DATA SETS 201A1, A2 AND 201B1, B2
TRANSMITTER-RECEIVER
TEST PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section contains information pertaining to the testing of Data Sets 201A1, A2 and 201B1, B2. This section is arranged so that tests may be performed individually if desired.

Note: Test information for Data Sets 201A3, A4 and 201B3, B4 is contained in Section 592-011-501. Test information for Data Set 201 list type is contained in Section 592-011-502.

1.02 This section is reissued to include information concerning Data Sets 201B1, B2. Prior to this issue, information concerning Data Sets 201B1, B2 was contained in Section 592-012-502. Due to extensive revision, change arrows have been omitted.

1.03 Part 3 of this section contains information for testing the data set using the 914B Data Test Set (DTS). If the craft employee is equipped with a 914B DTS, omit Part 2 and proceed to Part 3.

1.04 Before proceeding with any tests of the data set, assure that:

(a) The installation meets standard dc signaling, supervision, and transmission requirements as specified in Section 314-205-500.

(b) For DATA-PHONE® service, the loop meets the requirements specified in Section 314-205-500.

(c) For private line service, the facility meets the basic requirements specified in Section 314-410-500.

© American Telephone and Telegraph Company, 1970
Printed in U.S.A.

2. TEST PROCEDURES USING 901-, 902-, AND 903-TYPE DATA TEST SETS

2.01 This group of tests is divided into three parts: outlet ground source test, installation and maintenance tests, and end-to-end test. For procedure to be used when investigating a trouble report, refer to the section entitled Data Sets 201A1, A2 and 201B1, B2, Transmitter-Receiver, Maintenance (592-011-300).

A. Outlet Ground Source Test

2.02 If the data set and business machine are not connected to the same ground, errors may be caused by a potential difference between data set ground and business machine ground. A test should be made using the 6A impulse counter to detect the presence of noise potentials.

2.03 The 6A impulse counter is connected and the test is performed as shown in Fig. 1. If any errors are counted in the 15-minute test period, the grounds must be bonded together according to local instructions.

> ***Note:*** General description, calibration, and operating procedure for the 6A impulse counter are contained in the section entitled J94006A (6A) Impulse Counter, Description, Operation, and Maintenance (103-620-100).

B. Installation and Maintenance Tests

2.04 These tests are to be performed after installing the data set or when investigating a trouble report. This procedure provides a method of verifying proper data set operation. If the data set is not operating properly, this procedure also provides a method of isolating a data set trouble to a board or group of boards in the data set.

2.05 The back-to-back test must be performed first. If no errors are detected, this verifies that the data set is operating correctly. If excessive errors are detected during the back-to-back test, proceed as outlined in 2.13. For further information covering data set maintenance, refer to Section 592-011-300.

2.06 These tests check the operation of the transmitter, receiver, clock signals, control signals, and transmitter output level. Equipment required for performing this test is listed as follows:

(a) For data sets equipped with internal timing:

1—901-type Data Test Set

1—902-type Data Test Set

2—903-type Data Test Sets

1—KS-14510 L1 or KS-16979 L1 volt-ohm-milliammeter (VOM)

1—600- or 900-ohm resistor.

(b) For data sets equipped for external timing:

All of the equipment listed in (a) and

1—32LBMP-2000 (for 201A) or -2400 (for 201B) frequency standard. This is available from Bulova Watch Company, American Time Products Division, 61-20 Woodside Avenue, Woodside, New York

or

1—901-type Data Test Set and an internally timed Data Set 201-type (in addition to the data set under test).

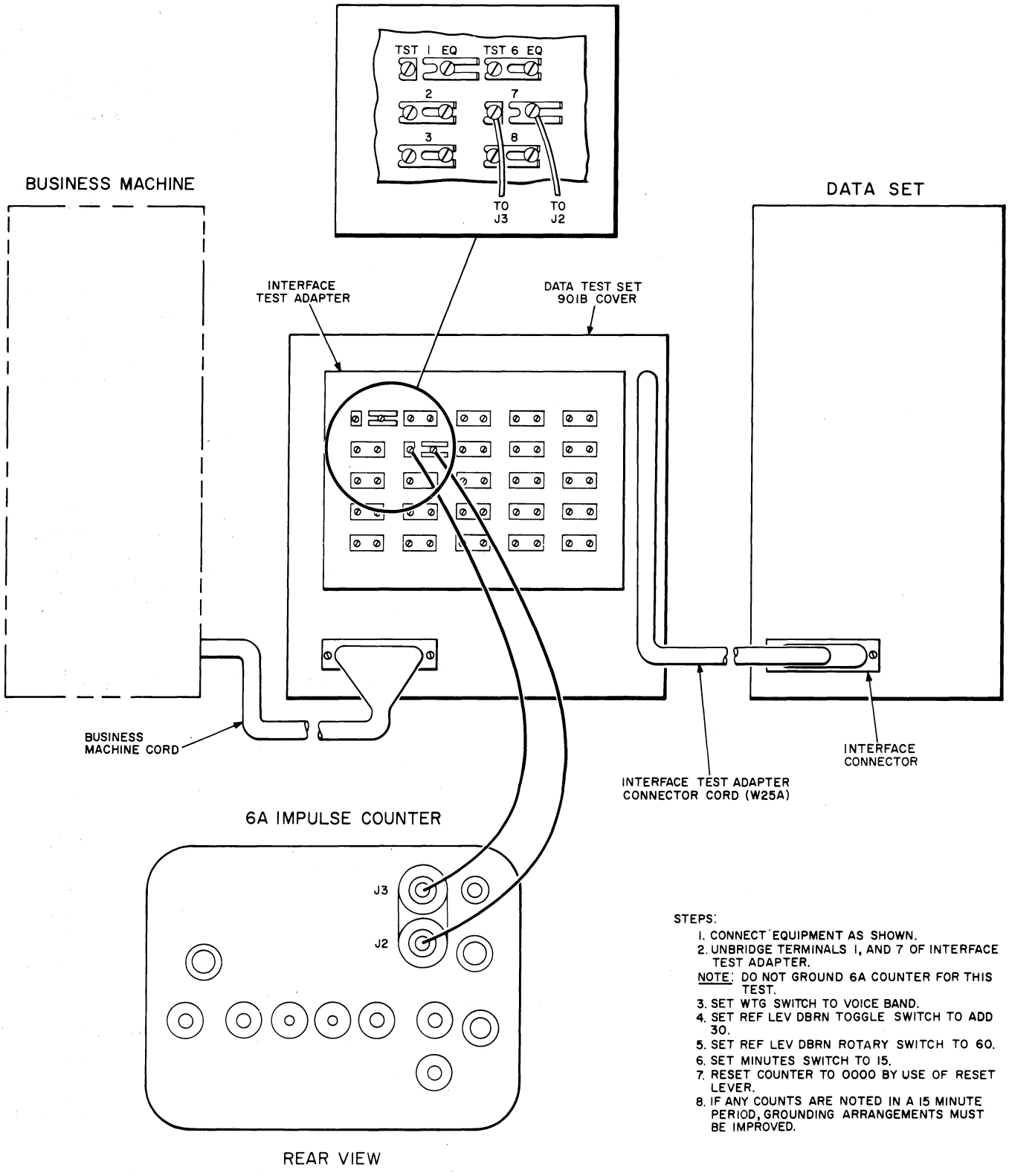
> ***Note:*** The additional data set must be of the same speed as the data set under test.

2.07 All tests specified throughout this section are written for data sets equipped with internal timing. To test an externally timed data set, it will be necessary to provide a clock signal from either the frequency standard or the additional data set.

2.08 The procedure for testing an externally timed data set by using the frequency standard is as follows:

(a) Run two leads from the TRANSMIT CLOCK terminals of the 901-type DTS to the OUTPUT terminals of the frequency standard (red to red, black to black). These leads must remain connected for the duration of the test.

(b) Connect the power cord of the frequency standard to a 117-volt ac outlet.



STEPS:

1. CONNECT EQUIPMENT AS SHOWN.
2. UNBRIDGE TERMINALS 1, AND 7 OF INTERFACE TEST ADAPTER.
   NOTE: DO NOT GROUND 6A COUNTER 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.
8. IF ANY COUNTS ARE NOTED IN A 15 MINUTE PERIOD, GROUNDING ARRANGEMENTS MUST BE IMPROVED.

Fig. 1—6A Impulse Counter Test

(c) No further operations are necessary. The data set, externally timed, can be tested as though it were internally timed.

2.09 The procedure for testing an externally timed set by using an internally timed data set and an additional 901-type DTS is as follows:

(a) Set the controls on the additional 901-type DTS as follows:

SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT switch to ATT.

(b) Run two leads between the 901-type DTSs to connect the TRANSMIT CLOCK terminals together (red to red, black to black).

(c) Plug the additional 901-type DTS into the internally timed Data Set 201A or 201B (in place of the business machine cord).

(d) Connect the data set power cord to a 117-volt ac outlet.

(e) No further operations are necessary. The externally timed data set can be tested as though it were internally timed.

Back-to-Back Test

2.10 In this test, the transmitter is driven by a 903-type DTS (63-bit generator). The receiver output is fed to a 902-type DTS (distortion- and error-checking test set). A second 903-type DTS feeds a signal to the 902-type DTS. The 902-type DTS compares the two signals and counts the errors in the receiver output. The 901-type DTS is used to gain access to the necessary interface leads and to provide the voltage which holds the Data Set 201-type in the transmit mode. Figure 2 shows the connection diagram for the back-to-back test.

2.11 The controls on the data test sets should be as follows:

●901-type DTS

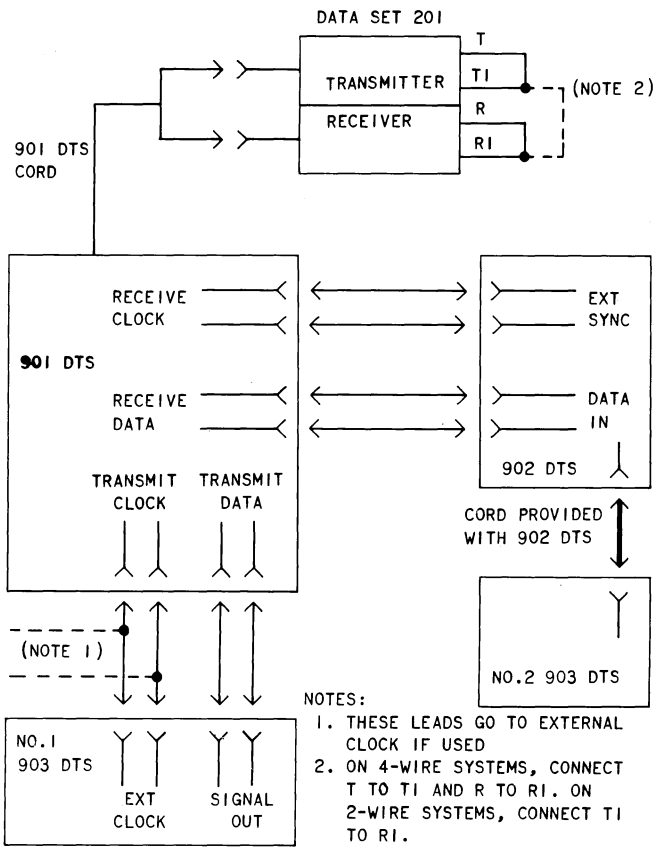


Fig. 2—Back-to-Back Test, Block Diagram

SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

A TEST switch to position 9

B TEST switch to OFF

ATT-UNATT switch to ATT.

●902-type DTS

BIT RATE switch to EXT SYNC

Meter selection switch to DIST MEAS

TRIGGER switch to minus (−).

●No. 1 (transmitting) and No. 2 (receiving) 903-type DTSs

BIT RATE switch to EXT CLOCK

RANDOM-DOT switch to RANDOM

TRIGGER switch to plus (+).

Each pair of terminals on all data test sets has one red and one black terminal. Connections between test sets must be made red to red and black to black.

(a) Run two leads from the SIGNAL OUT terminals of the No. 1 903-type DTS to the TRANSMIT DATA terminals of the 901-type DTS.

(b) Run two leads from the EXT CLOCK terminals of the No. 1 903-type DTS to the TRANSMIT CLOCK terminals of the 901-type DTS.

Note: For externally timed data sets, there are two pairs of leads on the TRANSMIT CLOCK terminals of the 901-type DTS.

(c) Run two leads from the RECEIVE DATA terminals of the 901-type DTS to the DATA IN terminals of the 902-type DTS.

(d) Run two leads from the EXT SYNC terminals of the 902-type DTS to the RECEIVE CLOCK terminals of the 901-type DTS.

(e) Connect the No. 2 903-type DTS to the 902-type DTS with the cord provided.

(f) Connect the power cords of both 903-type DTSs to a 117-volt ac outlet.

(g) Connect the 901-type DTS to the connector of Data Set 201B (in place of the business machine cord).

(h) ***2-Wire Systems:*** Disconnect line wires. If the installation uses a D25C cord, connect a 600- or 900-ohm resistor across cord leads W-BR and BR-W. If the installation uses a D25D cord and a 66E3 connector block, connect a 600- or 900-ohm resistor across terminals 14 and 16 at the 66E3 connector block. Temporarily strap terminal 5 to terminal 7 on terminal strip L2 in the data set and leave strapping as called for on the service order.

(i) ***4-Wire Systems:*** Disconnect line wires. If the installation includes a LINE—TEST key circuit, place the key in the TEST position. If the installation does not include a LINE—TEST key circuit, proceed as follows:

(1) For installations equipped with the D25C cord and 44A connector block, connect the S-W lead to the BR-W lead and the W-S lead to the W-BR lead. Connect a 600- or 900-ohm resistor across cord leads W-BR and BR-W.

(2) For installations equipped with the D25D cord and 66E3 connector block, connect terminal 14 to terminal 18 and terminal 16 to terminal 20. Connect a 600- or 900-ohm resistor across terminals 14 and 16.

(j) Connect the power cords of Data Set 201-type to a 117-volt ac outlet.

(k) Apply power to both 903-type DTSs by setting both power switches ON.

(l) Momentarily depress the START switch on both 903-type DTSs.

(m) Momentarily depress the WORD SYNC & RESET switch on the 902-type DTS. The sole purpose of the 902-type DTS in this test is to count errors; therefore, any meter reading or any adjustment of controls DISTORTION, VOLTS, or PHASE is disregarded.

(n) The TOTAL ERRORS lamps on the 902-type DTS note any errors which occur. To obtain the total errors, add the values indicated by all lighted lamps. When the bottom lamp is lighted, it indicates that the capacity of the counter is exceeded and that the amount indicated is erroneous.

(o) To insure that the 902-type DTS is counting errors, depress the START switch on the No. 2 903-type DTS. The 902-type DTS should indicate maximum errors by the bottom lamp lighting.

(p) Momentarily depress the WORD SYNC & RESET switch on the 902-type DTS and allow the test to continue for at least 5 minutes. No errors should be recorded. If an error is recorded, perform (l) through (o) again. If errors are recorded during the second test, the set is faulty and should be replaced or repaired as specified in 2.13.

(q) Reterminate line wiring. Remove the resistor and temporary straps from the connector block. If a LINE—TEST key was used, place it in the LINE position.

2.12 If no errors are detected during the back-to-back test, the data set is operating correctly. If the data station trouble persists, proceed as follows:

(a) Confirm that the business machine and associated cords test satisfactorily.

(b) Check for cord and connector defects.

(c) Check for intermittent trouble in the drop, inside wire, protector, etc.

Interface Test

2.13 If excessive errors are detected during the back-to-back test, the control signals should be tested. To test the control signals, proceed as follows:

(a) Disconnect the 901-type DTS from the Data Set 201-type and connect it to the interface test adapter (cover of 901-type DTS). Connect the interface test adapter to connector J2 (CUST EQPT) on the Data Set 201-type.

(b) Connect the VOM to the interface test adapter with the negative probe to terminal 1 and the positive probe to terminal 4. Verify that request-to-send (RS) is high.

Requirement: Approximately +12 volts

(c) Move the positive probe of the meter to terminal 5. Measure the voltage on the clear-to-send (CS) lead when RS is high.

Requirement: +5 volts or greater

(d) Move the positive probe of the meter to terminal 8. Measure the voltage on the carrier-on (CO) lead when RS is high.

Requirement: +5 volts or greater

Note: If the data set does not meet the requirements specified in (c), replace cards T5 and T9. If the data set does not meet the requirements specified in (d), replace cards R11 and R12.

(e) Remeasure CS and CO as specified in (c) and (d). If CS and CO do not meet requirements, the data set must be replaced.

Note: Verify that the replacing data set has the same list combination and is equipped with the same options as the data set being replaced.

(f) If CS and CO meet the specified requirements, perform the back-to-back test again.

(g) If excessive errors are detected, move the A TEST switch to position 7. This applies +12 volts to the send data (SD) lead. Turn both 903-type DTSs off.

(h) Move the positive probe of the meter to terminal 3. Measure receive data (RD) when +12 volts is applied to the SD lead.

Requirement: +5 volts or greater

(i) Disconnect the meter. Move the A TEST switch to position 6. This applies −12 volts to the SD lead. Connect the VOM to the interface test adapter with the positive probe to terminal 1 and the negative probe to terminal 3.

(j) Measure RD when −12 volts is applied to the SD lead.

Requirement: More negative than −4 volts

Note: If RD does not meet the requirements specified in (h) or (j), replace card R12.

(k) Remeasure the RD voltage as specified in (g) through (j). If the RD voltage does not meet requirements, the data set must be replaced.

(l) If RD meets the specified requirements, disconnect the VOM and move the A TEST switch to position 9.

(m) Perform the back-to-back test again as specified in 2.11.

(n) If excessive errors are detected, replace cards R13, R14, R15, and R16 as a group.

Note: Cards R13 through R16 are a matched group. If any card in the group is defective, the entire group must be replaced. If it is necessary to replace only one card in the group, the entire group must be tested and matched as specified in Section 592-011-151.

(o) If cards R13 through R16 are not available, replace the data set.

(p) If the data set is operating correctly, disconnect the data test sets, replace the cord to customer equipment, and restore the data station to normal. If the data set has a problem with the automatic answer, proceed to 2.14.

Automatic Answer Test

2.14 This is a test of the leads controlling the mechanical automatic answer circuit. If the data set fails this test, replace the mechanical automatic answer unit. The test is performed as follows:

(a) Plug the interface adapter (cover of 901-type DTS) into connector J2 (CUST EQPT) on the data set. Plug the 901-type DTS into the interface test adapter.

(b) Set the controls on the 901-type DTS as follows:

A TEST switch to OFF

B TEST switch to 5

ATT-UNATT switch to UNATT

SELECTOR switch to 201A (for 901A DTS) or to position 3 (for 901B DTS).

(c) Apply power to Data Set 201-type.

(d) Connect the VOM to the interface test adapter with the negative probe to terminal 1 and the positive probe to terminal 6. Measure the voltage on the interlock (IT) lead.

Requirement: Greater than +5 volts

(e) Manually operate the R relay and again measure the IT voltage. The IT voltage must drop to zero. Release the R relay.

(f) Move the positive probe of the meter from terminal 6 to terminal 20. Measure the voltage on the remote control (RC) lead.

Requirement: Approximately +12.0 volts

(g) Move the ATT-UNATT switch to the ATT position. The RC voltage must drop to zero.

(h) Reverse the leads to the VOM and operate the H relay. Measure the RC voltage.

Requirement: Approximately −12.0 volts

(i) Disconnect the power to the data set. Set up the VOM to measure ohms.

(j) Connect the ohmmeter across terminals 22 and 23 on the interface test adapter. The meter should indicate an open circuit.

(k) Operate the R relay. The ohmmeter should indicate an open circuit.

(l) End of test. Disconnect the test equipment and restore the data set to normal.

C. End-to-End Test

2.15 This test checks the transmitter and receiver of the data set and the connecting facilities. Refer to Fig. 3. In this test, Data Set 201-type is driven by a 903-type Data Test Set (DTS). The 901-type DTS is used to provide access to the interface of Data Set 201-type. At the distant end, the data signals are fed either to a 904B or 904D data test center or to a remote Data Set 201-type. The block diagram shows equipment setup for testing either end with a data test center or a remote Data Set 201-type.

Note: The procedure for testing with a 904 data test center is included in Section 668-102-500.

2.16 If the test is conducted using a data test center, the test will be coordinated and made under the direction of the data test center. The transmitting and receiving setup is the same for testing with a data test center or a remote Data Set 201-type. The block diagram shows the equipment setup at two terminals for testing one direction of transmission. The test equipment is

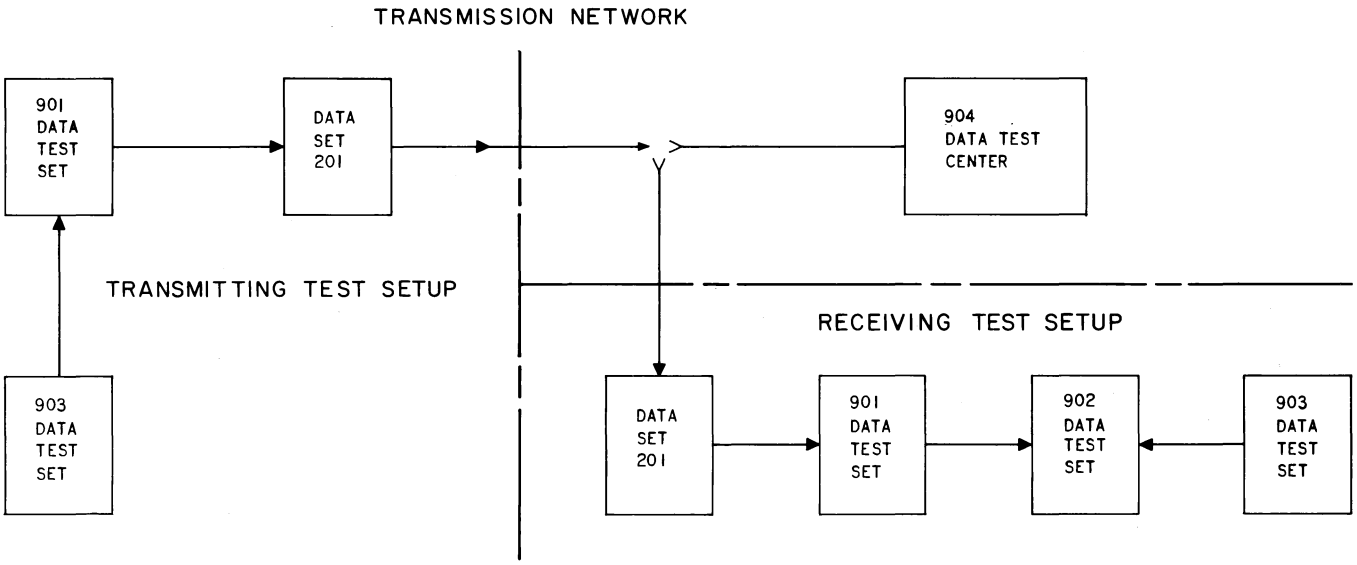


Fig. 3—End-to-End Test, Block Diagram

set up as shown in each location for one-half of the test, then reversed for the second half.

2.17 The transmitting-end controls on the data test sets should be as follows:

●901-type DTS

SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

A TEST switch to position 9

B TEST switch to OFF

ATT-UNATT switch to UNATT.

●903-type DTS

TRIGGER switch to + (plus)

RANDOM-DOT switch to RANDOM

BIT RATE switch to EXT CLOCK.

(a) Run two leads from the SIGNAL OUT terminals of the 903-type DTS to the TRANSMIT DATA terminals of the 901-type DTS.

Each pair of terminals on the data test set has one red and one black terminal. Connections between test sets must be made red to red and black to black.

(b) Run two leads from the EXT CLOCK terminals of the 903-type DTS to the TRANSMIT CLOCK terminals of the 901-type DTS.

(c) Connect the 901-type DTS to connector J2 (CUST EQPT) on Data Set 201A or 201B.

(d) Connect the power cord of the 903-type DTS to a 117-volt ac outlet. Turn the power switch ON.

2.18 The receiving-end controls on the data test sets should be as follows:

●901-type DTS

SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

A TEST switch to OFF

B TEST switch to position 8

ATT-UNATT switch to UNATT.

●902-type DTS

BIT RATE switch to EXT SYNC

TRIGGER switch to - (minus)

Meter selection switch to DIST MEAS.

●903-type DTS

RANDOM-DOT switch to RANDOM

BIT RATE switch to EXT CLOCK

TRIGGER switch to + (plus).

(a) Connect the 903-type DTS to the 902-type DTS with the cord provided.

(b) Connect the 901-type DTS to connector J2 (CUST EQPT) on Data Set 201A or 201B.

(c) Run two leads from the RECEIVE DATA terminals of the 901-type DTS to the DATA IN terminals of the 902-type DTS.

(d) Run two leads from the EXT SYNC terminals of the 902-type DTS to the RECEIVE CLOCK terminals of the 901-type DTS.

(e) Connect the power cord of the 903-type DTS to a 117-volt ac outlet. Turn the power switch ON.

2.19 On the switched telephone network, complete end-to-end tests consist of making two 15-minute and ten 1-minute test calls. Establish voice communication in the manner normally used by the customer when placing data calls.

Take proper steps to insure that the customer is not billed for toll calls on tests. See Section 010-250-001.

2.20 Place calls alternately from each end except where one customer location will always be originating the call. Test calls should be placed during busy hours. This will make certain that all test calls do not use the same trunks and routes.

2.21 During the 15-minute calls, the receiving station should make a minute-by-minute count of errors as indicated by lighted lamps on the 902-type DTS. To prevent exceeding counter capacity, the RESET button should be depressed at the end of each minute after error count has been noted. Figure 4 illustrates format which can be used for recording test data. The PEAK DISTORTION columns of Fig. 4 should be ignored for these tests. Occasionally, a noise burst or "hit" may cause the error counter to lose synchronization and indicate continuous errors. The interval up to and including the burst should be tabulated as "over 100 bit errors." The RESET button on the 902-type DTS should be depressed to continue tests.

2.22 On private line systems, the length of the test period will be prescribed by the serving test center. Voice communication between terminals can be established over a separate facility if a telephone set is not associated with the data set.

2.23 After a voice connection has been established, a brief continuity check must be made. This continuity check is conducted in the following manner:

(a) ***Telephone Associated With the Data Set:*** The transmitting station can be shifted from the talk mode to the data mode by depressing the DATA button. The START switch of the 903-type DTS should be depressed for approximately 15 seconds. The receiving station attendant should hear a high-pitched tone which indicates that data is being received.

(b) ***No Telephone Set Associated With the Data Set:*** The transmitting station attendant must depress the START switch on the 903-type DTS for approximately 15 seconds. By connecting a 1011-type handset across tip and ring (2-wire systems) or the receive pair (4-wire systems), the receiving station attendant should hear a high-pitched tone which indicates that data is being received.

2.24 After a prearranged time interval (approximately 15 seconds), the transmitting station attendant must shift the data set back to the talk mode, and if the receiving station reports that data is being received, the attendant must shift the data set to the data mode and depress the START switch on the 903-type DTS for 15 seconds. The

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 _____)						(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. 4—Data Set Preservice Performance Test Record

transmitting station attendant has no further duties until the end of the test.

2.25 The receiving station attendant must listen to verify that data is being received and must shift the data set to the data mode (if necessary). The WORD SYNC & RESET switch must then be depressed on the 902-type DTS.

2.26 The TOTAL ERRORS lamps on the 902-type DTS register any errors which occur in transmission. To obtain the total errors, add the values indicated by all lighted lamps. When the bottom lamp is lighted, the capacity of the counter has been exceeded and the amount indicated is erroneous.

2.27 To insure that the 902-type DTS is counting errors, depress the START switch on the receiving 903-type DTS. The 902-type DTS should indicate maximum errors by the bottom lamp lighting.

2.28 Momentarily depress the WORD SYNC & RESET switch on the 902-type DTS and note the time.

2.29 At the end of each minute, the WORD SYNC & RESET switch should be depressed after the total errors have been noted. This prevents exceeding the counter capacity.

2.30 At the end of the prearranged time interval, voice communication is established again and an agreement is made to repeat the test in the opposite direction. The test is then repeated with the first transmitting station becoming the receiver and the first receiving station becoming the transmitter.

2.31 The test call requirements for the switched telephone network are as follows:

(a) For 15-minute calls:

(1) During ten of the fifteen 1-minute intervals, no more than two bit errors per interval

(2) During three of the remaining five 1-minute intervals, no more than ten bit errors per interval

(3) During the remaining two 1-minute intervals, no error requirement.

(b) For 1-minute calls:

(1) During eight out of ten calls, no more than ten bit errors in any one minute.

2.32 ***Test Call Requirements For Private Line Systems:*** The allowable maximum error rate will vary between private line systems; therefore, specific requirements will be prescribed by the serving test center.

At the receiving station, the 903-type DTS obtains its clock signal from the receiver clock which is derived from the incoming line signal. When a clock is not present, the test set will not generate any signal; therefore, if the line should open, neither the received data nor the local 903 signal will be fed to the 902-type DTS and no errors will be recorded on the counter. To insure that this condition is not present, procedures in 2.27 and 2.28 should be repeated at periodic intervals during the test.

3 TEST PROCEDURES USING 914B DATA TEST SET

3.01 This group of tests can be used for checking the data set transmitter, receiver, clock signals, and control signals. The tests are divided into four parts: outlet ground source test, installation tests, maintenance tests, and end-to-end test. For procedure to be followed when investigating a trouble report, refer to the section entitled Data Sets 201A1, A2 and 201B1, B2, Transmitter-Receiver, Maintenance (592-011-300).

A. Outlet Ground Source Test

3.02 If the data set and business machine are not connected to the same ground, errors may be caused by a potential difference between data set ground and business machine ground. A test should be made using the 6A impulse counter to detect the presence of noise potentials.

3.03 The 6A impulse counter is connected and the test is performed as shown in Fig. 5. If any errors are counted in the 15-minute test period, the grounds must be bonded together according to local instructions.

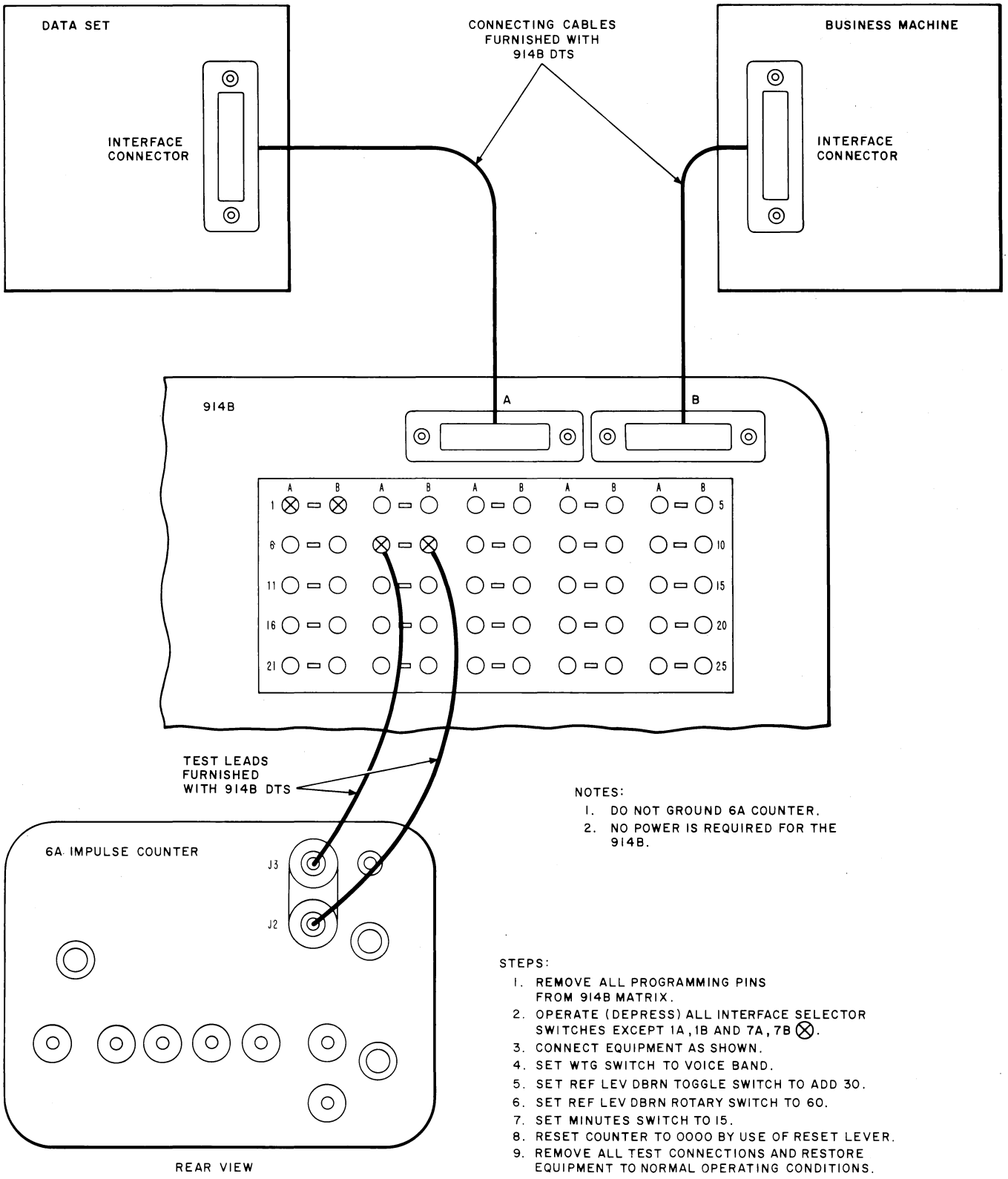


Fig. 5—Power Ground Noise Test Using 6A Impulse Counter and 914B Data Test Set

Note: General description, calibration, and operating procedures for the 6A impulse counter are contained in the section entitled J94006A (6A) Impulse Counter, Description, Operation, and Maintenance (103-620-100).

Do not ground the 6A impulse counter while performing this test.

B. Installation Tests

3.04 This test is to be performed after installing the data set or as a preliminary setup for the maintenance test (Part C of this section). This test can be used to check the data set transmitter, receiver, clock signals, control signals, and transmitter output level. If the data set fails this test, it must be replaced or repaired as outlined in the maintenance tests (3.13).

3.05 Equipment required for performing the test is as follows:

(a) For data sets equipped with internal timing:

1—914B Data Test Set (DTS).

(b) For data sets equipped for external timing:

1—914B DTS ***and***

1—32LBMP-2000 (for 201A) or -2400 (for 201B) frequency standard (available from Bulova Watch Company, American Time Products Division, 61-20 Woodside Avenue, Woodside, New York)

or

1—Internally timed Data Set 201-type (in addition to the data set under test).

Note: The additional data set must be of the same operating speed as the data set under test.

3.06 All tests specified in this section are written for data sets equipped with internal timing. To test an externally timed data set, it will be necessary to provide a clock signal either from the frequency standard or the additional data set.

3.07 The procedure for testing an externally timed data set using the frequency standard is as follows:

(a) Run two leads from the frequency standard to the interface control switch panel (red to terminal 15, black to terminal 1).

(b) Connect the power cord of the frequency standard to a 117-volt ac outlet.

(c) No further operations are necessary. The data set, externally timed, can be tested as though it were internally timed.

3.08 The procedure for testing an externally timed data set by using an additional internally timed data set is as follows:

(a) Connect a cord from the B interface connector on the 914B DTS to connector J2 (CUST EQPT) on the internally timed data set.

(b) Lift all B interface connector switches except 1 and 15.

(c) Connect the power cord of the internally timed data set to a 117-volt ac outlet.

(d) No further operations are necessary. The externally timed data set can be tested as though it were internally timed.

Two-Wire Test

3.09 Set up the equipment as shown in Fig. 6. The test is performed as follows:

(a) Disconnect the line wires (tip and ring). If the installation uses a D25C cord, connect a 600- or 900-ohm resistor across cord leads W-BR and BR-W. If the installation uses a D25D cord and 66E3 connector block, connect a 600- or 900-ohm resistor across terminals 14 and 16 at the 66E3 connector block. Connect the meter input leads across the resistor placed on the 66E3 connector block.

(b) Apply power to the data set and to the 914B DTS.

(c) Turn S1 switch on. Verify that the NO CLOCK and NO DATA lamps are extinguished.

(d) Depress the RESET button. The counter should read zero errors.

(e) Set the WORD LENGTH switch to 63. The counter should count rapidly.

(f) Set the WORD LENGTH switch to DOT. The counter should stop. Lamps DS1, DS2, DS3, DS4, DS5, and DS6 should be lighted.

Note: Refer to Fig. 6 for a description of which interface lead is presented on which lamp.

(g) Turn S1 switch off. Lamps DS1, DS2, DS3, and DS5 should be extinguished. The NO CLOCK and NO DATA lamps should light. (Disregard readings on the counter.)

(h) Turn S1 switch on. Remove the pin from SD-16 on the matrix and place it in S4-2. Only lamps DS1, DS2, DS3, and DS6 should be lighted.

(i) Turn S4 switch on. Lamps DS4 and DS5 should also light. The counter should count rapidly.

(j) Set the COUNTER switch to INTERVAL X.1 if the data set is equipped with B option. Set the COUNTER switch to INTERVAL X10 if the data set is equipped with E option.

(k) Move the BIT RATE switch to 2000 (for Data Set 201A) or 2400 (for Data Set 201B).

(l) Press the RESET button and switch S1 to ON. The TP1 FIRST lamp should light. The counter will indicate the interval between request-to-send on and clear-to-send on.

Requirement:

E Option—15 to 25 on counter

B Option—6.5 to 9 on counter

Note: Because of the setting of the INTERVAL switch, the 914B DTS is measuring an interval of 6.5 to 9.0 msec between RS and CS (with B option) or 150 to 250 msec (with E option).

(m) Read the transmitter output level from the meter on the 914B DTS. This reading should be approximately equal to the output level for which the data set is strapped.

(n) End of test. Proceed to the automatic answer test.

Four-Wire Switched Carrier Test

3.10 Set up the equipment as shown in Fig. 6. The test is performed as follows:

(a) Disconnect the line wires (tip and ring). If the installation includes a D25C cord, connect the S-W lead to the BR-W cord lead and the W-S cord lead to the W-BR cord lead. Connect a 600- or 900-ohm resistor across cord leads W-BR and BR-W. If the installation includes a D25D cord and a 66E3 connector block, connect terminal 14 to terminal 18 and terminal 16 to terminal 20. Connect a 600- or 900-ohm resistor across terminals 14 and 16.

(b) Connect the meter input leads across the resistor placed on the connector block.

(c) Apply power to the data set and 914B DTS. Turn switch S1 on. Verify that the NO CLOCK and NO DATA lamps are extinguished.

(d) Depress the RESET button. The counter should read zero errors.

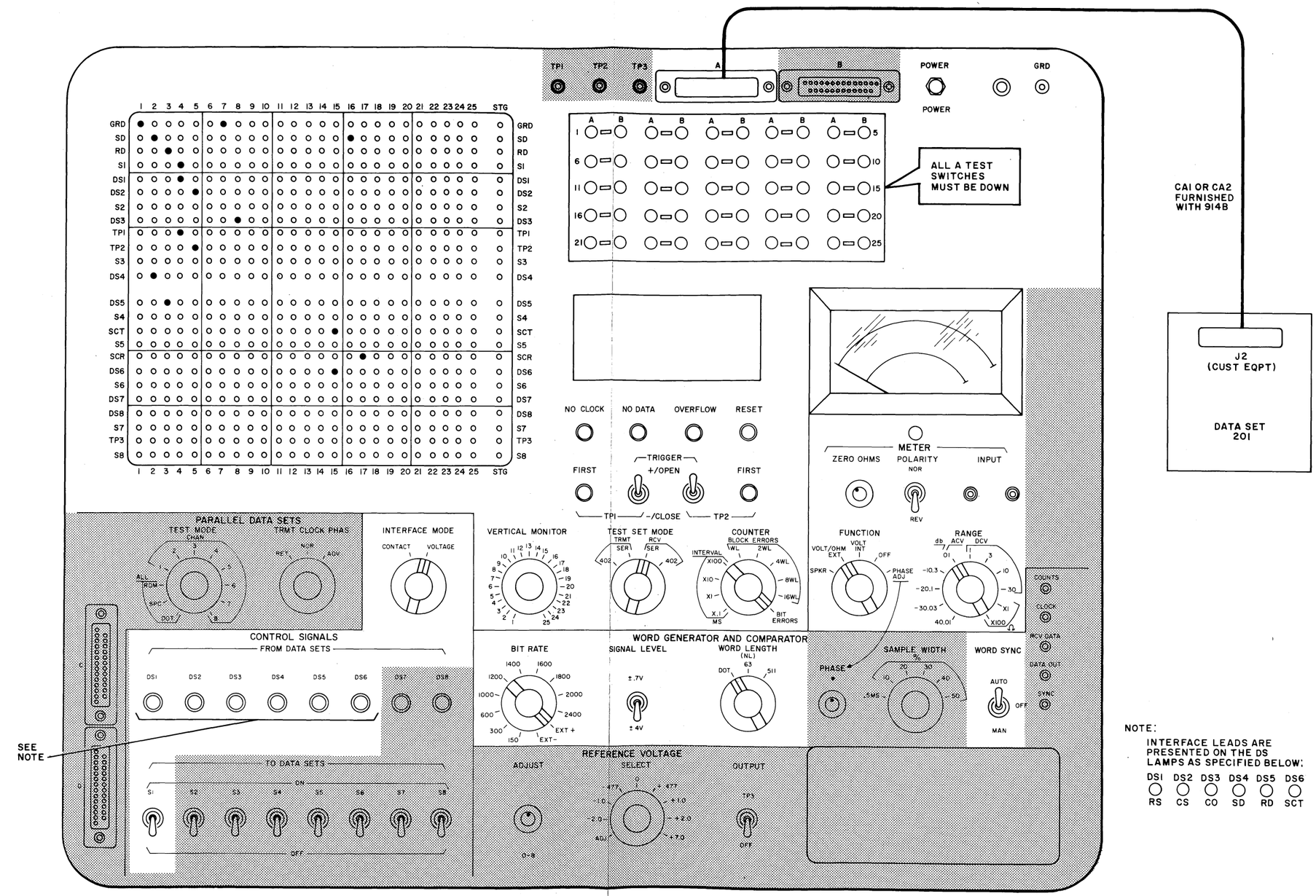
(e) Set the WORD LENGTH switch to 63. The counter should count rapidly.

(f) Set the WORD LENGTH switch to DOT. The counter should stop. Lamps DS1, DS2, DS3, DS4, DS5, and DS6 should be lighted.

(g) Turn switch S1 off. Lamps DS1, DS2, DS3, and DS5 should extinguish. The NO CLOCK and NO DATA lamps should light. (Disregard readings on the counter.)

Note: Refer to Fig. 6 for a description of which interface lead is presented on which lamp.

(h) Turn switch S1 on. Remove the pin from SD-16 on the matrix and place it in S4-2. Only lamps DS1, DS2, DS3, and DS6 should be lighted.



NOTE:
INTERFACE LEADS ARE PRESENTED ON THE DS LAMPS AS SPECIFIED BELOW:

DS1	DS2	DS3	DS4	DS5	DS6
RS	CS	CO	SD	RD	SCT

Fig. 6—Initial Test Setup

(i) Turn switch S4 on. Lamps DS4 and DS5 should also light. The counter should count rapidly.

(j) Set the COUNTER switch to INTERVAL X.1 if the data set is equipped with B option. Set the COUNTER switch to INTERVAL X10 if the data set is equipped with E option.

(k) Move the BIT RATE switch to 2000 (for Data Set 201A) or 2400 (for Data Set 201B).

(l) Press the RESET button and switch S1 to ON. The TP1 FIRST lamp should light. The counter will indicate the interval between request-to-send on and clear-to-send on.

Requirement:

E Option—15 to 25 on counter

B Option—6.5 to 9 on counter

Note: Because of the setting of the INTERVAL switch, the 914B DTS is measuring an interval of 6.5 to 9.0 msec between RS and CS (with B option) or 150 to 250 msec (with E option).

(m) Read the transmitter output level from the meter on the 914B. This reading should be approximately equal to the output level for which the data set is strapped.

(n) End of test. Proceed to the test of the automatic answer.

Four-Wire Continuous Carrier Test

3.11 Set up the equipment as shown in Fig. 6. The test is performed as follows:

(a) Disconnect the line wires (tip and ring). If the installation includes a D25C cord, connect the S-W cord lead to the BR-W cord lead. Connect a 600-ohm or 900-ohm resistor across the W-BR and BR-W cord leads. If the installation includes a D25D cord and a 66E3 connector block, connect terminal 14 to terminal 18 and connect terminal 16 to terminal 20. Place a 600- or 900-ohm resistor across terminals 14 and 16.

(b) Connect the meter input leads across the resistor placed on the connector block.

(c) Apply power to the data set and to the 914B DTS. Verify that the DS4, DS6, and NO DATA lamps are lighted and that the counter counts rapidly.

Note: Refer to Fig. 6 for a description of which interface lead is presented on which lamp.

(d) Turn switch S1 on. Lamps DS1, DS2, DS3, DS4, DS5, and DS6 should be lighted. The NO DATA lamp should extinguish and the counter should stop.

(e) Remove the pin from SD-16 on the matrix and place it in S4-2. Lamps DS1, DS2, DS3, DS6, and the NO DATA lamp should be lighted.

(f) Turn switch S4 on. Lamps DS4 and DS5 should light.

(g) Set the COUNTER switch to INTERVAL X.1 if the data set is equipped with B option. Set the COUNTER switch to INTERVAL X10 if the data set is equipped with E option.

(h) Move the BIT RATE switch to 2000 (for Data Set 201A) or 2400 (for Data Set 201B).

(i) Press the RESET button and switch S1 to ON. The TP1 FIRST lamp should light. The counter will indicate the interval between request-to-send on and clear-to-send on.

Requirement:

E Option—15 to 25 on counter

B Option—6.5 to 9 on counter

Note: Because of the setting of the INTERVAL switch, the 914B DTS is measuring an interval of 6.5 to 9.0 msec between RS and CS (with B option) or 150 to 250 msec (with E option).

(j) Read the transmitter output level indicated on the meter of the 914B DTS. This reading should be approximately equal to the output level for which the data set is strapped.

(k) End of test. Proceed to the automatic answer test.

Automatic Answer Test

3.12 This is a test of the leads controlling the automatic answer unit. If the data set fails this test, the automatic answer unit should be replaced. Set up the equipment as shown on Fig. 7. The test is performed as follows:

(a) Apply power to the data set and to the 914B DTS.

(b) Turn switch S1 on. Lamp DS3 should light indicating a voltage of +5.0 volts or greater on the interlock (IT) lead.

(c) Manually operate the R relay. The DS1 lamp should light indicating that the R relay is functioning properly.

(d) Manually operate the H relay. The DS2 lamp should light indicating that the H relay is functioning properly.

C. Maintenance Tests

3.13 This test procedure provides a method of isolating a data set trouble to a board or group of boards in the data set. This is done by analyzing the pattern of lighted and unlighted lamps which appear on the 914B DTS. Refer to Fig. 8 for the flow chart which indicates the order in which the lamps are to be analyzed.

3.14 Before attempting to use the flow chart (Fig. 8), the installation test must be set up. Refer to Part 3B (Installation Tests) and set up the equipment as instructed for the data set under test. The DS lamps are each connected to a different interface lead. The lamp will light when a positive voltage appears on that lead. The NO CLOCK lamp will light when the 914B DTS is not receiving a clock signal from the data set. The NO DATA lamp will light when data is not being received from the data set. Refer to Fig. 8 for a comparison of which DS lamp is connected to which interface lead.

3.15 The DS1 lamp is connected to the request-to-send lead and will light when switch S1 is turned on. When performing the installation test and a DS lamp fails to light or if the NO CLOCK or NO DATA lamps light when they should not, refer to Fig. 8 and replace cards as recommended. If the lamps then light in the proper sequence, proceed with the installation test. Refer to Section 592-011-300 for other procedure to be followed when investigating a trouble report.

D. End-to-End Test

3.16 This is a test of the data set transmitter and receiver and of the connecting facilities. In this test, Data Set 201-type is driven by a word generator in the 914B DTS. At the distant end, the data signals are fed either to a 904B or 904D data test center or to a remote Data Set 201-type. When the data set transmitter is being tested, the equipment is set up as shown in Fig. 9. When the data set receiver is being tested, the equipment is set up as shown in Fig. 10.

3.17 If the test is conducted using a data test center, the test will be coordinated under the direction of the data test center. In either case, the transmitting and receiving equipment setup is as shown in Fig. 9 and 10.

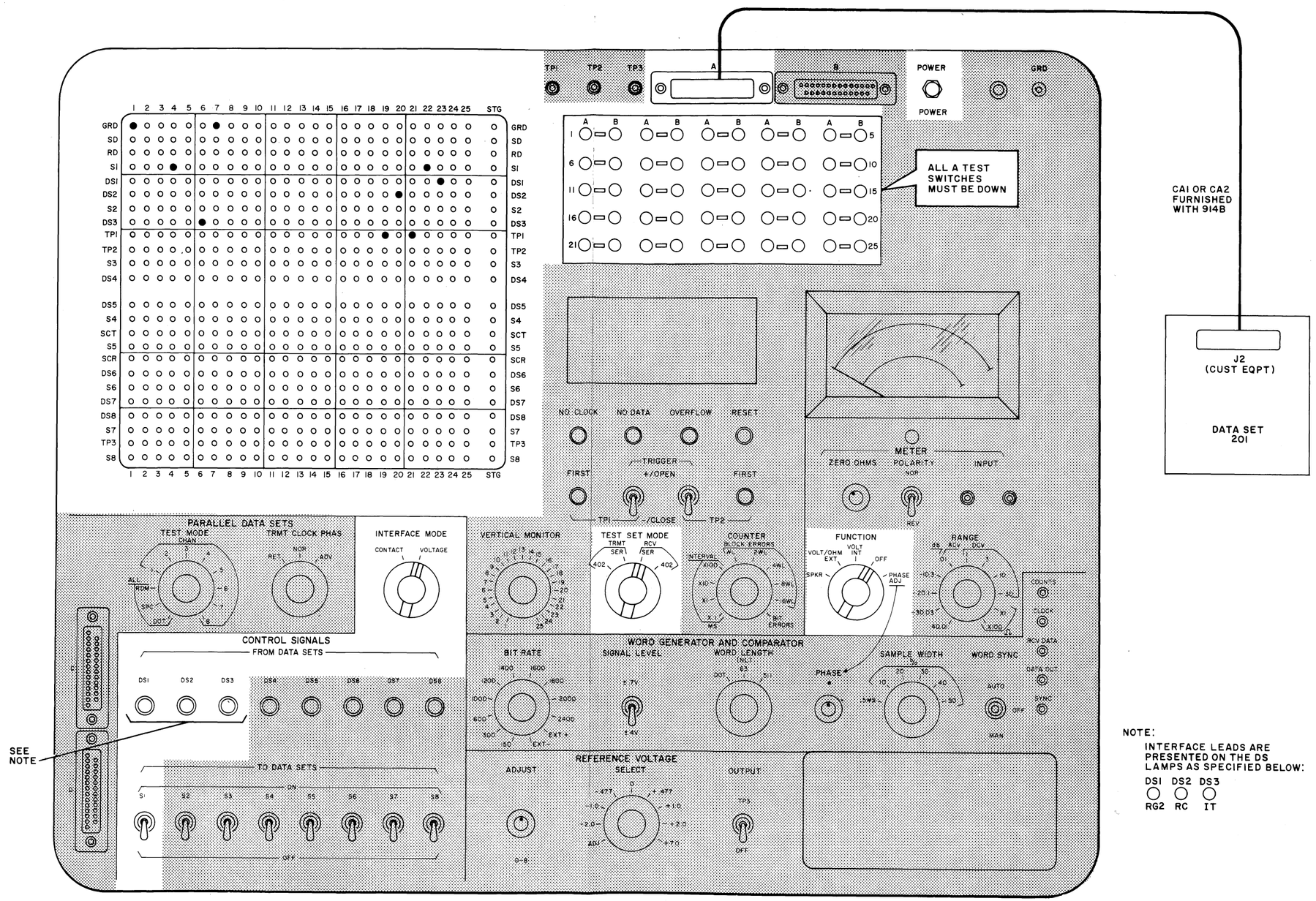
Note: The procedure for testing from a 904 data test center is included in Section 668-102-500.

3.18 Apply power to the 914B DTS. On the switched telephone network, complete end-to-end tests consist of making two 15-minute calls and ten 1-minute calls. Establish voice communication in the manner normally used by the customer when placing data calls.

Take proper steps to insure that the customer is not billed for toll calls on test. Refer to Section 010-250-001.

3.19 Place calls alternately from each end except where one customer location will always be originating the call. Test calls should be placed during busy hours. This will make certain that all test calls do not use the same trunks and routes.

3.20 During the 15-minute calls, the receiving station should make a minute-by-minute count of errors as indicated by the counter on the 914B DTS. To prevent exceeding the counter capacity, the RESET button should be depressed at the end of each minute after the error count has been noted. Figure 4 illustrates a format which can be used for recording test data. The PEAK DISTORTION columns of Fig. 4 should be



NOTE:

INTERFACE LEADS ARE PRESENTED ON THE DS LAMPS AS SPECIFIED BELOW:

DSI	DS2	DS3
○	○	○
RG2	RC	IT

Fig. 7—Automatic Answer Test

DS LAMPS ON 914B DTS ARE ASSIGNED AS FOLLOWS:

DS1	DS2	DS3	DS4	DS5	DS6
RS	CS	CO	SD	RD	SCT

* IF R1,R2,R3 ARE NOT AVAILABLE AS A MATCHED GROUP, REPLACE THE DATA SET.

† IF R13,R14,R15, AND R16 ARE NOT AVAILABLE AS A MATCHED GROUP, REPLACE THE DATA SET.

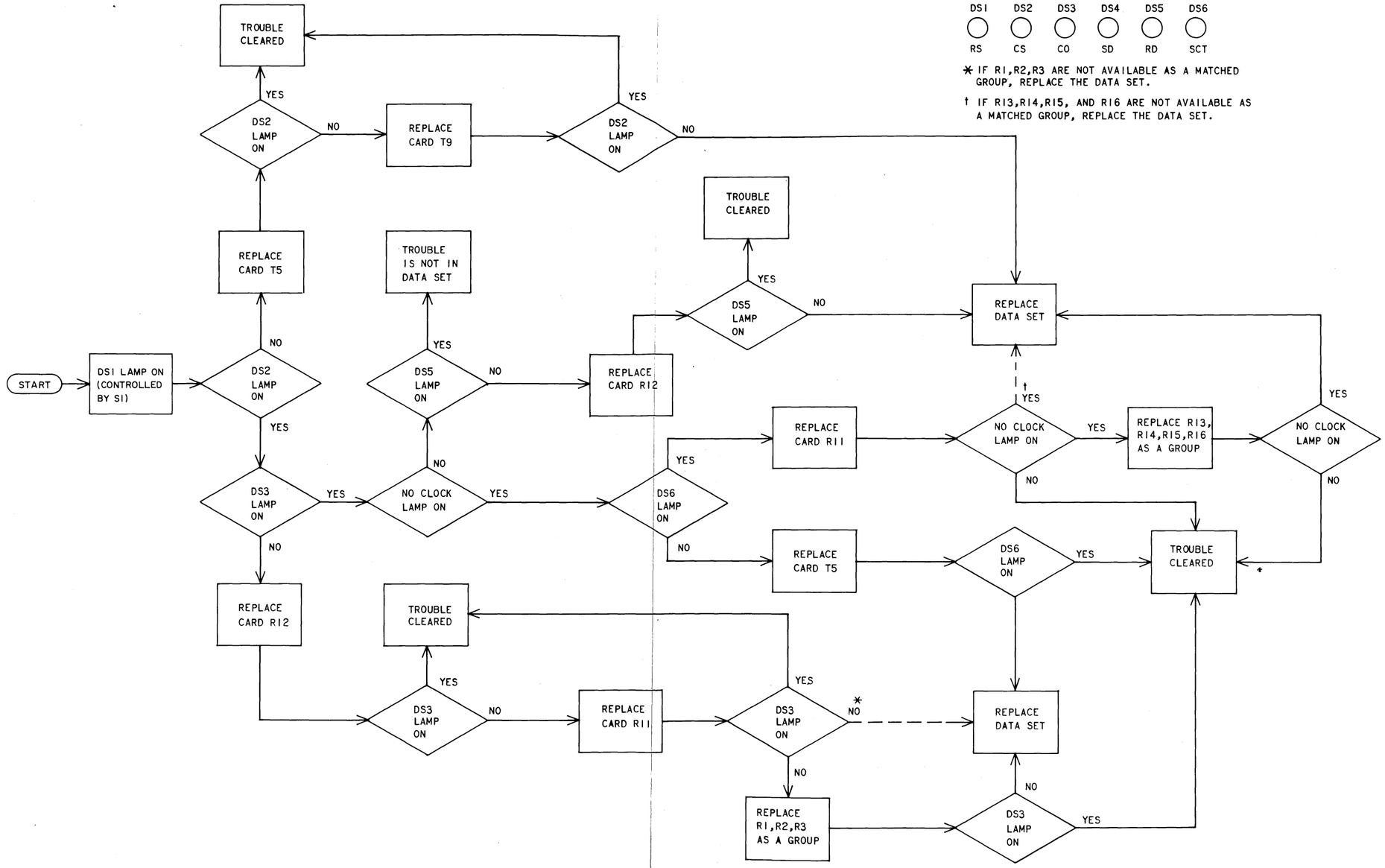


Fig. 8—Maintenance Flow Chart

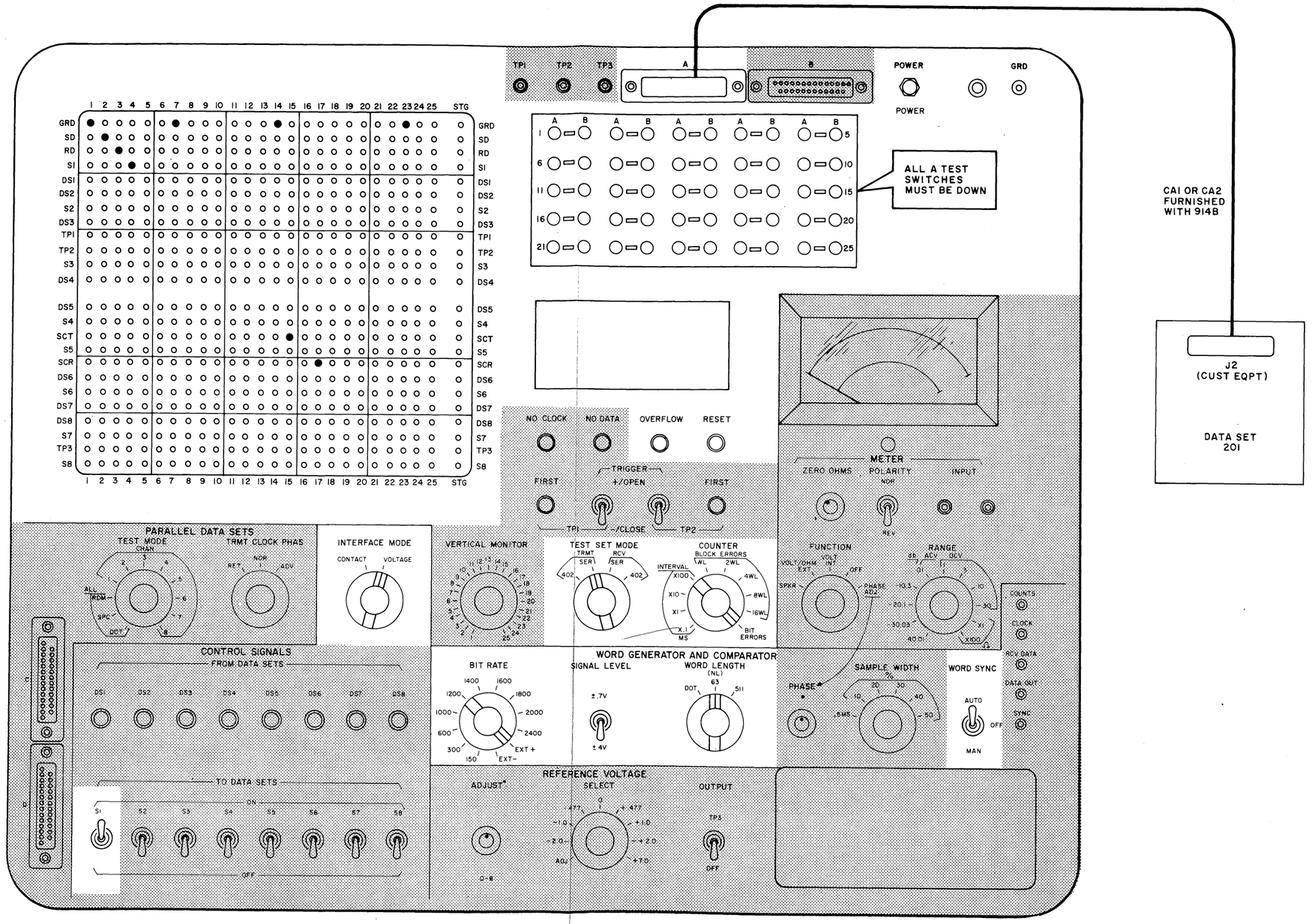


Fig. 9—End-to-End Test, Transmitting Side

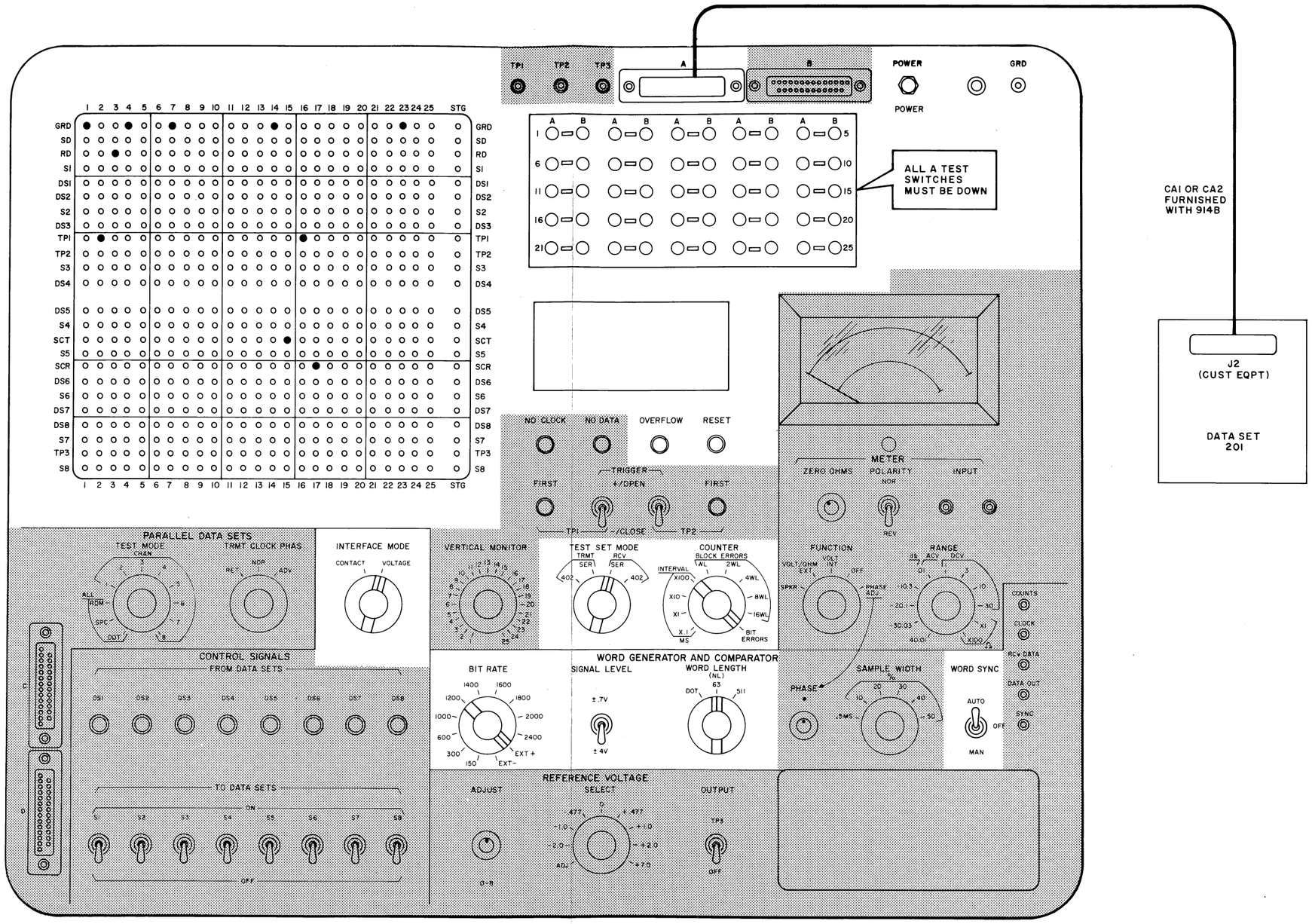


Fig. 10—End-to-End Test, Receiving Side

ignored for those tests. Occasionally, a noise burst or "hit" may cause the error counter to lose synchronization and indicate continuous errors. The interval up to and including the burst should be tabulated as "over 100 bit errors." The RESET button on the 914B DTS should be depressed to continue tests.

3.21 On private line systems, the length of the test period will be prescribed by the serving test center. Voice communication between terminals can be established over a separate facility if a DAS 804A or telephone set is not associated with the data set.

3.22 After a voice connection has been established, the attendant at the receiving end should verify that the CLOCK and DATA lamps on the 914B DTS are extinguished. This will indicate that a valid connection has been established. If either of the lamps light during the test, the receiving station attendant must contact the transmitting station attendant and agree to retest.

3.23 At the end of the prearranged time interval, voice communication is established again and an agreement is made to repeat the test in the opposite direction. The test is then repeated with the first transmitting station becoming the receiver and the first receiving station becoming the transmitter.

3.24 The test call requirements for the switched telephone network are as follows:

(a) For 15-minute calls:

(1) During ten of the fifteen 1-minute calls, no more than two bit errors per interval

(2) During three of the remaining five 1-minute intervals, no more than ten bit errors per interval

(3) During the remaining two 1-minute intervals, no error requirements.

(b) For 1-minute calls:

(1) During eight out of ten calls, no more than ten bit errors in any one minute.

3.25 Restore the equipment to operating condition. Refer to Section 592-011-200 for option strapping.