

## DATA AUXILIARY SET 828C

### MAINTENANCE AND TEST PROCEDURES

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#### 1. GENERAL

**1.01** This section provides the procedures for tests to be made at the time of installation and during maintenance visits to determine the performance of data auxiliary set (DAS) 828C.

**1.02** DAS 828C is primarily used to provide switched network backup capability to a 4-wire (4W) private line (PL) voicegrade data channel where DAS 828A is used as the interface between the PL and the data set. Both 2W and 4W Telephone Company-provided data sets may be used. It also provides backup capability to a 4W PL that is not equipped with DAS 828A, or it is used to provide a 4W channel over the switched 2-wire network where no PL is involved.

**1.03** Switched network lines used for data transmission should meet DATA-PHONE requirements as described in Section 314-205-501. These requirements should be checked with the 828C in the circuit. Information is given in 3.10 and 3.11 on the proper terminals in the 828C that are to be used for the tests.

#### 2. TEST EQUIPMENT

**2.01** The following test equipment is required at the station and used in testing the 828C:

- 1—Portable Volt-Ohm-Milliammeter, KS-14510-L1 or equivalent
- 1—Voiceband Transmission Test Set, TTS-4 or equivalent, with bridging measurement capability
- 2—2W6A Patch Cords or equivalent (310 plug on one end and clip leads on the other end).

#### 3. INSTALLATION TESTS

**3.01** A check of the 828C can be made by performing the following tests:

- A. Control Circuit Tests
- B. DATA-PHONE Loop Tests
- C. Pad Verification
- D. Transmission Tests
- E. Not-In-Data Test

**3.02** These tests provide a checkout of the 828C without the aid of a test center or distant station.

**3.03** For these tests, the switched network lines must be connected to the 828C, and the 828C should be connected to the 828A if it is provided. The data set should not be connected to the 828C at this time. The 828A should be equipped with all specified plug-ins.

**Note:** The pad socket in the 828C should not be equipped with a plug-in resistor at the start of these tests.

**3.04** Perform the following tests in the order listed in 3.01.

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**A. Control Circuit Tests**

**3.06** This test verifies that relay circuits and telephone set control circuits of the 828C are operating properly. No test equipment is required for these tests.

**3.07 Test for 4W PL Data Set Arrangement:**

STEP	PROCEDURE
1	<p>Take handset off-hook and depress the DDD1 line key.</p> <p><b>Requirement:</b> The line lamp does not light at this time. Dial tone is heard in handset receiver.</p>
2	<p>Dial the directory number of the DDD2 line at the same station.</p> <p><b>Requirement:</b> The RU2 and R relays follow ringing, DDD2 line rings, and the lamp flashes in response to ringing.</p>
3	<p>After the DDD2 line starts to ring, depress the HOLD key and then release it.</p> <p><b>Requirement:</b> The DDD1 line lamp lights and the DDD1 key releases on the up-stroke of the HOLD key. CA1 operates. MS operates if option Y is installed. Line 2 continues to ring.</p>
4	<p>Depress the DDD2 line key.</p> <p><b>Requirement:</b> Ringing is tripped, RU2 and R relays cease to operate, and DDD2 line lamp no longer flashes.</p>
5	<p>Depress the HOLD key and then release it.</p> <p><b>Requirement:</b> DDD2 line lamp lights and the DDD2 key releases on the up-stroke of the HOLD key. CA2 operates. The A relay operates. MS releases on A if option Y is installed. Both line lamps are lighted. The 828C is now in the backup mode.</p>
6	<p>Place the telephone handset on-hook.</p> <p><b>Requirement:</b> The line lamps extinguish and all relays release.</p>
7	<p>Repeat Steps 1 through 6 and have DDD2 line dial to DDD1 line.</p>
8	<p>If all test requirements are met satisfactorily, proceed to Part 3B.</p>

**3.08 Test for 2W PL Data Set Arrangement:**

STEP	PROCEDURE
1	<p>Take handset off-hook and depress the DDD1 key.</p> <p><b>Requirement:</b> The line lamp does not light at this time. Dial tone is heard.</p>
2	<p>Depress the HOLD key and then release it.</p> <p><b>Requirement:</b> Both line 1 and line 2 lamps light. Relays CA1, CA2, and A operate. The up-stroke of the HOLD key releases the DDD1 key.</p>
3	<p>Place the handset on-hook.</p> <p><b>Requirement:</b> Both lamps extinguish and all relays release.</p>
4	<p>Take handset off-hook, depress DDD1 key, and after dial tone is heard, dial the central office ringback circuit and initiate a ringback, or call another station and request it to dial the calling station. Place the handset on-hook and await incoming ringing.</p> <p><b>Requirement:</b> On incoming ringing, the RU1 and R relays and line 1 lamp follow ringing.</p>
5	<p>Take handset off-hook.</p> <p><b>Requirement:</b> Ringing ceases and the line 1 lamp extinguishes.</p>
6	<p>Place handset on-hook.</p>
7	<p>If all tests are successful, proceed to Part 3B.</p>

**B. DATA-PHONE Loop Tests**

**3.09** Dial-up lines used should meet DATA-PHONE test requirements as specified in Section

314-205-501. These tests may be made at the 828C terminals specified in 3.10 and 3.11 using the 828C to dial and hold on each line. Before making the tests, verify that the pad socket is empty.

**3.10 Line 1 Testing:**

STEP	PROCEDURE
1	<p>Take handset off-hook and depress the DDD1 key.</p>
2	<p>Dial the appropriate directory number for the DATA-PHONE test to be made (eg, to measure the loop loss at 1000 Hz, dial the milliwatt supply).</p>

STEP	PROCEDURE
3	Once connected, depress and release the HOLD key. Line 1 is now connected to TB3-41 and 42, and the test may be made. For example, connecting the receiver of TTS-4 on these terminals with <b>600 ohms</b> impedance allows the measurement of the signal received from the milliwatt supply and the determination of the loop loss.
4	Record the loop loss, when measured, to use in subsequent test.
5	To release the line, place the handset on-hook.

### 3.11 Line 2 Testing:

STEP	PROCEDURE
1	When all line 1 tests have been made, perform the same steps on line 2. When line 2 is held, it is connected to TB3-43 and 44.
2	Record the loop loss when measured.
3	Release the line by placing the handset on-hook.

### C. Pad Verification

**3.12** This procedure is used to verify that the pad value, as shown on the service order and circuit layout record, will result in the data set transmit signal arriving at the serving central office at a power level not greater than  $-12$  dBm.

**3.13** It is assumed that the loop loss of line 1 has already been measured, using the test in 3.10. The requirement for the proper pad value is as follows:

$$\text{Pad} = 12 \text{ dB} - 0.3 \text{ dB} + \text{meter reading} + \text{data set transmit level.}$$

0.3 dB is the loss of the 22-ohm resistor (TB1 terminals 37 to 47 and 38 to 48); and the meter reading is the loop loss measured in 3.10.

**3.14 Example:** The meter reading is  $-5$  dBm and the transmit level is  $0$  dBm. The required pad is  $11.7 \text{ dB} + (-5 \text{ dB}) = 6.7 \text{ dB}$ . The pad shown on the service order or circuit layout record may be used if it is within  $\pm 1$  dB of the value determined in 3.13. For example, if an 89AJ resistor (7 dB) had been specified, it could be used. The 0-dBm transmit power level would thus be attenuated 0.3 dB by the 22-ohm resistors, 7 dB by the pad, and 5 dB by the loop to arrive at the serving central office at  $-12.3$  dBm. The pad should now be installed.

### D. Transmission Tests (4-Wire Data Sets Only)

**3.15** This test checks the complete transmit and receive paths in the 828C. During the test, a call is made from line 1 to line 2 at the same location. A level measurement is made of the signal received on line 2 that was transmitted on line 1. This test requires a TTS-4 or equivalent.

## 3.16 Test Procedure:

STEP	PROCEDURE
1	<p>If the 828C is used to provide DDD backup to a private line equipped with DAS 828A, disconnect the 828C cable (J3) that goes to the 828A DATA connector (P1). Also, verify that option Z is not installed in the 828C. If no PL transmission is required, verify that option Z is installed in the 828C. Cable J3 is stored.</p>
2	<p>Connect the TTS-4 SEND 310 jack to TB3 terminals 7 and 8 at the 828C, using a 2W6A cord.</p>
3	<p>Connect the TTS-4 REC 310 jack to TB3 terminals 17 and 18 at the 828C, using a 2W6A cord.</p>
4	<p>Set the TTS-4 controls as follows:</p> <p style="padding-left: 40px;">SEND LEVEL to 0</p> <p style="padding-left: 40px;">SEND FREQ to 1000 Hz</p> <p style="padding-left: 40px;">SEND IMP to 600Ω</p> <p style="padding-left: 40px;">REC IMP to 600Ω if option Z is not installed in 828C</p> <p style="padding-left: 40px;">REC IMP to BRDG if option Z is installed in 828C.</p> <p><b>Requirement:</b> The TTS-4 meter indicates 0 dBm.</p>
5	<p>Reconnect the SEND 310 jacks to TB3 terminals 9 and 10 and the REC 310 jack to TB3 terminals 19 and 20.</p> <p><b>Requirement:</b> The TTS-4 meter indicates 0 dBm.</p>
6	<p>Connect the SEND 310 jack to TB3 terminals 7 and 8. Connect the REC 310 jack to TB3 terminals 9 and 10. Set the TTS-4 REC IMP to 600Ω.</p>
7	<p>Repeat the backup call procedure described in Part 3A, Steps 1 through 5. When the backup mode is entered, the 828C will be looped back as shown in Fig. 1. Figure 2 shows the typical test arrangement. The TTS-4 meter indicates the power level of the received signal. From Fig. 1, the telephone company employee performing the test can determine the expected meter reading and compare it to the actual received power level.</p> <p><b>Requirement:</b> A reading within <math>\pm 3</math> dB of the actual received power level.</p> <p><b>Example:</b> Assume the losses as given in Table A. From this, the expected meter reading is <math>-17.6 \pm 3</math> dBm as shown.</p>
8	<p>When tests are completed satisfactorily, disconnect the TTS-4 and proceed to Part 3E. Reconnect 828C to 828A if required.</p>

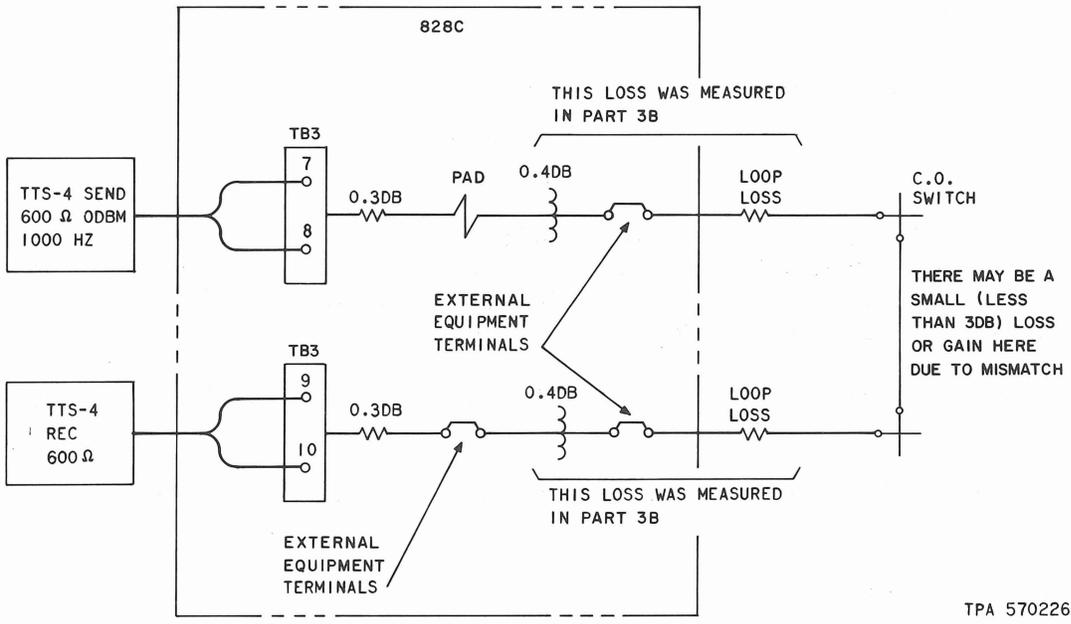


Fig. 1—Loop Around Transmission Test

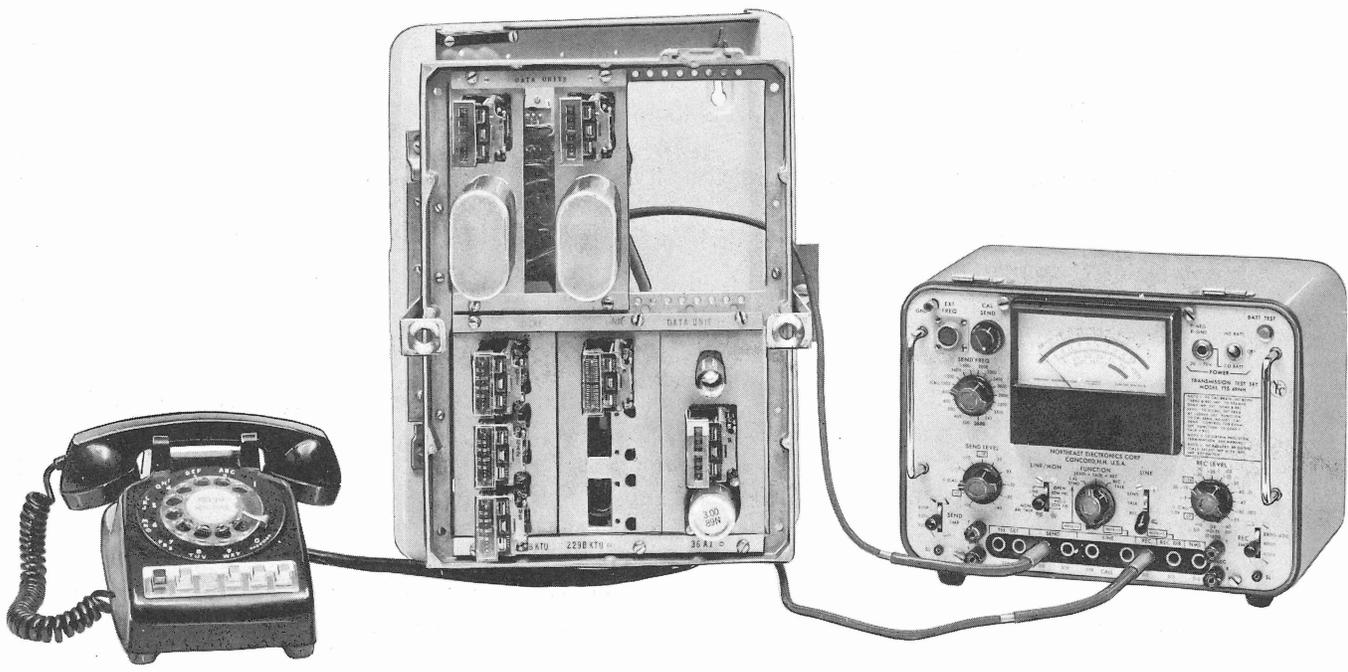


Fig. 2—Typical Test Connection—Transmission Tests

TABLE A

SAMPLE OF MEASURED LOSSES

CIRCUIT ELEMENT	LOSS
Pad	7.0 dB
Transmit Loop (with Repeat Coil)	5.0 dB
Receive Loop (with Repeat Coil)	5.0 dB
828C Losses (Assumed)	0.6 dB*
TOTAL	17.6 dB

\* Represents total loss in 22-ohm resistors.

**3.20 4-Wire Data Set:**

**E. Not-In-Data Tests**

**3.17** The "in-data" and "not-in-data" indications are used in Bell System data sets to control the data set ready (DSR) lead to the customer terminal equipment.

**3.18** The procedures below cover two arrangements: (1) private line data transmission with DDD backup (DAS 828A used to terminate the 4-wire PL facilities), and (2) DDD network transmission with no PL transmission (4-wire data set only). The tests require the use of an ohmmeter (KS-14510-L1 VOM or equivalent).

**3.19** Tests for private line (828A) with DDD backup (828C) are given in 3.20 and 3.21. Tests for DDD network transmission with no PL are given in 3.22.

STEP	PROCEDURE										
1	Verify that the 828A and 828C are interconnected and that the telephone handset is on-hook. Also, verify that options X and W are not installed in the 828C.										
2	Obtain and connect the KS-14510 VOM (or equivalent) to the terminals indicated below. The ohmmeter readings should be as given: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>TB3 TERMINALS 828C</th> <th>READING (IN-DATA)</th> </tr> </thead> <tbody> <tr> <td>1 and 2</td> <td>Infinity</td> </tr> <tr> <td>1 and 4</td> <td>Infinity</td> </tr> <tr> <td>3 and 4</td> <td>1900 to 2300 ohms</td> </tr> <tr> <td>5 and 6</td> <td>0 ohms</td> </tr> </tbody> </table>	TB3 TERMINALS 828C	READING (IN-DATA)	1 and 2	Infinity	1 and 4	Infinity	3 and 4	1900 to 2300 ohms	5 and 6	0 ohms
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1 and 2	Infinity										
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3 and 4	1900 to 2300 ohms										
5 and 6	0 ohms										
3	Operate the LB relay in the 828A by the local key, by taking the handset off-hook and operating the LB key on the telephone set, or by applying -24 volts and ground to terminals 11 and 12, respectively, of TB2 on the 828A. Repeat the resistance checks as follows: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>TB3 TERMINALS 828C</th> <th>READING (NOT-IN-DATA)</th> </tr> </thead> <tbody> <tr> <td>1 and 2</td> <td>0 ohms</td> </tr> <tr> <td>1 and 4</td> <td>1900 to 2300 ohms</td> </tr> <tr> <td>5 and 6</td> <td>Infinity</td> </tr> </tbody> </table>	TB3 TERMINALS 828C	READING (NOT-IN-DATA)	1 and 2	0 ohms	1 and 4	1900 to 2300 ohms	5 and 6	Infinity		
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1 and 2	0 ohms										
1 and 4	1900 to 2300 ohms										
5 and 6	Infinity										
4	Release the LB relay.										

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STEP	PROCEDURE
5	If PL alternate voice is provided, take the handset off-hook, operate the PL TLK key and repeat resistance checks of Step 3.
6	Depress the DDD1 key on the telephone set and dial the directory number of line 2.
7	When line 2 starts to ring, depress the HOLD key to put line 1 on hold. After the line 1 lamp lights, release the HOLD key and depress DDD2 key to trip ringing.
8	Depress the HOLD key again and release after the line 2 lamp is illuminated.
9	Perform the resistance checks as given in Step 2.
10	Operate the LB relay or TK relay in the 828A as given in Step 3.
11	Repeat the resistance checks of Step 2.
12	If all resistance checks are met, the test is complete. Place the handset on-hook. If not, refer to Part 4 for further checks that can be made.
13	Disconnect the ohmmeter leads from terminal points on TB3. Proceed to 3.23.

**3.21 2-Wire Data Set:**

STEP	PROCEDURE
1	Repeat Steps 1 through 5 of 3.20 except verify that option W is installed.
2	Depress the DDD1 key on the telephone set, and then depress HOLD key until the line 1 and line 2 lamps light.
3	Repeat Steps 9 through 13 of 3.20, then proceed to 3.23.

**3.22 Test for DDD Network Transmission (828C)  
With No PL Transmission (No 828A)—4-Wire  
Data Set Only:**

STEP	PROCEDURE
1	Verify that the handset is on-hook and that option X is installed and option W is not installed in the 828C.

STEP	PROCEDURE										
2	<p>Obtain and connect the VOM to the terminals indicated below. The ohmmeter readings should be as given:</p> <table border="1"> <thead> <tr> <th>TB3 TERMINALS 828C</th> <th>READING (NOT-IN-DATA)</th> </tr> </thead> <tbody> <tr> <td>1 and 2</td> <td>0 ohms</td> </tr> <tr> <td>1 and 4</td> <td>1900 to 2300 ohms</td> </tr> <tr> <td>5 and 6</td> <td>Infinity</td> </tr> </tbody> </table>	TB3 TERMINALS 828C	READING (NOT-IN-DATA)	1 and 2	0 ohms	1 and 4	1900 to 2300 ohms	5 and 6	Infinity		
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1 and 2	0 ohms										
1 and 4	1900 to 2300 ohms										
5 and 6	Infinity										
3	Depress the DDD1 key on the telephone set and dial the directory number of line 2.										
4	When line 2 starts to ring, depress the HOLD key to put line 1 on hold. After line 1 lamp lights, release the HOLD key and depress DDD2 key to trip ringing.										
5	Depress and release the HOLD key to place line 2 on hold. Make the resistance checks as follows:										
	<table border="1"> <thead> <tr> <th>TB3 TERMINALS 828C</th> <th>READING (IN-DATA)</th> </tr> </thead> <tbody> <tr> <td>1 and 2</td> <td>Infinity</td> </tr> <tr> <td>1 and 4</td> <td>Infinity</td> </tr> <tr> <td>3 and 4</td> <td>1900 to 2300 ohms</td> </tr> <tr> <td>5 and 6</td> <td>0 ohms</td> </tr> </tbody> </table>	TB3 TERMINALS 828C	READING (IN-DATA)	1 and 2	Infinity	1 and 4	Infinity	3 and 4	1900 to 2300 ohms	5 and 6	0 ohms
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1 and 2	Infinity										
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6	If all resistance checks are met, the test is complete. If not, refer to Part 4 for further checks that can be made.										
7	Place handset on-hook. Disconnect the ohmmeter leads and proceed to 3.23.										

**3.23** At the completion of all tests, connect the DAS 828C to the data set.

#### 4. TROUBLE ISOLATION TESTS

**4.01** When trouble is traced to the 828C at the station, troubleshooting may best be done by checking the relay operation as given in the tests in Part 3A.

**4.02** Depending on trouble symptoms, the cause may be due to lack of battery voltage or signaling voltage. For this reason, the telephone company employee should first verify that the 828C has the required voltages applied to TB1, as follows.

(a) Measure for  $-24 (\pm 2V)$  signaling voltage between terminals 3 ( $-24V$ ) and 4 (ground) of TB1.

(b) Measure for 105 Vac (75 to 110 Vac) at terminals 31 and 32 of TB1.

(c) If either voltage is not present, check the power supply for proper output voltage.

**Note:** When the PL circuit is for data only and the data set is 2-wire, no 105-Vac ringing supply is required. The key telephone set ringer may be connected directly to the DDD line being used for backup.

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**4.03** If all primary voltages required are present at the 828C, perform the installation tests outlined in 3.01. If any test fails its requirement, the cause can be located using the test equipment listed in 2.01 and by referring to SD-1D233-01.

**4.04** Other troubles involving internal wiring of the 828C should be cleared by replacing the 828C. Field repair of KTUs, relays, and ringers is not recommended.