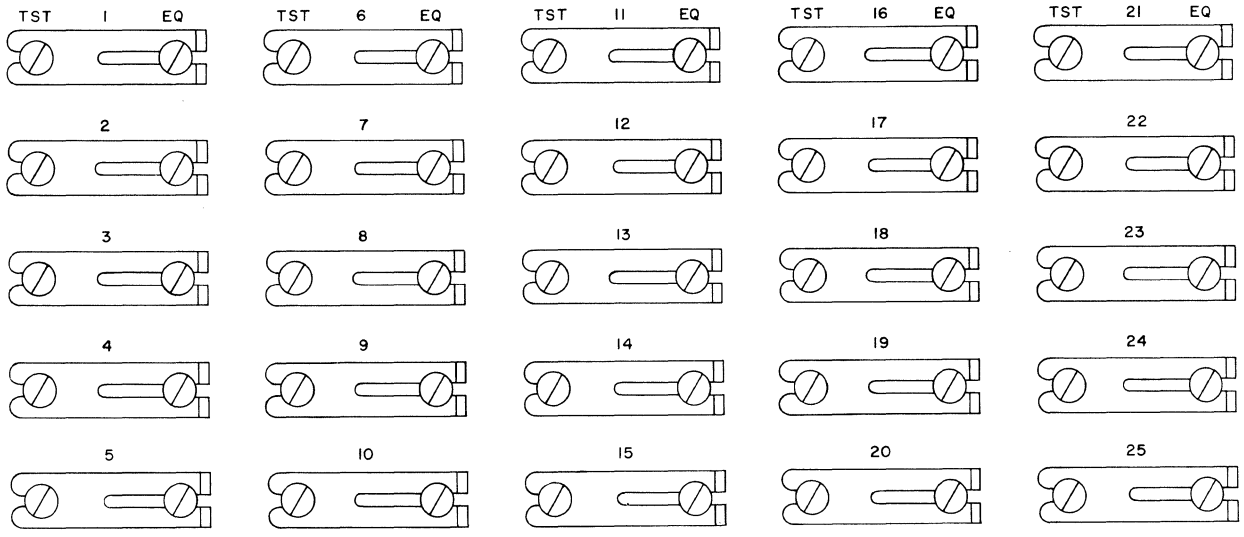


Fig. 5 - Interface Test Adapter, Connection Arrangement - 202A/B Type Interface (Wiring Option M)

TABLE B

INTERFACE TEST - VOLTAGE INTERFACE (N OPTION)

STEP	PREPARATION	901 TEST SET			VOLT-OHM-MILLIAMMETER				INTERFACE LEAD AND CONDITION	PRINTED WIRING BOARD ASSEMBLY NUMBER (SEE FIG. 1 AND TABLE A)
		TEST SWITCH		TOGGLE SWITCH	SCALE	CONNECT PROBE		READING		
		A	B			+	-			
1	SET SELECTOR TO 202A (IF 901A IS USED). SET SELECTOR TO POSITION 4 (IF 901B IS USED).	-	-	-	-	-	-	-	-	-
2	CONNECT INTERFACE TEST ADAPTER (ARRANGED PER FIG. 4) TO INTERFACE OF DATA SET. CONNECT 901 TO INTERFACE TEST ADAPTER.	OFF	1	ATT	60VDC	C	A	19.0 ±1.5	NEGATIVE POWER SUPPLY	-
3	DISCONNECT METER PROBES BEFORE MOVING TEST SWITCH.	OFF	2	ATT	60VDC	A	C	18.5 ±1.5	POSITIVE POWER SUPPLY	-
4		2	OFF	ATT	12VDC	C	A	8.0 ±3.0	BB(MARK)	4
5	CHANGE METER SCALE BEFORE MOVING TEST SWITCH	1	OFF	ATT	60VDC	C	A	18.5 ±1.5	CC(OFF)	1
6	NOTE: IF DATA SET IS NOT WIRED FOR AUTO ANSWER (Q WIRING), TEMPORARILY ARRANGE NOW. *	OFF	OFF	ATT	60VDC	C	B	16.5 ±2.0	CE(OFF)	1
7	REQUEST DATA TEST CENTER TO PLACE CALL TO DATA SET. NOTE: METER POINTER WILL BE OFF SCALE TO THE LEFT OF ZERO DURING SILENT PORTION OF RINGING CYCLE.	OFF	OFF	ATT	12VDC	B	C	6.5 ±3.0 (DURING RING PORTION OF RINGING CYCLE)	CE(ON)	1
8	RINGER IN DATA AUXILIARY SET SHOULD STOP RINGING; DATA AND TALK LAMPS SHOULD LIGHT.	1	OFF	UNATT	12VDC	A	C	9.2 ±1.0	CC(ON)	1
9	REQUEST DATA TEST CENTER SEND 1200 ±10 CPS AT -10 dbm LEVEL.	5	OFF	UNATT	12VDC	A	C	8.0 ±3.0	CF(ON)	3
10	REQUEST DATA TEST CENTER SEND 2200 ±10 CPS AT -10 dbm LEVEL. †	2	OFF	UNATT	12VDC	A	C	8.0 ±3.0	BB(SPACE)	4
11 ‡	IF REVERSE CHANNEL IN OPTION IS NOT PROVIDED, TEMPORARILY PROVIDE NOW (I WIRING).	OFF	OFF	UNATT	12VDC	C	D	8.0 ±3.0	SB(OFF)	DATA UNIT 1A1
12 ‡	REQUEST DATA TEST CENTER SEND 387 ±3 CPS AT -10 dbm FOR 30 SECONDS.	OFF	OFF	UNATT	12VDC	D	C	11.0 ±3.0	SB(ON)	DATA UNIT 1A1
13 ‡	REQUEST DATA TEST CENTER MEASURE REVERSE CHANNEL TONE FREQUENCY. REQUIREMENTS: §	17	OFF	UNATT	-	-	-	-	-	-
14	END OF TEST. RESTORE TO PRETEST CONDITION.									

* MAINTAIN COMMUNICATION WITH DATA TEST CENTER ON ANOTHER LINE IF POSSIBLE, OTHERWISE IT WILL BE NECESSARY TO COMMUNICATE WITH DATA TEST CENTER VIA DATA AUXILIARY SET BY SWITCHING FROM TALK TO DATA MODES USING TALK AND DATA KEYS.

† END OF TEST. IF REVERSE CHANNEL IS NOT EQUIPPED, RESTORE DATA SET TO PRETEST CONDITION. (IF A WIRING OPTION WAS CONNECTED TEMPORARILY FOR TEST AS PER STEP 6, REMOVE.)

‡ WHEN REVERSE CHANNEL IS EQUIPPED, IT SHOULD BE TESTED AT TIME OF INSTALLATION, (EVEN THOUGH ITS USE MAY NOT BE REQUIRED INITIALLY).

§ REQUIREMENTS: WITHOUT CARRIER (OTHER THAN N OR ON TYPE) FACILITIES 387 ±3 CPS
WITH CARRIER (OTHER THAN N OR ON TYPE) FACILITIES 387 ±12 CPS.

TABLE C

INTERFACE TEST - 202A/B TYPE INTERFACE (M OPTION)

STEP	PREPARATION	901 TEST SET			VOLT-OHM-MILLIAMMETER				INTERFACE LEAD AND CONDITION	PRINTED WIRING BOARD ASSEMBLY NUMBER (SEE FIG.1 AND TABLE A)
		TEST SWITCH		TOGGLE SWITCH	SCALE	CONNECT PROBE		READING		
		A	B			+	-			
1	SET SELECTOR TO 202A (IF 901A IS USED). SET SELECTOR TO POSITION 4 (IF 901B IS USED).	-	-	-	-	-	-	-	-	-
2	CONNECT INTERFACE TEST ADAPTER (ARRANGED PER FIG. 5) TO INTERFACE OF DATA SET. CONNECT 901 TO INTERFACE TEST ADAPTER.	OFF	1	ATT	60VDC	C	A	19.0 ±1.5	NEGATIVE POWER SUPPLY	-
3	DISCONNECT METER PROBES BEFORE MOVING TEST SWITCH.	OFF	2	ATT	60VDC	A	C	18.5 ±1.5	POSITIVE POWER SUPPLY	-
4		2	OFF	ATT	12VDC	C	A	8.0 ±3.0	BB(MARK)	4
5	CHANGE METER SCALE BEFORE MOVING TEST SWITCH.	1	OFF	ATT	60VDC	C	A	0 ±0.7	CC(OFF)	1
6	NOTE: IF DATA SET IS NOT WIRED FOR AUTO ANSWER (Q WIRING), TEMPORARILY ARRANGE NOW. *	OFF	OFF	ATT	X10,000	B	C	APPROXIMATELY 300,000Ω	RI(OFF)	-
7	REQUEST DATA TEST CENTER TO PLACE CALL TO DATA SET. RINGER IN DATA AUXILIARY SET SHOULD RING.	OFF	OFF	ATT	X10,000	B	C	APPROXIMATELY 100,000Ω (DURING RING PORTION OF RINGING CYCLE)	RI(ON)	-
8	RINGER IN DATA AUXILIARY SET SHOULD STOP RINGING; DATA AND TALK LAMPS SHOULD LIGHT.	1	OFF	UNATT	12VDC	A	C	9.2 ±1.0	CC(ON)	1
9	REQUEST DATA TEST CENTER SEND 1200 ±10 CPS AT -10 dbm LEVEL.	5	OFF	UNATT	12VDC	A	C	8.0 ±3.0	CF(ON)	3
10	REQUEST DATA TEST CENTER SEND 2200 ±10 CPS AT -10 dbm LEVEL. †	2	OFF	UNATT	12VDC	A	C	8.0 ±3.0	BB(SPACE)	4
11 ‡	IF REVERSE CHANNEL IN (I WIRING) IS NOT PROVIDED, TEMPORARILY ARRANGE NOW.	OFF	OFF	UNATT	12VDC	C	D	8.0 ±3.0	SB(OFF)	DATA UNIT 1A1
12 ‡	REQUEST DATA TEST CENTER SEND 387 ±3 CPS AT -10 dbm FOR 30 SECONDS	OFF	OFF	UNATT	12VDC	D	C	11.0 ±3.0	SB(ON)	DATA UNIT 1A1
13 ‡	REQUEST DATA TEST CENTER MEASURE FREQUENCY OF REVERSE CHANNEL TONE. REQUIREMENTS: §	17	OFF	UNATT	-	-	-	-	-	-
14	END OF TEST. RESTORE TO PRETEST CONDITION.									

* MAINTAIN COMMUNICATION WITH DATA TEST CENTER ON ANOTHER LINE IF POSSIBLE, OTHERWISE IT WILL BE NECESSARY TO COMMUNICATE WITH DATA TEST CENTER VIA DATA AUXILIARY SET BY SWITCHING FROM TALK TO DATA MODES USING TALK AND DATA KEYS.

† END OF TEST. IF REVERSE CHANNEL IS NOT EQUIPPED, RESTORE DATA SET TO PRETEST CONDITION. (IF A WIRING OPTION WAS CONNECTED TEMPORARILY FOR TEST AS PER STEP 6, REMOVE.)

‡ WHEN REVERSE CHANNEL IS EQUIPPED, IT SHOULD BE TESTED AT TIME OF INSTALLATION, (EVEN THOUGH ITS USE MAY NOT BE REQUIRED INITIALLY).

§ REQUIREMENTS: WITHOUT CARRIER (OTHER THAN N OR ON TYPE) FACILITIES 387 ±3 CPS
WITH CARRIER (OTHER THAN N OR ON TYPE) FACILITIES 387 ±12 CPS.

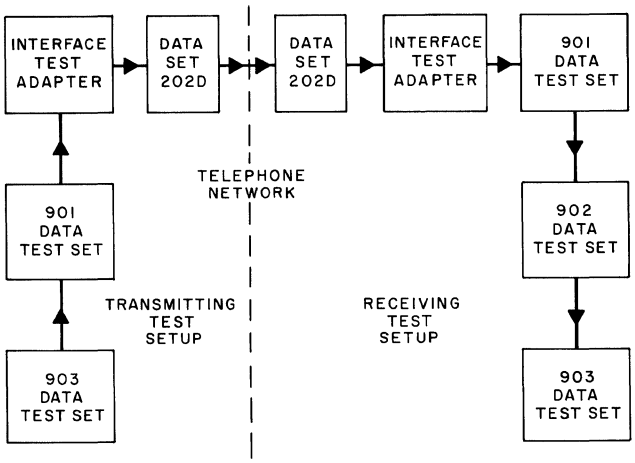


Fig. 6 - Block Diagram - End-to-End Test

5.02 A block diagram illustrating the equipment set up for end-to-end tests is shown in Fig. 6.

Verify that test equipment is in good operating condition.

5.03 Refer to the appropriate sections covering operational and calibration tests. Sections covering data test sets specified in these tests are as follows:

Data Test Set	Section
901 Type (and Adapter)	107-100-100
902 Type	107-300-100
903 Type	107-200-100

5.04 The block diagram shows the equipment set up at the two terminals for testing one direction of transmission. The test setup is reversed at each end to test the other direction of transmission. This checks the transmitter and receiver of both data sets and the two directions of transmission of the connecting facilities.

5.05 These tests measure the distortion and error rate of the data system. The transmitting data set is driven by a 903-type data test set (63-bit word generator). At the receiving end, the data set feeds the data signals to a 902-type data test set (distortion measuring and error checking set). Also at the receiving end, a 903-type data test set is used to deliver to the 902 test set a signal identical to the signal sent from the transmitting end. The 902 test set synchronizes these two signals, measures the peak distortion, and counts the number of errors in the received data.

5.06 Preparation of Test and Data Sets

Note: The following test checks circuitry furnished on printed wiring board assembly No. 2. (On 4-wire applications, circuitry on printed wiring board No. 5 is also checked.)

Transmitting End

- 901-Type Data Test Set:

  SELECTOR to Position 4 (if 901B is used).
  SELECTOR to 202A (if 901A is used)
  A TEST to Position 8.
  B TEST to OFF.
  UNATT-ATT to UNATT.

- 903 Data Test Set:

  TRIGGER to + .
  RANDOM-DOT to RANDOM .
  BIT RATE to as close to business machine bit rate as possible, but not lower.

5.07 Make the following connections between data set and data test sets:

(1) Run two leads from the SIGNAL OUT terminals of the 903 set to TRANSMIT DATA terminals of the 901 set. (Terminals are connected red to red and black to black.)

(2) On the interface test adapter, strap or open connections as per Fig. 4 (for sets arranged for voltage interface) or Fig. 5 (for sets arranged for 202A/B type interface).

(3) Connect interface test adapter to interface connector of data set (in place of business machine cord).

(4) Connect 901 data test set to connector of interface test adapter.

(5) Connect the power cord of 903 set to 117-volt ac outlet. Turn power switch ON.

5.08 Receiving End

Note: The following test checks circuitry furnished on printed wiring board assemblies No. 3 and 4. (On 4-wire applications, circuitry on printed wiring board No. 5 is also checked.)

- 901-Type Data Test Set

  SELECTOR to Position 4 (if 901B is used).
  SELECTOR to 202A (if 901A is used)
  A TEST to OFF.
  B TEST to OFF.
  UNATT-ATT to UNATT.

- 902-Type Data Test Set:

  BIT RATE to transmitted bit speed.
  Meter selection switch to DIST ADJ.
  TRIGGER - Not required.

- 903-Type Data Test Set:

  BIT RATE to EXT CLOCK.
  RANDOM-DOT to RANDOM.
  TRIGGER to +.

(1) Run two leads from RECEIVE DATA terminals of the 901 set to DATA IN terminals of the 902 set. (Terminals are connected red to red and black to black.)

(2) On the interface test adapter, strap or open connections as per Fig. 4 (for sets arranged for voltage interface) or Fig. 5 (for sets arranged for 202A/B type interface).

(3) Connect the 903 set to the 902 set with the cord provided.

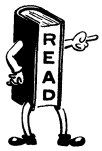
(4) Connect 901 data test set to connector of interface test adapter.

(5) Connect interface test adapter to interface connector of data set (in place of business machine cord).

(6) Connect power cord of 903 set to 117-volt ac outlet. Turn power switch ON.

5.09 Complete end-to-end tests will involve making two 15-minute and ten 1-minute test calls. Establish voice communication in the manner normally used by customer when placing data calls, eg:

- DDD.
- Attendant or operator assisted.



Take proper steps to ensure customer is not billed for calls on test (see Section 010-250-001).

5.10 Alternately place calls from each end except where one customer location will always be originating the call. These test calls should be made during busy hours; this will give reasonable assurance that all test calls do not use the same trunks and routes.

5.11 Procedure

(1) Establish voice communication between stations.

(2) The answering (called) station goes from the talk to data mode by depressing DATA button.

Note: This test checks circuitry furnished on data unit 1A1.

(3) When the originating (calling) station attendant hears the 2025-cps tone change to a lower frequency (either 1200 cps or 387 cps), he should go to the data mode by depressing the DATA key.

(4) The transmitting station momentarily depresses START switch of 903. The transmitting station has no further duties until end of test period.

(5) The receiving station performs the following steps:

(a) Allow the 902 meter selection switch to remain in the DIST ADJ position for several seconds before making distortion calibration adjustment. Zero the meter by means of the DISTORTION adjustment knob.

(b) Move the meter selection switch to VOLT ADJ position and again zero the meter by means of the VOLTS adjustment control.

(c) Move the meter selection switch to PHASE ADJ and again zero the meter by means of the PHASE adjustment control.

Note: The BIAS ADJ position on the 902 is not used in this test.

(d) Move the meter selection switch to DIST MEAS. Depress the WORD SYNC & RESET switch momentarily and record the time.

(e) The microammeter should settle down to some relatively stable value that indicates peak distortion. One microamp is equal to one per cent distortion. For example, a meter indication of 8 microamps would be 8 per cent peak distortion.

(f) The TOTAL ERROR lamps lighted on the 902 set indicate the number of errors in received data from the time the WORD SYNC & RESET switch was released. For example, should the 8, 4, and 1 lamps be lighted, this would be an indication of a total of 13 errors.

(g) See Fig. 7 for example of form for recording test results.

Test Call Requirements

5.12 During 15-minute calls, count errors in one minute test periods:

- Disregard the two test periods with highest number of errors.
- Of the remaining 13 test periods, 10 periods may have no more than two errors per period.
- The remaining three test periods may have no more than 10 errors per period.

5.13 For 1-minute calls:

- No more than 10-bit errors shall occur in 8-out-of-10 calls.
- The average distortion of 20 per cent must not be exceeded in 9-out-of-10 calls.

Note: The above limits are in no way guaranteed error rates. Except for the occasional extraordinary call, the error rates experienced by the customer should be considerably less.

DATA SET PRE-SERVICE PERFORMANCE TEST RECORD

Date: _____

Data Test Calls Placed Between:

	LOCATION	TEL. # OF TEST LINE OR STATION
(A)	_____	_____
(B)	_____	_____

Contemplated Customer S.O. Number's _____

Under Control of Data Test Center at _____

LONG DURATION TEST CALLS					BIT ERROR COUNT — MINUTE NUMBER													
ORIGINATED #	ORIGINATED AT	TIME	PEAK DISTORTION AT	PEAK DISTORTION %	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

SHORT DURATION TEST CALLS			SHORT CALL — NUMBER (READINGS AT _____)						SHORT CALL — NUMBER (READINGS AT _____)					
ORIGINATED AT	TIME		1	2	3	4	5		1	2	3	4	5	
		Peak Dist. Reading (%)												
		One Minute Error Count (Bits in Error)												
		Peak Dist. Reading (%)												
		One Minute Error Count (Bits in Error)												

Billing Adjustment (if required) referred to: _____

Parties involved in Tests: _____

Coordinated with tests to other locations at: _____

Comments and Notes:

Fig. 7 - Data Set Pre-Service Performance Test Record