

**DATA SET 202E-TYPE**  
**TRANSMITTER**  
**INSTALLATION AND CONNECTIONS**

	<b>CONTENTS</b>	<b>PAGE</b>
<b>1. GENERAL</b>	. . . . .	<b>1</b>
<b>Cover Removal and Replacement</b>	. . . . .	<b>1</b>
<b>2. CONNECTIONS</b>	. . . . .	<b>2</b>
<b>3. LOOP-LOSS COMPENSATION</b>	. . . . .	<b>2</b>
<b>Data Set 202E-Type With Circuit Pack BE27 or BE58</b>	. . . . .	<b>2</b>
<b>Data Set 202E-Type With Circuit Pack BE60</b>	. . . . .	<b>7</b>

**1. GENERAL**

**1.01** This section contains information on the installation and connection of Data Set (DS) 202E-type. The data set should be installed in conformance with existing practices covering the installation of station sets.

**1.02** This section is reissued to add information concerning the loop-loss compensation on late model Data Sets 202E-type and to add the use of a TTS-4 type of transmission test set when making adjustments for loop loss. Because of extensive revision, change arrows (ordinarily used to indicate changes) have been omitted.

**1.03** Data Set models 202E1, E2, E7, and E9 have a rotary dial (X option) and differ in basic features on a modular basis. Their functional equivalents in a TOUCH-TONE® dial version (W option) are 202E10, E11, E12, and E13, respectively. These sets are identical except for the dial mechanisms; therefore, information in this section will refer to the rotary dial version only.

**1.04** Information covering DS 202E9 will also pertain to DS 202E8, Manufacture Discontinued.

**1.05** It is preferred that the data set be installed apart from the business machine equipment on a nearby desk, table, stand, or in a Bell System-provided equipment cabinet. The data set is designed to operate within an ambient temperature range of 40° to 120°F and a relative humidity range of 20 to 95 percent.

**1.06** Data Set 202E-type should be located so that the interface cord supplied by the customer will not exceed 50 feet in length (to reduce stray capacitance and to conform with EIA standards).

**1.07** In order to maintain high-quality service and to minimize interference from related devices, it is preferable to use data sets on individual lines that do not have extensions.

**1.08** Data Sets 202E2, E7, and E9 require an ac outlet to accept the two parallel blades on the KS-20426-L1 transformer. The outlet must not be under control of a switch.

**1.09** To minimize inductive interference to data signals on the telephone (data) line, the line should not be carried in the same run as cable between the data set and the business machine or lines connected to teletypewriter services. If this condition cannot be met, it will be necessary to run the telephone (data) line in type SK (shielded) station wire between the data set and the cable distribution terminal or building entrance. Ground the shield at one end only, preferably at the distribution terminal end.

**Cover Removal and Replacement**

**1.10** To remove the covers, loosen the six captive retaining screws located around the base of the housing. Lift the covers, removing the rear half first.

**SECTION 592-018-200**

**1.11** To replace the covers, position the retaining wedges so that they will receive the cover lugs easily. Lower the front cover over the dial and keys by tilting the cover forward as it is lowered. Lower the rear cover in place by positioning the two rear retaining wedges first. Tighten the six captive retaining screws.

**2. CONNECTIONS**

**2.01** Data Set 202E-type is connected to external equipment and circuits as shown in Fig. 1 and Table A. The transformer connections shown in Fig. 1 are not used with DS 202E1.

**2.02** The KS-20426-L1 transformer should be mounted in a standard 2-pole 3-wire grounded outlet. The inside wire from the transformer to the 42A connecting block should be connected to terminals 3 and 6 on the transformer. Plug the transformer into a 115-volt ac outlet.

**2.03** Verify that the loop and overall facilities have been tested and meet requirements in the section entitled Data Systems—DATA-PHONE® Service on Direct Distance Dialing Network—Overall Transmission Test Requirements (314-205-500) for switched network application or Private Line Data Circuits, Voice Bandwidth Circuits for Miscellaneous Data, Over-all Tests and Requirements (314-410-500) for private line application.

**3. LOOP-LOSS COMPENSATION**

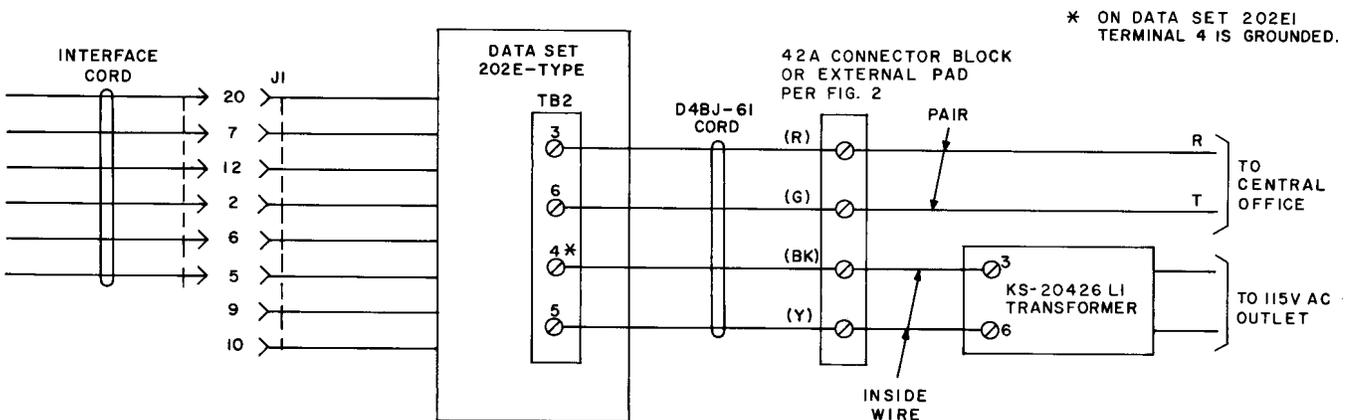
**3.01** The loop-loss compensation network in the early models of DS 202E-type differs from the compensation network in the later models. The compensation network in the late model sets, with circuit pack (CP) BE60, contains a variable internal pad with three adjusting screws in the build-out network. The compensation network in the early model sets, with CP BE27 or CP BE58 (Manufacture Discontinued), contains an external pad, if needed, and eight adjusting screws in the build-out network. Because of these differences, the loop-loss adjustment will be divided into two parts.

**Data Set 202E-Type With Circuit Pack BE27 or BE58**

**3.02** The following equipment is required at the station to make adjustment for loop loss:

- TTS-4ANH transmission test set with cover (TTS-4XD)
- KS-16979-L1 volt-ohm-milliammeter (VOM) or equivalent.

**3.03** The line build-out network and the power level network on the line coupler circuit board must be adjusted after the data set has been installed. The signal at the central office must be approximately -12 dBm. Because the line loss varies at different locations, it will be necessary to adjust the output level of the data set and, in certain cases, add an external pad to insure that



**Fig. 1—Data Set 202E-Type Connection Diagram**

**TABLE A**  
**DATA SET INTERFACE CONNECTIONS**

INTERFACE LEAD NUMBER	LEAD DESIGNATION	DATA SET 202
2	Transmitted Data (BA)	E1, E2, E7, E9
5	Clear to Send (CB)	E7, E9
6	Data Set Ready (CC)	E7, E9
7	Signal Ground (AB)	E1, E2, E7, E9
9	Positive Power (+P)*	E2, E7, E9
10	Negative Power (–P)*	E2, E7, E9
12	Supervisory Received Data (SBB)	E2, E9
20	Data Terminal Ready (CD)	E7, E9

\* For telephone company use only.

a correct level arrives at the central office. Therefore, it will be necessary to construct a pad according to Fig. 2 and Table B (48V central office) or Table C (72V central office). This pad is connected externally and is used with the adjustment screws on the line coupler board to provide the correct output level.

**3.04** The following procedure describes the method for making the adjustments to compensate for loop loss.

**Note:** These adjustments are made by tightening or loosening screws (designated A through H) on the terminal blocks mounted on the line coupler module (Fig. 3). Tightening a screw makes contact between two terminals on the block. Loosening the screw opens the circuit between the terminals.

- (1) Remove the rear cover of the data set.
- (2) Loosen the eight terminal block screws (designated A through H) on the line coupler module.
- (3) Determine the loop loss and loop resistance. This information should be available from the line card maintained at the data test center. This procedure is recommended in the section entitled Data Systems—DATA-PHONE® Service

on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501). If this information is not available from the line card, it may be determined as follows.

**Note:** The TTS-4ANH test set should be calibrated before making measurements. Refer to the section entitled Model TTS-4 Series of Transmission Test Sets, (Northeast Electronics Corporation), Instruction Manual (103-204-100) for information concerning the TTS-4ANH.

- (a) Make the following connections on the TTS-4ANH as follows:

Connect cords from the LINE jack on the test set cover to the line and from the TTS-4 jack on the test set cover to the LINE 310 jack on the TTS-4ANH.

- (b) Set up the TTS-4ANH as follows:

- (1) REC IMP to 900Ω
- (2) FUNCTION to SEND REC
- (3) LINE to REC
- (4) LINE/MON to LINE HOLD

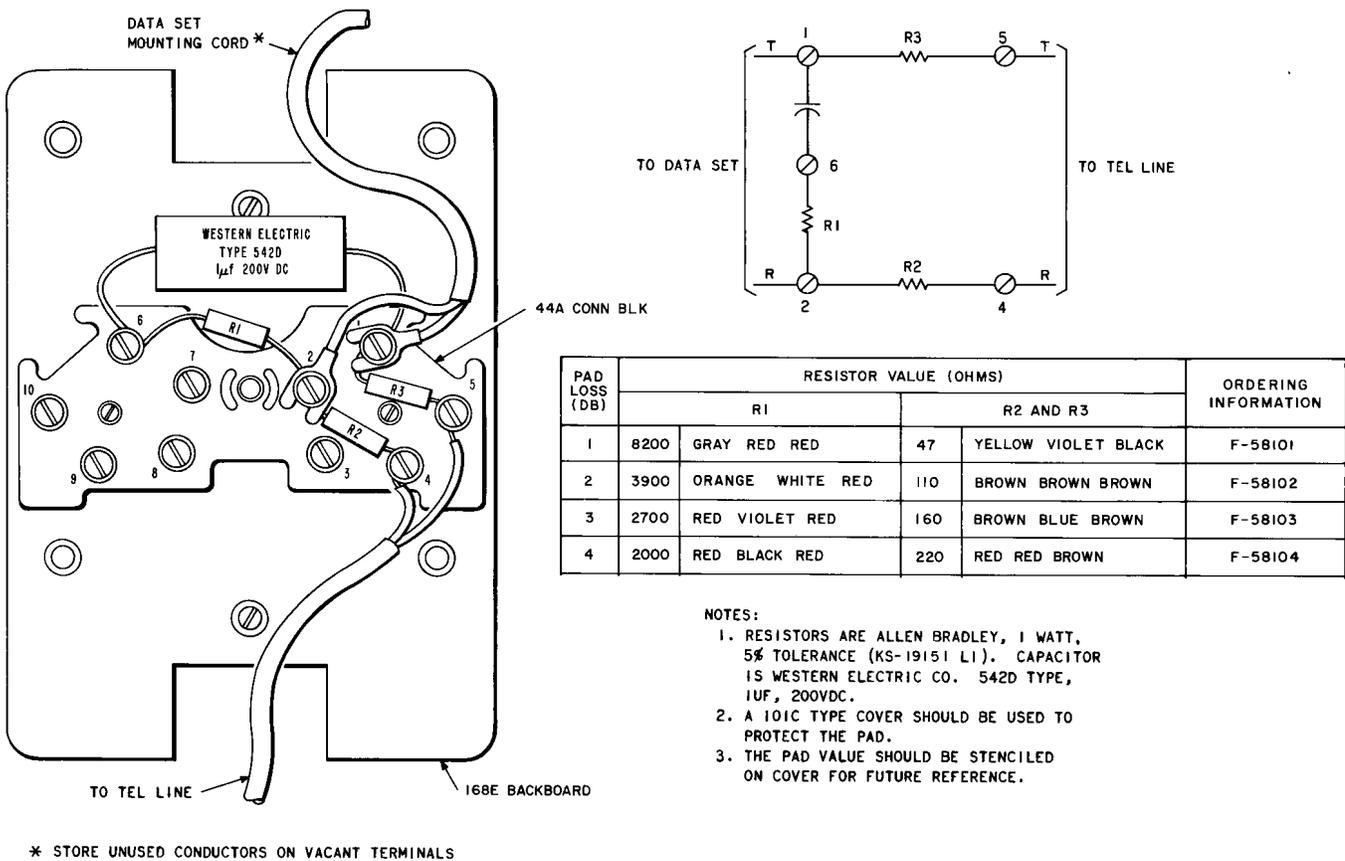


Fig. 2—Insertion Loss Pad Connections and Construction

(5) POWER switch to ON position.

(c) Place a call to a milliwatt supply by using the dial on the test set cover. Turn the REC LEVEL switch to get a reading between the -3 and +3 marks and record the loop loss.

(d) Remove all connections from the line and connect the data set line cord to the line. Depress the TALK key and set up a call to quiet battery.



**Determine the polarity of the central office battery before performing the next step to avoid damage to the meter.**

(e) Connect the KS-16979-L1 VOM, or equivalent, adjusted to indicate a maximum of 150

milliamperes between terminals 6 (tip) and 13 (ring) on TB2.

(f) Replace the handset on-hook and measure the central office battery current. Use this current value (I) in the following formula to determine the loop resistance (R). The voltage (E) will be either 48 or 72 volts, depending on the central office.

**Formula:**  $R = E/I$

**Example:** If voltage E is 48 volts and measured current (I) is 40 milliamperes, the formula is as follows:

**Formula:**  $R = 48/0.040; R = 1200$  ohms

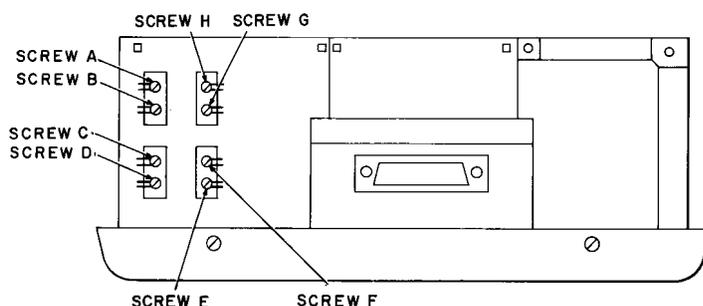
(4) After the loop loss and loop resistance have been determined, refer to Table B (for 48-volt central office) or Table C (for 72-volt central

**TABLE B**  
**OUTPUT LEVEL ADJUSTMENT FOR 48V SYSTEM**

LOOP LOSS	RESISTANCE RANGE ( $\Omega$ )	PAD	OPTION SCREWS	dBm READING
0-1	400	2 dB	G,F (-10)	-11.7
	884			-11.65
1-2	400	4 dB	B,D,G,E (-7)	-10.5
	964			-10.4
2-3	800	1 dB	B,D,G,F (-9)	-9.4
	1300			
	450	0 dB	G,F (-10)	-10.2
	800			
3-4	900	0 dB	B,D,G,F (-9)	-8.95
	1404			
	450	4 dB	B,D,H (-5)	-8.6
	900			
4-5	1100	4 dB	A,B,C,D,G,E (-4)	-8.0
	1506			
	500	3 dB	B,D,H (-5)	-7.6
	1084			-7.5
5-6	1000	0 dB	A,C,G,F (7.5)	-8.2
	1646			
	400	1 dB	H (-6)	-6.4
	1000			-6.3
6-7	1100	2 dB	A,B,C,D,E,G (-4)	-5.6
	1726			
	400	0 dB	H (-6)	-6.6
	1100			-6.5
7-8	1404	1 dB	A,B,C,D,E,G (-4)	-4.4
	1852			
	704	0 dB	B,D,H (-5)	-4.9
	1404			-4.8
8-9	1300	0 dB	A,B,C,D,E,G (-4)	-3.8
	1950			
	926	3 dB	A,B,C,D (-1)	-3.5
	1300			-3.4
9-10	1246	0 dB	A,B,C,D,H (-2.5)	-2.95
	1950			-2.9
	1026	2 dB	A,B,C,D (-1)	-2.6
	1246			
10-11	1246	0 dB	A,B,C,D,H (-2.5)	-2.7
	1950			-2.65
	1152	1 dB	A,B,C,D (-1)	-1.5
	1246			
11-12	1246	0 dB	A,B,C,D (-1)	-1.0
	1950			-0.95

**TABLE C**  
**OUTPUT LEVEL ADJUSTMENT FOR 72V SYSTEM**

LOOP-LOSS (dB)	LOOP & C. O. RESISTANCE RANGE (WITH CONNECTION ESTABLISHED)	PAD (dB)	202E LINE COUPLER BAND (TIGHTEN SCREW)
0-1	1800 - 2906	4	A-C-G & F
1-2	1800 - 2500	2	B-D-G & F
	2500 - 3026	3	A-C-G & F
2-3	1800 - 2500	0	G & F
	2500 - 3000	3	A-C-G & F
3-4	2500 - 3000	0	B-D-G & F
	1800 - 2500	2	B-D-G & E
4-5	1800 - 3000	1	B-D-G & E
5-6	1800 - 2500	2	B-D & H
	2500 - 3000	0	B-D-G & E
6-7	1800 - 3000	1	B-D & H
7-8	1900 - 3000	0	B-D & H
8-9	2126 - 3000	3	A-B-C & D
9-10	2226 - 3000	2	A-B-C & D
10-11	2350 - 3000	1	A-B-C & D
11-12	2446 - 3000	0	A-B-C & D



**Fig. 3—Location of Line Build-Out and Power Level Network Adjustment Screws**

office). These tables provide information about how much attenuation is required to provide a -12 dBm signal at the central office.

(5) Connect the pad (Fig. 2) to the line and tighten the screws on the line coupler module in accordance with Table B or Table C.

**Note:** Care must be taken to not use excessive pressure when tightening terminal block screws to avoid stripping the screw threads.

(6) Replace the data set cover.

**3.05** Check the installation by requesting a test by the data test center and performing the

test procedure given in the section entitled Data Set 202E-Type, Test Procedures (592-018-500).

- 3.06 Verify proper operation to the customer by having the data set transmit data to a receiving station.



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

**Data Set 202E-Type With Circuit Pack BE60**

- 3.07 The following equipment is required at the data set station:

- (a) For DS 202E1 use a 914B DTS.
- (b) For Data Sets 202E2, E7, and E9, use either a 901 DTS interface test adapter or a 914B DTS.
- (c) TTS-4ANH transmission test set.
- (d) KS-16979-L1 volt-ohm-milliammeter (VOM) or equivalent.

- 3.08 The following procedure describes the method for making the adjustments to compensate for loop loss.

**Note:** The adjustments are made by tightening or loosening screws A and B on the terminal blocks mounted on the line coupler module.

- (a) Remove the rear cover of the data set.
- (b) Loosen the two terminal block screws (designated A and B) on the line coupler module.
- (c) Connect the data set line cord to the line, depress the TALK key, and set up a call to quiet battery.



**Determine the polarity of the central office battery before performing the next step to avoid damage to the meter.**

- (d) Connect the KS-16979-L1 VOM, or equivalent, adjusted to indicate a maximum of 150

milliamperes between terminals 6 (tip) and 3 (ring) on TB2.

- (e) Replace the handset on-hook and measure the central office battery current. Table D lists the screws to be tightened, if necessary, according to central office battery current. Remove data set connection from the line.

**TABLE D  
SERIES BUILD-OUT NETWORK ON CP BE60**

CENTRAL OFFICE BATTERY CURRENT (mA)	TIGHTEN SCREW
Less than 38.5	A, B
38.5 - 48.0	A
48.0 - 68.0	B
More than 68.0	None

- (f) On the TTS-4ANH, connect cords from the LINE jack on the test set cover to the line and from the TTS-4 jack on the test set cover to the LINE 310 jack on the TTS-4ANH.

- (g) Set up the TTS-4ANH as follows:

- (1) REC IMP to 900Ω
- (2) FUNCTION to SEND REC
- (3) LINE to REC
- (4) LINE/MON to LINE HOLD
- (5) POWER switch to ON position.

- (h) Place a call to a milliwatt supply by using the dial on the cover of the TTS-4ANH. Turn the REC LEVEL switch to get a reading between the -3 and +3 marks and record the level, V<sub>1</sub>, indicated on the test meter.

- (i) Terminate the call to the milliwatt supply and set up the TTS-4ANH as follows:

- (1) FUNCTION to SEND REC
- (2) REC IMP to BRDG ADD 20 db

**SECTION 592-018-200**

- (3) LINE to REC
  - (4) SEND IMP to 900Ω
  - (5) SEND FREQ to 1000
  - (6) SEND LEVEL to 0 (CAL)
  - (7) POWER switch to ON position.
- (j) Connect cords from SEND 309 jack to the TTS-4 jack on the test set cover, from the LINE jack on the cover to the line, and from the REC 310 jack to the two line jacks on the cover (located below the dial).
- (k) Place a call to quiet battery using the test set cover and measure and record the level of the signal,  $V_a$ , as it goes out on the line. Refer to Table E and record the value,  $V_t$ , to which the variable resistor on CP BE60 must be adjusted to obtain a -12 dBm signal level at the central office.
- (l) The following paragraphs cover the equipment setup for adjusting the power level for each data set model.
- (m) For DS 202E2 employing a 901-type DTS interface test adapter, set up the equipment as follows:
- (1) Connect patch cords from EQ 2 to EQ 10 and from EQ7 to TST 10.
  - (2) Connect the 901 DTS interface test adapter connection cord to the rear of the data set, in place of the business machine cord, and connect DS 202E to the line.
- (n) Bridge the line with the TTS-4ANH set up as follows:
- (1) REC IMP to BRDG
  - (2) FUNCTION to SEND REC
  - (3) POWER to ON.
  - (4) LINE/MON to OPEN
  - (5) LINE to TALK
- (o) Connect a cord from the REC 310 jack to the line.
- (p) Depress TALK key on the data set and place a call to quiet battery. Depress DATA key, leaving handset off-hook, and adjust the variable resistor of the line coupler board to get a reading on the test meter equal to  $V_t$  found in Table E.
- (q) For Data Sets 202E1 and E2 employing a 914B DTS, set up equipment as follows:
- 914B DTS
    - Plug power cord into a 117-volt ac outlet.
    - Place pins in matrix at positions 7 by GRD and 2 by S1. Switch S1 to OFF.
    - INTERFACE MODE to VOLTAGE (to CONTACT if DS 202E1, contact interface, is being adjusted)
    - Depress all A interface selector switches.
    - Connect a cord from the rear of the data set, in place of the business machine cord, to connector A on the test set. Connect DS 202E to the line, connect a cord from the line to REC 310 jack on the TTS-4ANH, and set up the TTS-4ANH as in step (n).
- (r) Depress POWER button on the 914B DTS and the TALK key on DS 202E and place a call to quiet battery. Depress DATA key on DS 202E, leaving handset off-hook, and adjust the variable resistor of the line coupler board to get a reading on the test meter equal to  $V_t$  found in Table E.
- (s) For Data Sets 202E7 and E9 employing a 901 DTS interface test adapter, set up equipment as follows:
- Interface Test Adapter
    - Connect W25A connection cord to the rear of the data set in place of business machine cord.
    - Connect patch cords from EQ 2 to EQ 10, EQ 9 to EQ 20, and EQ 7 to TST 10.

**TABLE E**  
**LEVEL SETTING CHART FOR DATA SET 202E**

$V_a$	$V_i$												
	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12
6	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
5	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5
4	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4
3	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3
2	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2
1	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1
0	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
-1	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
-2	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2
-3	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3
-4	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4
-5	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5
-6	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6
-7	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7
-8	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8
-9	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9
-10	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10

Note: Read  $V_i$  at the junction of  $V_a$  and  $V_i$ .

Connect DS 202E to the line and connect a cord from the line to the REC 310 jack on the TTS-4ANH. Set up the TTS-4ANH as in step (n). Depress the TALK key on the data set and place a call to quiet battery. Depress the DATA key on DS 202E, leaving handset off-hook, and adjust the variable resistor of the line coupler board to get a reading on the test meter equal to  $V_i$  found in Table E.

- (t) For Data Sets 202E7 and E9 employing a 914B DTS, set up equipment as follows:

● 914B DTS

Plug power cord into 117-volt ac outlet.

Insert pins in matrix board at 7 by GRD, 2 by S1, and 20 by S2.

S1 to OFF and S2 to ON.

INTERFACE MODE to VOLTAGE.

Depress POWER button.

Depress all A interface selector switches. Connect a cord from the rear of the data set, in place of the business machine cord, to connector A on the test set. Connect DS 202E to the line and connect a cord from the line to the REC 310 jack on the TTS-4ANH. Set up the TTS-4ANH as in step (n). Depress the data set TALK key and place a call to quiet battery. Depress the DATA key on DS 202E, leaving handset off-hook,

**SECTION 592-018-200**

and adjust the variable resistor of the line coupler board to get a reading on the test meter equal to  $V_f$  found in Table E.

- 3.09** Replace data set cover, remove all temporarily installed straps, and verify proper operation

to the customer by having the data set transmit data to a receiving station.



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