

**REPLACING PAGE ADDENDUM**

**Filing Instructions:**

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**DATA SETS 108D- AND 108E-TYPE  
SINGLE PRIVATE LINE STATION ARRANGEMENT  
USING DATA AUXILIARY SET 820D  
TEST PROCEDURES**

**1. GENERAL**

**1.001** This addendum supplements Section 591-028-501, Issue 1. The attached pages must be inserted in this section in accordance with the above filing instructions.

**1.002** This addendum is issued to add information to the audible indication and frequency measurement tests to compensate for signal ground (AB) *not* being connected to protective ground (AA).

**3. TEST PROCEDURES**

The following changes apply to Part 3 of this section.

- (a) Audible Indication paragraph 3.07, Step 6—revised
- (b) Frequency Measurement paragraph 3.08, Steps 10 through 13—revised

**Attached:**

**Page 5 dated June 1974, revised**

**Page 6 dated June 1974, revised**

**DATA SETS 108D- AND 108E-TYPES**  
**SINGLE PRIVATE LINE STATION ARRANGEMENT**  
**USING DATA AUXILIARY SET 820D**  
**TEST PROCEDURES**

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used in data auxiliary set (DAS) 820D in a private line arrangement. In this section, data sets 108D- and E-types will be referred to as data sets 108D and E.

**1.02** This section is to be used in conjunction with troubleshooting procedures in Section 591-028-301.

**1.03** In order to test the near-end station used in a private line arrangement, it is necessary:

- To remove the carrier squelch on carrier fail option while performing test procedures if it is installed at either end
- To ensure that the TEST button has *not* been pushed (TEST lamp should be unlit) at either end
- To send the data set 108E an unmodulated (steady) marking or spacing frequency to reestablish connection after carrier fail (if carrier squelch on carrier fail option is installed at the station with data set 108E)
- To send the data set 108D a unmodulated (steady) marking frequency to reestablish connection after carrier fail (if carrier squelch on carrier fail option is installed at the station with data set 108D).

**1. GENERAL**

**1.01** This section describes the test procedures and associated requirements that can be performed at the time of installation or when investigating trouble conditions associated with data sets 108D- or 108E-type and AR17 circuit pack

If the carrier squelch on carrier fail option is not removed at a station and a carrier fail condition occurs, the station cannot transmit until the data set at that station receives a connect signal. This condition will cause difficulty in isolating receive, loop, or far-end transmit problems. The test mode automatically installs a carrier squelch on carrier fail which can result in the same difficulty.

## 2. TEST EQUIPMENT

**2.01** The following is a complete list of test equipment necessary to perform the tests outlined in this section:

- 901B data test set (interface test adapter J79901B)
- Portable station test set TTS-28, or equivalent
- 1013-type handset (dial hand test set)
- Portable telegraph carrier test set (TCTS) (KS-19935-L7)

**Note:** The TCTS includes the auxiliary power supply.

- 911A data test set
- 902-type data test set
- 903-type data test sets (two required)
- W2DW cords (three required)
- W1AD cords, or equivalent (three required)
- 1W2A cords, or equivalent (two required)
- 2W42A cord, or equivalent
- 2W20A cord, or equivalent
- KS-20538-L1 VOM (or equivalent).

## 3. TEST PROCEDURES

### CARRIER MONITORING TEST

**3.01** This test determines the presence of both near- and far-end carriers. Equipment necessary for this test consists of the following:

- 1013-type handset
- Telegraph carrier test set (TCTS) and two W1AD cords.

### A. Far-End Carrier

#### Audible Indication

**3.02** The following procedure should be used to determine the presence of far-end carrier at the station when using the 1013-type handset.



*This test assumes the carrier squelch on carrier fail option (if installed at far end) has been removed for this test and that the far end is not in the test mode.*

- (1) Remove power from DAS 820D.

**Note:** This will disable near-end carrier and allow monitoring of weak far-end carrier.

- (2) Remove plastic housing of DAS 820D-L1 or gain access to DAS 820D-L1A.
- (3) Operate 1013 handset TALK MON switch to MON.
- (4) Connect leads of 1013 handset to data set TP1 and TP2 for 2-wire line facilities or TP6 and TP13 for 4-wire line facilities (see Fig. 1).
- (5) Monitor for incoming carrier F1 (data set 108E) or F2 (data set 108D).

**Note:** Modulated incoming carrier will not extinguish the data set CF lamp if it has become lit (refer to 1.03).

- (6) Remove 1013 handset, replace cover, if supplied, and restore power to the DAS.

#### Frequency Measurement

**3.03** The following procedure measures the frequency of the far-end carrier using the TCTS and two W1AD cords.

- (1) Using a nearby telephone, instruct far-end station not to send data until instructed to return the station to normal operation.
- (2) Remove plastic housing of DAS 820D-L1 or gain access to DAS 820D-L1A.
- (3) Connect one end of the auxiliary power supply (with TCTS) interconnection power

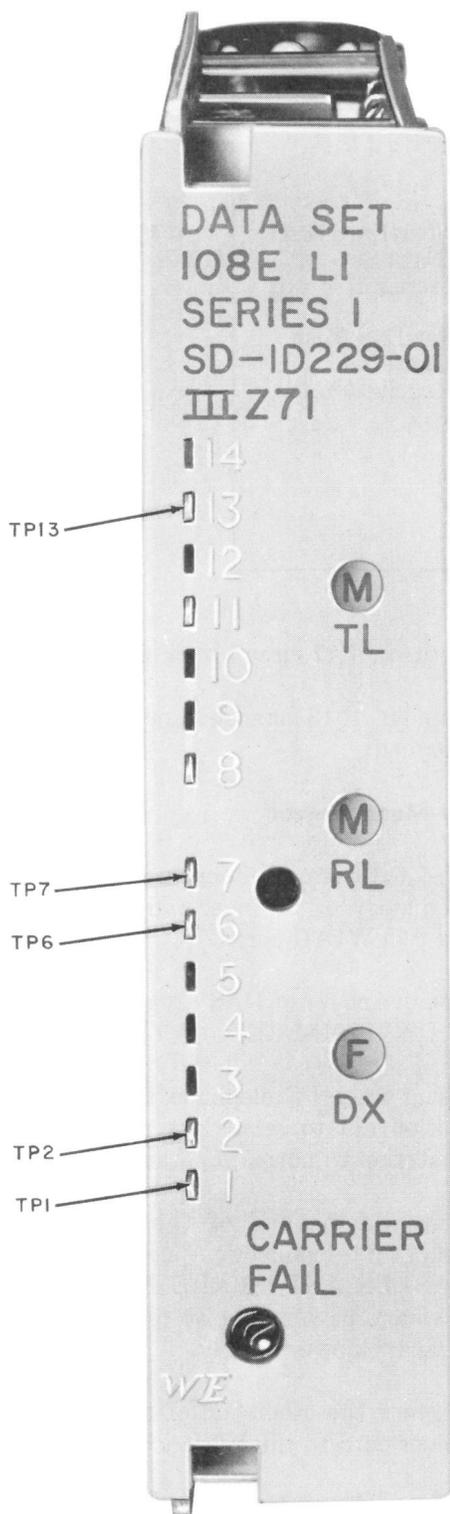


Fig. 1—Data Set Test Points

cord (stored in the CABLES AND SPARE FUSES section of the auxiliary power supply) to the PWR jack of the auxiliary power supply.

- (4) Connect the other end of the interconnection power cord to the PWR jack of the TCTS.
- (5) Operate the controls on the TCTS in accordance with Table A.
- (6) Connect alligator clip ends of the two W1AD cords to data set TP1 and TP2 for 2-wire line facilities or TP6 and TP13 for 4-wire line facilities.
- (7) Connect spade-tip ends of the two W1AD cords to VF-1 and VF-2 screws of TB1 on the back of the TCTS.
- (8) Connect the power cord of the auxiliary power supply to an available 120V 60-Hz ac power source.
- (9) Operate the PWR switch of auxiliary power supply to ON.
- (10) Monitor the incoming carrier frequency F1 (data set 108E) or F2 (data set 108D).

**Note:** If the far-end station is sending a mark, the SIGS M-ON lamp of the TCTS will be lighted. If the far-end station is sending a space, the SIGS M-ON lamp will not be lighted. The lamp will blink to indicate modulated carrier (refer to 1.03).

- (11) **Requirement:** FREQUENCY DEVIATION meter indicates not less than  $-6$  and not more than  $+6$  Hz from F1 frequencies for data set 108E (1270 Hz for a mark and 1070 Hz for a space) or from F2 frequencies for data set 108D (2225 Hz for a mark and 2025 Hz for a space).
- (12) Operate PWR switch of auxiliary power supply (with TCTS) to OFF.
- (13) Disconnect all power cords and test cords.
- (14) Replace cover (if supplied) and restore normal station operation to the near- and far-end stations.

**TABLE A**  
**TCTS CONTROL SETTINGS**

CONTROL	POSITION
AM/FM	FM
SW/DW/F	F
CHANNEL SELECT	F1 (108D) } Near-End Test (Data Set
	F2 (108E) } Transmit Freq)
	F2 (108D) } Far-End Test (Data Set
	F1 (108E) } Receive Freq)
SPKR switch	ON
HI-M/LO-M	HI-M
LEVEL dBm	-17

**B. Near-End Carrier****Audible Indication**

**3.04** The following procedure should be used to determine the presence of near-end carrier using the 1013 handset.



*This test assumes that the near end is not in test mode.*

- (1) Remove cover of DAS 820D-L1 or gain access to DAS 820D-L1A.
- (2) Operate 1013 handset TALK MON switch to MON.
- (3) Connect leads of 1013 handset to data set TP1 and TP2 (2-wire or 4-wire).
- (4) Pull AR17 circuit pack approximately 2 inches from mounting.
- (5) Monitor for carrier frequency F1 (data set 108D) or F2 (data set 108E). The unmodulated marking frequency will be heard.

**Note:** Near-end carrier will be the louder of two tones heard in 2-wire arrangements. In 4-wire operation only near-end carrier is present on data set TP1 and TP2.

- (6) Return AR17 circuit pack to proper position.

- (7) Remove 1013 handset and replace cover, if supplied.

**Frequency Measurement**

**3.05** The following procedure measures the frequency of the near-end carrier using the TCTS and two W1AD cords.

- (1) Remove cover of DAS 820D-L1 or gain access to DAS 820D-L1A.
- (2) Using a nearby telephone, instruct the far-end station not to send data until instructed to return station to normal operation.
- (3) Connect one end of the auxiliary power supply interconnection power cord (stored in the CABLES AND SPARE FUSES section of the auxiliary power supply) to the PWR jack of the auxiliary power supply.
- (4) Connect the other end of the interconnection power cord to the PWR jack of the TCTS.
- (5) Operate the controls of the TCTS in accordance with Table A.
- (6) Connect the alligator clip ends of the two W1AD cords to data set TP1 and TP2 (2-wire or 4-wire).

- (7) Connect the spade-tip ends of the two W1AD cords to VF-1 and VF-2 screws of TB1 on the back of the TCTS.
- (8) Connect the power cord of the auxiliary power supply (with TCTS) to an available 120V 60-Hz ac power source.
- (9) Operate the PWR switch of auxiliary power supply to ON.
- (10) Pull AR17 circuit pack approximately 2 inches from mounting.
- (11) Monitor the near-end carrier frequency F1 (data set 108D) or F2 (data set 108E).

**Note:** The SIGS M-ON lamp of the TCTS will be lighted.

- (12) **Requirement:** The FREQUENCY DEVIATION meter indicates not less than -6 and not more than +6 Hz from F1 frequencies for data set 108D (1270 Hz for a mark) or from F2 frequencies for data set 108E (2225 Hz for a mark).
- (13) Operate the PWR switch of the auxiliary power supply to OFF.
- (14) Disconnect all test cords.
- (15) Return AR17 circuit pack to proper position.
- (16) Replace cover (if supplied) and return the near-end and far-end stations to normal operation.

### CARRIER SHIFT TEST

**3.06** This test determines if the near-end carrier can be shifted. The following test equipment is required at the station.

- 901B data test set
- W1AD cords, or equivalent (3 required)
- 1013-type handset or portable TCTS.

### Audible Indication

**3.07** The following procedure using the 1013 handset should be used to determine if the near-end carrier can be shifted.

- (1) Remove cover of DAS 820D-L1, or gain access to DAS 820D-L1A.
- (2) Remove carrier squelch on carrier fail option (if installed) by opening screw switch A7 on AR17 circuit pack (see Fig. 2), and verify that the near-end station is *not* in the test mode.
- (3) Remove customer interface cord from J3 of the DAS, and plug cord from the interface test adapter in its place.
- (4) Operate 1013 handset TALK MON switch to MON, and connect leads to data set TP1 and TP2 (2-wire or 4-wire).
- (5) Clip one end of W1AD cord to terminal 2 (BA lead) of interface test adapter.
- (6) Using free end of W1AD cord, momentarily touch terminal 10 (-24V) and then terminal 9 (+24V) of the interface test adapter for an E1A interface arrangement or momentarily touch terminal 10 (-24V) for a current interface while monitoring with 1013 handset.
- (7) Monitor for shift in tone.
- (8) Remove handset and interface test adapter, replace carrier squelch on carrier fail if originally installed, and replace cover, if supplied.

### Frequency Measurement

**3.08** The following procedure is used to measure the frequency of the near-end carrier when it is shifted.

- (1) Remove cover of DAS 820D-L1 or gain access to DAS 820D-L1A.
- (2) Remove carrier squelch on carrier fail option (if installed) by opening screw switch A7 on AR17 circuit pack (see Fig. 2), and verify that the near-end station is *not* in the test mode.
- (3) Remove customer interface cord from J3 of DAS, and plug cord from the interface test adapter in its place.

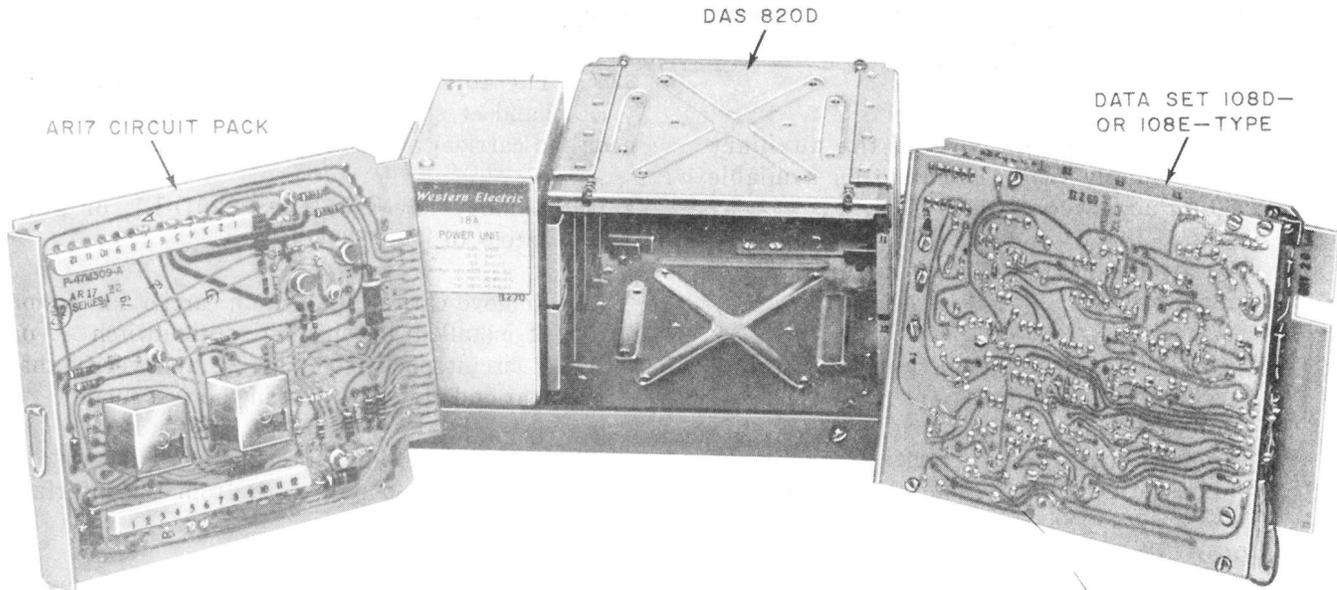


Fig. 2—Data Set 108D- or E-Type and AR17 Circuit Pack Used in Data Auxiliary Set 820D

- (4) Connect the auxiliary power supply (with TCTS) interconnection power cord (stored in its CABLES AND SPARE FUSES section) to the PWR jack of the auxiliary power supply.
- (5) Connect the other end of the power cord to the PWR jack of the TCTS.
- (6) Operate the controls of the TCTS in accordance with Table A.
- (7) Connect the alligator clip ends of two of the W1AD cords to data set TP1 and TP2 (2-wire or 4-wire).
- (8) Connect the spade-tip ends of the two W1AD cords to VF-1 and VF-2 screws on the back of the TCTS.
- (9) Clip the alligator clip end of the third W1AD cord to terminal 2 of the interface test adapter.
- (10) Connect the other end of the third W1AD cord to terminal 10 (-24V).
- (11) Operate the PWR switch of the auxiliary power supply to ON.

**Requirement:** The meter will indicate not less than -6 and not more than +6 Hz deviation from F1 mark frequency for data set 108D (1270 Hz) or from F2 mark frequency for data set 108E (2225 Hz).

**Note:** If the near-end station is sending a mark, the SIGS M-ON lamp of the TCTS will be lighted.

- (12) Disconnect W1AD cord from terminal 10 (-24V).
- (13) Connect the third W1AD cord to terminal 9 (+24V) of the interface test adapter.

**Requirement:** A continuous tone on the speaker will be lower than in Step 11. FREQUENCY DEVIATION meter indicates not less than -6 and not more than +6 Hz from F1 space frequency for data set 108D (1070 Hz) or from F2 space frequency for data set 108E (2025 Hz).

- (14) Operate the PWR switch of the auxiliary power supply to OFF.
- (15) Replace carrier squelch on carrier fail option if originally installed.

- (16) Disconnect the interconnection power cord and test cords.
- (17) End of test.

### LOOP-BACK TEST

**3.09** The loop-back test is required when investigating trouble reports, or at the time of installation to ensure proper operation of the data station. If the service offering is a voiceband data circuit, the 904-type data test center (DTC) will perform the test; if it is a telegraph channel, the private line telegraph testboard will perform the test. If the service is station-to-station operation, the far end must be placed in the test mode.

**3.10** Usually, the loop-back test will have been performed prior to dispatching a telephone company employee in response to a trouble report.

**3.11** The data station is conditioned for loop-back testing by depressing the TEST button on the front of the DAS or the remote TEST button when remote facilities are installed. The DAS TEST button is a push-push type. It is pressed once to condition the data station for testing and pressed again to release the data station from the test mode. The TEST lamp lights when the data station is in the test mode.

**3.12** The following test equipment is required at the near-end station:

- Interface test adapter J79901B (901B data test set cover)
- KS-20538 VOM, or equivalent
- W1AD cord, or equivalent.

**3.13** The following procedure should be used to perform the loop-back test using a KS-20538 VOM, or equivalent.

- (1) At DAS 820D, remove customer interface cord from J3.
- (2) Connect interface test adapter to J3 of DAS 820D.
- (3) Request that far end be placed in the test mode.

- (4) Set FUNCTION switch of VOM to 30 VDC.
- (5) Connect + terminal of VOM to interface test adapter, terminal 7 (signal ground).
- (6) Connect – terminal of VOM to interface test adapter, terminal 3 (BB lead).
- (7) Meter should read between 5 and 25 volts.
- (8) Remove meter leads from interface test adapter (901B data test set cover).
- (9) Clip one end of W1AD cord to terminal 2 (BA lead) of the interface test adapter, and clip other end to terminal 9 (+24V).
- (10) Connect – terminal of VOM to interface test adapter, terminal 7 (signal ground).
- (11) Connect + terminal of VOM to interface test adapter, terminal 3 (BB lead).
- (12) Meter should indicate between 5 and 25 volts.
- (13) Remove test equipment; return to pretest conditions.

### DISTORTION MEASUREMENT TEST

#### A. Distortion Measurement Test Using 911A Data Test Set

**3.14** This test measures the loop-back distortion of the data system. The transmit lead is driven by the test sentence generator. At the receive lead, the data set feeds the data signals to the distortion measuring set, which measures the distortion introduced by the loop-back mode.

**3.15** The block diagram (Fig. 3) shows the equipment setup at the terminal with EIA voltage interface for testing both directions of transmission. This checks the transmitter and receiver of both data sets and the two directions of transmission of the connecting facilities. Refer to 3.18(2), (4), and (7) for current interface information.

**3.16** Verify that the test equipment is in good operating condition. Refer to the section entitled 911-Type Data Test Sets (J79911A, B, and C), (103-813-100).

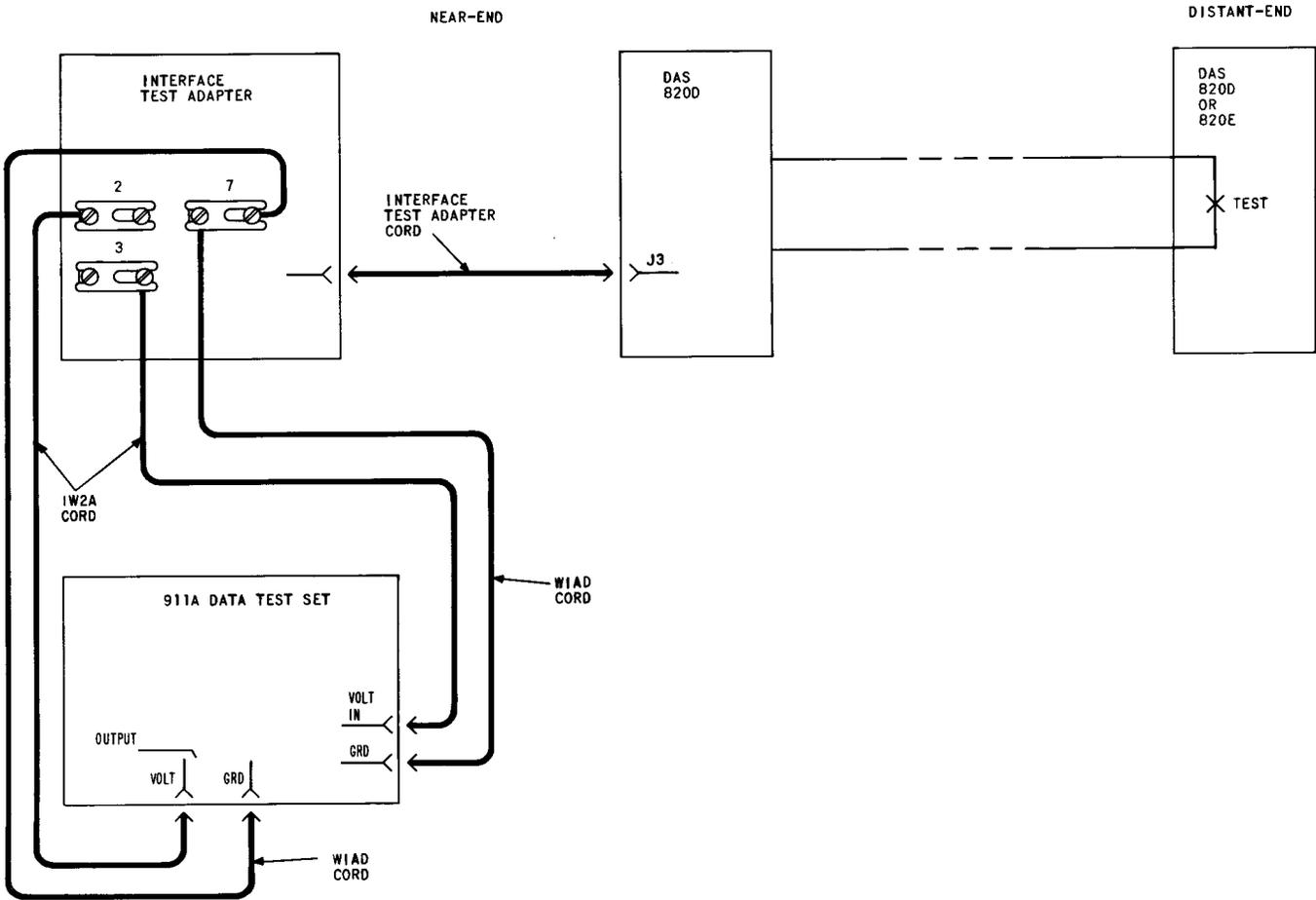


Fig. 3—Distortion Test Using 911A Data Test Set (EIA Interface Shown)

3.17 The following equipment is required at the near-end station:

- 901B data test set
- W1AD cords, or equivalent (two required)
- 911A data test set
- 1W2A cords, or equivalent (two required) for EIA interface
- 2W42A cord, or equivalent for current interface
- 2W20A cord, or equivalent for current interface

**Note:** If 2W42A cord is not available for current interface connection, the equivalent

cord must be equipped with a 310-type plug on one end to be compatible with the REL jack on test sentence generator. If the 2W20A cord is not available, the equivalent cord must be equipped with a 347-type plug on one end to be compatible with the CUR. IN. jack on distortion measuring set.

3.18 The following procedure should be used to measure distortion using the 911A data test set:

- (1) Remove customer interface cord from J3 of DAS 820D, and connect interface test adapter in its place.
- (2) Set controls on test sentence generator as follows:

AUTO. MAN. STEP to AUTO.

BAUDS to speed desired (maximum is 300)

BIAS to 0

CODE to code desired

DIST 1% to 0

DIST 5% to 0

REPEAT to OFF

RY OR U\* to OFF

OUTPUT to EIA for EIA interface; OUTPUT to REL for current interface.

#### EIA Interface Connection

- (3) For EIA interface, patch OUTPUT VOLT jack on test sentence generator to terminal 2 of the interface test adapter using 1W2A cord. Clip one end of a second W1AD cord to GRD on test sentence generator and the other end to pin 7 of the interface test adapter.

#### Current Interface Connection

- (4) For current interface, patch between REL jack and interface test adapter using a 2W42A cord. Connect black wire to terminal 2 (BA lead) of the interface test adapter and white wire to terminal 10 (-24 volts).

- (5) Set controls of the distortion measuring set as follows:

BAUDS to speed desired

CODE to code desired

DISCR% to 5

FILTER to OUT

INPUT to EIA for EIA interface; INPUT to REV 20 for current interface

PARITY to OFF

AUTO. PK-PIP to PIP.

#### EIA Interface Connection

- (6) For EIA interface, patch from VOLT IN. jack on distortion measuring set to pin 3 (BB lead) of the interface test adapter using 1W2A cord. Clip one end of a second W1AD cord to GRD on distortion measuring set, and the other end to pin 7 (AB lead) of the interface test adapter.

#### Current Interface Connection

- (7) For current interface, patch between CUR. IN. jack and interface test adapter using 2W20A cord. Connect red wire to 3 (BB lead) of the interface test adapter and white wire to 10 (-24 volts) in interface test adapter.

- (8) Connect power cord of 911A data test set to 117-volt ac outlet. Turn power switch ON.

- (9) Momentarily operate AUTO. PK-PIP switch to PK and then back to PIP.

- (10) Operate RESET switch on distortion measuring set to prepare set to receive incoming signals.

- (11) **Requirement:** Distortion displayed on pixie tubes should be 15 percent or less.

- (12) Set DIST 5% switch on test sentence generator to 25.

- (13) Set BIAS switch to SWC.

- (14) Set DISCR% switch on distortion measuring set to 0.

- (15) **Requirement:** Distortion displayed on pixie tubes should be less than 40 percent.

**Note:** This checks the ability of the system to operate with high distortion.

- (16) Remove test equipment; return to pretest conditions.

#### B. Distortion Measurement Test Using 902- and 903-Type Data Test Sets

- 3.22** This test measures the distortion and error rate of the data system using an EIA

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

**3.20** The block diagram (Fig. 4) shows the equipment setup at the terminal for testing both directions of transmission. This checks the transmitter and receiver of both data sets and the two directions of transmission of the connecting facilities.

**Caution:** *Do not connect the 903-type data test set until all other equipment is connected and all of their switches have been placed to proper settings.*

**3.21** Verify that test equipment is in good operating condition. Refer to the appropriate sections covering operational and calibration tests. Sections covering data test sets specified in these tests are as follows:

SECTION	TITLE
107-100-100	901A and 901B Data Test Sets—Identification and Operation
107-300-100	902A and 902B Data Test Sets—Identification and Operation
107-200-100	903A and 903B Data Test Sets—Description and Operation

**3.22** The following equipment is required at the near-end station:

- Interface test adapter J79901B (901B data test set cover)
- 903-type data test sets (two required)
- 902-type data test set
- W2DW cords, or equivalent (three required).

**3.23** The following procedure should be used to measure distortion.

**Transmit Lead**

- **903-type Data Test Set:**

RANDOM-DOT to RANDOM

TRIGGER to +

BIT RATE to speed desired.

**Note:** Set BIT RATE on 903B to 180. For compatible bit rate, use a second 903B and a 902B at the receive lead. Set BIT RATE on 903C to 300. For compatible bit rate, use a second 903C and a 902C at the receive lead.

- (1) Remove business machine cord from J3 of DAS 820D and replace with cord from interface test adapter.
- (2) Using the W2DW cord, connect from red SIGNAL OUT jack to terminal 2, and from black SIGNAL OUT jack to terminal 7 of the interface test adapter.
- (3) Connect the power cord of 903-type data test set to 117-volt ac outlet. Turn power switch ON.

**Receive Lead**

- **902-type Data Test Set:**

BIT RATE to speed desired

**Note:** On 902B data test set, set BIT RATE to 180. On 902C data test set, set BIT RATE to 300.

Meter selection switch to DIST ADJ

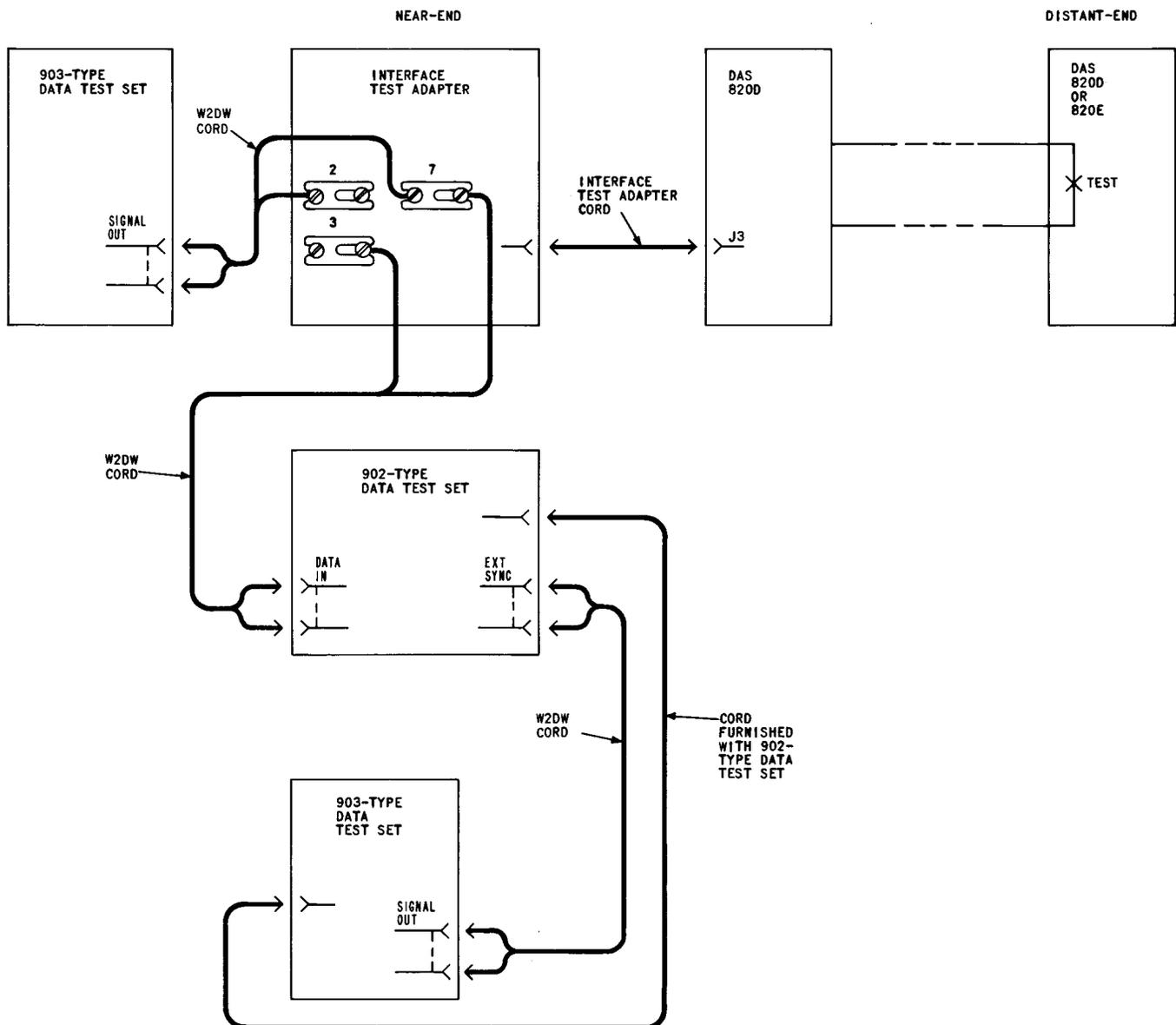
TRIGGER—not required.

- **903-type Data Test Set:**

BIT RATE to EXT CLOCK

RANDOM-DOT to RANDOM

TRIGGER to +.



**Fig. 4—Distortion Measurement Using 901-, 902-, and 903-Types Data Test Sets**

- (4) Using W2DW cord, connect from red DATA IN. jack of 902-type data test set to terminal 3, and from black DATA IN. jack to terminal 7 of the interface test adapter.
- (5) Connect the 903-type set to the 902-type set with the cord provided.
- (6) Connect power cord of 903-type set to 117-volt ac outlet. Turn power switch ON.
- (7) Request that far end be placed in test mode.
- (8) Momentarily depress START button on transmitting 903-type data test set. The transmitting station has no further duties until end of test period.
- (9) Allow the 902-type data test set meter selection switch to remain in the DIST ADJ position for several seconds before making

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distortion calibration adjustment. Zero the meter by means of the DISTORTION adjustment control.

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

**Note:** The BIAS ADJ position on the 902-type data test set is not used in this test.

- (11) Move the meter selection switch to PHASE ADJ position, and again zero the meter by means of the PHASE adjustment control.

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

- (13) The microammeter should settle down to some relatively stable value that indicates peak distortion. One microamp is equal to 1-percent distortion. For example, a meter indication of 8 microamps would be 8-percent peak distortion.

- (14) The TOTAL ERRORS lamps lighted on the 902-type data test 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.

- (15) **Requirements:** 10 percent or less distortion; 2 or less errors in a 5-minute test.

**Note:** For marginal cases of trouble (ie, customer complains of random errors), 15- to 30-minute tests should be made; same limits should be used.

- (16) Disconnect test equipment; return to pretest conditions.

### POWER SUPPLY MEASUREMENT

**3.24** The only equipment required at the station to perform the power unit voltage test is a KS-20538-L1 VOM, or equivalent, and a 901B data test set.



*This test assumes that 117-volt ac power is available from the customer.*

**3.25** The following procedure should be used to measure the voltage of the 18A power unit.

- (1) At the DAS 820D, remove the customer business machine cord from J3.
- (2) Connect the interface test adapter to J3 on the DAS 820D.
- (3) Set FUNCTION switch on VOM to 30 VDC.
- (4) Connect - terminal of VOM to interface test adapter, terminal 7.
- (5) Connect + terminal of VOM to interface test adapter, terminal 9.
- (6) Meter should indicate  $24 \pm 3$  volts.

**Note:** If meter indicates zero volt, alternately pull the AR17 circuit pack and data set approximately 2 inches from the mounting to verify that neither unit is shorting the power supply. If meter indicates  $24 \pm 3$  volts while either unit is pulled, that unit should be replaced or the cause of the short removed.

- (7) Remove test lead that was connected in Step (5) from terminal 9.
- (8) Exchange test lead from - terminal to + terminal on VOM.
- (9) Connect - terminal of VOM to interface test adapter, terminal 10.
- (10) Meter should indicate  $24 \pm 3$  volts (see note in Step 6).
- (11) Remove test leads, remove interface test adapter, and reconnect customer business machine cord disconnected in (1).

### TRANS-HYBRID LOSS MEASUREMENT



*This measurement requires that a 900-ohm termination (quiet line) be placed on the line at either the far end or the near end.*

**3.26** The following procedure should be used to perform the trans-hybrid loss measurement test using a TTS-28, or equivalent.

- (1) Request the 900-ohm termination to be placed on the line.
- (2) Check the send level of the data set by using TTS-28.
  - (a) Set FUNCTION switch of TTS-28 to DBM BRDG 0 position.
  - (b) Connect + and - terminals of TTS-28 to TP1 and TP2 of data set.
  - (c) Read the meter and record reading.
- (3) Set FUNCTION switch of TTS-28 to DBM BRDG -10 position.
- (4) Connect + and - terminals of TTS-28 to terminal 24 of TB1 of DAS and TP7 of data set, respectively.
- (5) Meter indication should be less than reading in (2)(c).

**Note:** Meter reads a 10-dB difference due to the FUNCTION switch being set to -10.

**3.27** To reduce crosstalk from the transmitter into the receiver for incoming carrier below -30 dBm, an optimum trans-hybrid balance must be achieved. To verify proper trans-hybrid balance of data set under test, refer to Section 591-028-201 for details of switch arrangements.

**LOOP-LOSS MEASUREMENT**

**3.28** This measurement requires the use of the TTS-28 and an oscillator capable of furnishing 1000 Hz and 2300 Hz. The measurement is made as follows.

- (1) Remove power from DAS 820D and remove cover, or gain access to the DAS.
- (2) Pull data set approximately 2 inches from mounting position.
- (3) Set FUNCTION switch of TTS-28 to DBM 900Ω TERM 0 position.
- (3) Connect + and - terminals of TTS-28 to TB1 terminals 1 and 2 (2-wire) or terminals 3 and 4 (4-wire).

- (4) Request distant station or STC to send 1000 Hz at 0 dBm.
- (5) Read TTS-28 meter.
 

**Note:** It may be necessary to set FUNCTION switch of TTS-28 to DBM 900Ω TERM -10 position to obtain reading.
- (6) Request distant station or STC to send 2300 Hz at 0 dBm.
- (7) Read TTS-28 meter.
- (8) Meter readings are the actual measured loss (AML) of the line facilities. These readings should be the same as the readings taken during installation of the data station. The station layout card shows the expected measured loss (EML) when the facilities were designed. The readings taken in (5) and (7) should not deviate from the limits shown in Table B. If the AML is not within limits, the loop should be turned back for repair.

**TABLE B**

**LOOP LIMITS**

TYPE OF LOOP	AML LIMITS
Without repeaters or carriers	EML 1 dB
With E7 repeaters only	EML 1 dB
With all other repeaters and/or carriers	EML 2 dB

**Note:** The maximum AML possible for station-to-hub configurations should be -16 dB. The maximum AML for station-to-station configurations should be -24 dB.

- (9) If AML is within limits, remove connections from TTS-28, return data set to proper position, replace cover, and restore power to the station.

**Note:** For 4-wire application, the loop loss of the transmit loop (terminals 1 and 2) can be measured from the far end with a loop-loss measurement test.

**SECTION 591-028-501****4. REFERENCES**

**4.01** Detailed information for data sets 108D and E private line station using DAS 820D is found in the following circuit descriptions (CDs), schematic drawings (SDs), and Bell System Practices (BSPs):

	<b>SECTION</b>	<b>TITLE</b>
	591-028-301	Data Sets 108D- and 108E-Types—Single Private Line Station Arrangement—Using Data Auxiliary Set 820D—Maintenance
	591-801-202	37 Teletypewriter Keyboard Send-Receive (KSR) Station Arrangement — Nonswitched Point-to-Point Private Line Service—Installation
CD&SD-3D031-01		Data Auxiliary Sets 820D- and 820E-Type
CD&SD-73060-01		Data Set 108D-Type
CD&SD-1D229-01	591-802-201	37 Teletypewriter Automatic Send-Receive (ASR) Station Arrangement — Nonswitched Point-to-Point Private Line Service—Installation
591-028-100		Data Sets 108D- and 108E-Types—Used in Station Applications—Description
591-028-101	591-803-201	37 Teletypewriter Receive Only (RO) Station Arrangement—Non-switched Point-to-Point Private Line Service—Installation
591-028-201	591-815-201	33 and 35 Teletypewriter Stations for General Purpose—Point-to-Point Private Line Service—Installation and Checkout