DATA SET 207-TYPE TRANSMITTER-RECEIVER TEST PROCEDURES

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1. GENERAL

1.01 This section contains test procedures for Data Set 207-type. The following tests are to be made at the time of installation and may be used for correcting routine trouble conditions.

1.02 This section is reissued to add information concerning the 65A oscillator and 72A oscillator and to provide information for testing Data Set 207 using a 914B Data Test Set (DTS). If the craft employee is equipped with the 914B DTS, omit Part 4 or 7 and perform the test procedures presented in Part 5 or Part 8. Due to extensive revision, change arrows have been omitted.

1.03 Within this section, test procedures are provided for testing Data Sets 207-type which are conditioned either as terminators or half-regenerators. Data sets conditioned as terminators are coded 207B1, 207B2, 207C1, and 207C2. Data sets conditioned as half-regenerators are coded 207B3, 207B4, 207C3, and 207C4.

2. CAUTIONS

2.01 The following cautions must be observed when working with the data set:

(1) Always remove power to the data set before removing or installing the RFI (radio frequency interference) shield, rear connector cover, or any printed wiring board except AR161 in slot location C21.

(2) With the RFI shield or rear access box cover removed, it is easy to accidentally short the +18 vdc or −18 vdc power supply voltages which appear on terminals on the rear of the data set to adjacent terminals. This must be avoided because application of either +18 vdc or −18 vdc to ***virtually any*** other terminal on the rear of the data set will result in transistor or diode destruction.

When power is applied to the data set, connections should be made only to the test jack J1 or printed wiring board test points.

(3) If it becomes necessary to repair or replace wires on the rear of the data set, extreme care is required to avoid pulling on the terminal pins. Pulling on the terminal pins will deform the contacts and destroy the terminal. Use wire wrapping and unwrapping tools only.

(4) Before attempting any tests, check that all printed circuit boards are pushed all the way in and securely seated in their respective connectors.

3. REMOTE TEST OF TERMINAL EQUIPMENT

3.01 The remote test is normally accomplished by a 904-type Data Test Center (DTC) arranged for Data Set 207-type. The data set may be placed in the remote test mode with either an applicable signal on the appropriate interface lead or with a switch located on the data set switch panel.

3.02 The remote test may be used to check the accuracy of the data set oscillator, if the data set is self-timed, or to check the accuracy of the externally provided timing source if the data set is externally timed.

3.03 The remote test can determine the condition of a Data Set 207-type arranged as a terminal data set and can determine when a maintenance visit is necessary if a trouble report has been received.

3.04 In preparation for a remote test of the data set, the switches on the front of the data set must be positioned as follows:

MODEM LOOP TEST—OFF

BIT RATE—Per service order

LAMP TEST—OFF

TERMINAL—Per service order

SENSOR OUTPUT SWITCHES—AUTO.

3.05 Upon request of the operator of a 904-type DTC (arranged for Data Set 207-type), the data set is placed in the remote test mode by setting the MODEM LOOP TEST switch to the DIGITAL position. Alternately, if the data set is strapped for external control of DIGITAL LOOP TEST (DLT), the customer may condition the data set for the remote test by applying an ON voltage to the DLT interface lead. If a data test center is not available, proceed to Installation and Maintenance Tests.

3.06 During the remote test, the DTC may check the following:

(a) Data set performance at the speed determined by the BIT RATE switch

(b) Alarm operation and time interval of the delayed alarms RDTX, SDTX, and RSSD

(c) Operation of the compatible signal sensor

(d) Effectiveness of the transmitter and receiver synchronization recovery circuits

(e) Effectiveness of the external receiver timing circuit when the data set is externally timed

(f) Timing source accuracy for a data set that is self-timed or externally timed.

3.07 Data Sets 207-type may be supplied with one of three types of oscillators:

(a) 65A oscillator

(b) 69A oscillator

(c) 72A oscillator.

The 65A and 72A oscillators assure an outage holdover of six seconds. The 69A oscillator provides a 30-minute outage holdover.

3.08 If the terminator data set is equipped with the 69A oscillator, the oscillator must be calibrated at the time of installation and thereafter as follows:

(a) 30 days after installation

(b) 30 days plus six months after installation

(c) Annually thereafter.

3.09 If the terminator data set is equipped with the 65A or 72A oscillator, the oscillator must be calibrated at the time of installation and at least once every three years thereafter.

Note: The local oscillator shall be adjusted only when instructed to do so by the DTC operator. When the DTC requests adjustment of the oscillator, refer to the procedure in 3.10 and 3.11.

3.10 ***69A Oscillator:*** The oscillator is enclosed in a metal case and occupies slot locations D06 through D21. The adjusting potentiometer is accessible through an opening located at the left front of the oscillator case. The opening is covered by a rectangular metal plate which is held in place by four machine screws.

Note: The data set must have had power on continuously for at least one hour prior to the determination of the accuracy of the local oscillator frequency.

One revolution of the oscillator potentiometer screw varies the oscillator frequency by not more than 0.065 parts per million (PPM).

(a) To increase the oscillator frequency, turn the screw clockwise.

(b) To decrease the oscillator frequency, turn the screw counterclockwise.

Note: Only the DTC determines when the local 69A oscillator is in calibration.

3.11 ***65A or 72A Oscillator:*** The oscillator adjustment potentiometer is located at the top and to the front of the 65A or 72A oscillator. One revolution of the oscillator potentiometer screw varies the oscillator frequency by approximately 5.5 parts per million (PPM). The data set under test must have had power on for at least 15 minutes prior to the determination of frequency by the data test center. To increase the oscillator frequency, turn the screw clockwise. To lower the oscillator frequency, turn the screw counterclockwise.

3.12 Only the DTC determines when the local 65A, 69A, or 72A oscillator is in calibration.

3.13 If the remote test is successful, no further testing need be done. Restore the data set to normal operation and condition the switches as indicated on the service order. Complete the installation as instructed in the section entitled Data Set 207-Type, Transmitter-Receiver, Installation Instructions (592-020-200).

3.14 If the remote test is not successful and the data set under test is self-timed (207B2 or C2), restore the data set to normal operation and proceed to Installation and Maintenance Tests. If the data set under test is externally timed (207B1 or C1) and fails ***only*** the timing accuracy test, follow the procedure given in 3.15; otherwise, restore the data set to normal operation and proceed to Installation and Maintenance Tests.

3.15 This test is to be performed only if the data set is externally timed and has failed ***only*** the timing accuracy test.

(1) Take the data set out of the remote test mode by placing the MODEM LOOP TEST switch in the OFF position and/or applying an

OFF voltage to interface lead DLT if applicable. (See 3.05.)

(2) Request the DTC to repeat the timing accuracy test.

Note: For this test, the DTC-transmitted line signal and send data are arbitrary. The data set under test will transmit to the DTC the customer's send data with the transmitter of the data set under test being timed by the customer's accurate timing source. The customer must apply random data or repeated "1s" (steady mark) to the send data interface lead. Repeated "1s" are suitable only if the data set is strapped to scramble the send data (E2 to E3 on C21-AR161). The idle code is also suitable for this test.

3.16 If the second timing accuracy test *is* successful, the data set is in trouble. Restore the data set to normal operation and proceed to 4.01 of Installation and Maintenance Tests.

3.17 If the second timing accuracy test is ***not*** successful, the accuracy of the customer-provided timing should be suspected. Request that the customer check the accuracy of the timing source. If the accuracy of the external timing source meets requirements (not more than $\pm$0.058 PPM), the data set is in trouble. Restore the data set to normal operation and proceed to Installation and Maintenance Tests.

3.18 If the customer-provided timing source does not meet requirements, no further testing of the data set should be performed until the accuracy is corrected to be within $\pm$0.058 PPM.

4. TERMINAL EQUIPMENT TEST USING 901-, 902-, AND 903-TYPE DATA TEST SETS

4.01 The following tests are to be made when a DTC is not available or under conditions given in 3.13 through 3.17.

Note: This test cannot be used to perform a timing accuracy check. Disregard the ALARM lamp on the switch control panel, which may be illuminated or extinguished during any test, unless otherwise stated.

4.02 The equipment required to perform these tests is as follows:

1—901-type Data Test Set (DTS)

1—902-type Data Test Set

2—903-type Data Test Sets

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

1—1011-type handset

6—Clip leads with insulated alligator clips for connection to test points on data set printed wiring boards.

4.03 If the data set under test is a 207C-type, the front panel RFI shield and the rear power terminal access cover must be removed in accordance with the section entitled Data Set 207-Type, Transmitter-Receiver, Installation Instructions (592-020-200).

4.04 Always be aware of the following test equipment limitations:

(a) When voltage measurements are required in the following tests, the values given as normal do not include allowances for meter tolerances. If the KS-16979 test meter is used, the following tolerances should be added to all readings:

DC—$\pm$3 percent of full scale

AC—$\pm$4 percent of full scale.

(b) In the AC mode, the KS-16979 meter detects and indicates the average of the waveform being measured. The ac voltages given in the following tests are average; therefore, if a meter is used that indicates rms, all ac voltages given in the following tests should be multiplied by a factor of 1.11.

A. Installation and Maintenance Tests

Power Test

4.05 Measure the ac line voltage between terminals L1 and L2 on terminal block TB1 on the rear of the 32A1 power unit (or 32B1 if it is used)

with a KS-16979 test meter. The ac line voltage should be between 95 vac and 133 vac for 120-volt ac operation or between 186.5 vac and 228 vac for 230-volt ac operation.

Equipment Setup and Interface Test

4.06 The following preparation procedures include instructions for both preparing the data set for succeeding tests and conditioning selected control leads to provide the desired operation. The test procedures are written for use with 900-type Data Test Sets listed in 4.02. To provide data set conditioning with equipment different from 900-type Data Test Sets, the required condition of both control and data signal inputs for each test step is given. Regardless of the test equipment used, the data set under test may be conditioned as required with the following instructions. Control settings of the 900-type Data Test Sets are described in sequence.

4.07 Voltages applied to interface control leads through test jack J1 require a minimum of +3.5 to a maximum of +25 vdc for an ON voltage or a maximum of +2.2 to a minimum of −25 vdc for an OFF voltage.

4.08 Prepare the data set as follows:

(a) Remove ac power to the data set.

(b) Check that interface adapters A1 and A2 are inserted in their connectors on the rear of the data set. For Data Set 207C-type, the data access box cover must be removed before adapters A1 and A2 can be checked. Be sure that the cover is replaced after test requirements are complete.

(c) Check that terminal SG1 is strapped to terminal FG1 located below the switch panel on the data set. If not, inform the customer that safety precautions require that data set frame ground be connected to the signal ground system (FG1 to SG1).

(d) Carefully remove circuit board AR161 (strap circuit) from slot location C21 and condition the straps as follows: A2 to A3, B2 to B3, C2 to C3, E2 to E1, G2 to G3, J2 to J3, K2 to K1, M2 to M1, N2 to N3, and R2 to R3. The following terminals on the AR161 should be strapped as required by the service order: D, F, H, and P. Carefully reinsert circuit board AR161 in slot location C21.

(e) Straps on the following circuit boards should be made as required by a service order: B19-AR3, F01-AR5, C15-AR152, G03-AR159.

(f) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—1200

TERMINAL—RESTRICTED

LAMP TEST—OFF

REC CARRIER—ON

TRAN CARRIER—ON

RD TRANSITIONS—ON

SD TRANSITIONS—ON.

(g) Remove the plug from test jack J1.

(h) Apply power to the data set. If the 32A1 or 32B1 power unit is used, position the AC INPUT and the ±18 VDC circuit breakers to ON.

4.09 ***In the following tests, if the indication specified is not obtained, proceed to Trouble Location.***

4.10 Measure the −18 vdc and +18 vdc power to the data set by using the following procedure:

(a) Condition the KS-16979 test meter to measure 60 vdc full scale. Connect the negative test lead to the metal frame.

(b) Connect the positive test lead to TS7-3 (+18). The voltage should be 18 (±0.9) vdc. Disconnect both test leads.

(c) Connect the positive test lead to the metal frame.

(d) Connect the negative test lead to TS7-5 (−18). The voltage should be 18 (±0.9) vdc. Disconnect both test leads.

4.11 If the data set is equipped with the 69A oscillator (207B2 or C2), position the 18VAC circuit breaker to ON and measure the 18 vac power to the data set by using the following procedure. (If the data set is not equipped with a 69A oscillator, proceed to 4.12.)

(a) Condition the KS-16979 test meter to measure 60 vac full scale.

(b) Connect either meter test lead to TS7-1 (18AG) and the other test lead to TS7-2 (18AC). The voltage should be 16.2 (+3.0 −4.0) vac. Disconnect the meter test leads.

4.12 Momentarily set the LAMP TEST switch to the ON position. The lamp shall be illuminated while the switch is held in the ON position and shall extinguish when the switch is released.

4.13 Check the remote test logic with the following procedure:

(a) Disable the receive signal sensor by connecting a clip lead between TP9-E07 (CSD) and the metal frame. Place the REC CARRIER switch in the AUTO position.

(b) Disable the transmitter by connecting a clip lead between test point TP5-B19 (TL) and the metal frame.

(c) Clamp RD to the 11 code by connecting a clip lead between test point TP12-C07 (RD') and the metal frame.

(d) Cause relay K3 to operate and relay K1 to release by connecting a clip lead between test point TP13-C13 (DLT') and the metal frame.

(e) Condition the test meter to read 12 vdc full scale, and connect the negative test lead to the metal frame and the positive test lead to test point TP1-A03 (E128). The voltage should vary continuously between a value not less than 2.0 vdc and a value not greater than 4.0 vdc.

(f) Connect the positive test lead to test point TP9-G21 (EC4). The voltage should be 3.2 (±0.7) vdc.

(g) Connect the positive test lead to test point TP4-A01 (SD'3). The voltage shall be less than +0.25 vdc.

(h) Position the RD TRANSITIONS switch to AUTO. The voltage indication shall switch to 1.7 (±0.5) vdc approximately 3.0 seconds after the switch is operated.

(i) Position the TRAN CARRIER switch to AUTO. Position both the REC CARRIER and RD TRANSITIONS switches to ON. The voltage shall be +6.2 (±1.2) vdc.

(j) Position the TRAN CARRIER switch to ON. The voltage indication shall switch to +3.1 (±0.8) vdc.

(k) Position the REC CARRIER switch to AUTO. The voltage indication will switch immediately to +6.2 (±1.2) vdc and then, approximately 2.0 seconds after the switch is operated, the test meter indication shall switch to less than +0.5 vdc.

(l) Position the RD TRANSITIONS switch to AUTO. The test meter indication shall switch to +6.2 (±1.2) vdc approximately 3.0 seconds after the switch is operated.

(m) Position the SD TRANSITIONS switch to AUTO. The indication on the test meter shall switch to less than +0.5 vdc approximately 5.0 seconds after the switch is operated.

(n) Position the REC CARRIER switch to ON. Momentarily connect a clip lead between test point TP13-A03 and the metal frame. The test meter indication shall read 1.7 (±0.5) vdc.

(o) Remove all clip leads connected to test points and disconnect the test meter.

4.14 Prepare the data set for testing through the test jack as follows:

(a) Remove power from the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

REC CARRIER—AUTO

TRAN CARRIER—AUTO

RD TRANSITIONS—AUTO

SD TRANSITIONS—AUTO.

(c) Disable the transmitter by connecting a clip lead between test point TP5-B19 (TL) and the metal frame.

(d) On the C15-AR152 board, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12. This selects the ±6 volt data terminator and driver.

(e) On C21-AR161, strap E2 to E3.

4.15 Connect and prepare the 901B2 test set as follows:

(a) Position the SELECTOR switch to 3.

(b) Position both A TEST and B TEST switches on the 901B-type test set to OFF.

(c) Position the UNATT-ATT switch to ATT. This key is used to control the idle code (IC). With the key in the ATT position, an OFF indication is applied to the IC interface lead.

(d) Check that each EQ terminal is connected to the respective TST terminal on the test set cover, and then make the following changes on the test set cover:

(1) Open shorting clips 4 (TSSE), 11 (DLT), 14 (SCRE'), 18 (IC), 19 (RDTX), 20 (RSSE), and 23 (SCRB).

(2) Strap 9 (+18I) to TST 19, EQ 18 (IC) to TST 20, and EQ 19 (RDTX) to TST 18.

(e) Connect the 901B-type test set cord to the jack on the test set cover (interface adapter). Connect the test set cover cord to test jack J1 on the data set.

4.16 Apply power to the data set and check the ±18 vdc as follows:

(a) Condition the KS-16979 test meter to measure 60 vdc full scale. Connect the negative test lead to terminal A (on the 901B-type test set) and the positive test lead to terminal C (ground).

(b) Position B TEST switch to 1. The test meter should indicate 18 (±0.9) vdc.

(c) Disconnect both meter test leads and position the B TEST switch to 2.

(d) Connect the positive test lead to terminal A and the negative test lead to terminal C. The test meter should indicate 18 (±0.9) vdc.

(e) Disable the coherent detector by connecting a clip lead between test points TP3-C07 (CSD'1) and TP4-H19 (COGB').

4.17 Use the test meter to measure the dc and ac interface voltages listed in Table A. DC measurements are made between terminals A and C on the 901B-type test set. Terminal C is always at ground potential. Connect the negative test lead to terminal C. AC measurements are made between terminals B and C on the test set. For each lead tested, position the A TEST and B TEST switches as indicated in the table. The B TEST switch is used to apply the appropriate code to the SD lead. The A TEST switch connects the lead to be tested to terminal A and, through a capacitor, to terminal B on the test set.

4.18 Connect a clip lead between 9 (+18) and EQ 11 (DLT) on the test set cover. Relay K3 should operate and relay K1 should release. Relay contacts K3 and K1 should open interface driver leads TSS, RSS2, RD, and SCRA. Check that these leads are opened by using the following procedure:

(a) Condition the KS-16979 test meter to read 1 vac full scale.

(b) Position the B TEST switch to OFF.

(c) Connect one test meter lead to terminal A and the other lead to terminal C on the 901B-type test set. Measure the voltage for each position of the A TEST switch given in Table B. The voltage should be 0 vac at each position.

(d) Disconnect the test meter.

TABLE A

INTERFACE REQUIREMENTS

4.17	LEAD TESTED	SWITCH POSITION		SEND DATA CODE	ALARM LAMP	METER READING	
		A TEST	B TEST			DC (VDC)	AC (VAC)
a	SCA	23	5	10	ON	<0.5	5.8 (±0.5)
b	DTI	22	5	10	ON	<0.5	6.0 (±0.5)
c	SDTX	21	5	10	ON	6.2 (±0.5)	0
d	SDTX	21	3	00	ON	<0.25*	0
e	RD	20	3	00	ON	6.2 (±0.5)	0
f	SCRA	19	3	00	ON	<0.5	5.8 (±0.5)
g	RDTX	18	3	00	ON	<0.25	0
h	RSS2	17	3	00	ON	<0.25	0
i	TSS	1	3	00	ON	<0.25	Do not measure.
j	Remove clip lead between TP5-B19 (TL) and frame.						
k	TSS	1	3	00	ON	6.2 (±0.5)	Do not measure.
l	RSS2	17	3	00	ON	6.2 (±0.5)	0
m	Remove clip lead between TP4-H19 (COGB') and TP3-C07 (CSD'1).						
n	RSS2	17	3	00	ON	<0.25	0
o	RSS2	17	4	11	ON	6.2 (±0.5)	0
p	RD	20	4	11	ON	6.2 (±0.5)	0
q	RD	20	5	10	OFF	<0.5	6.0 (±0.5)
r	Switch UNATT-ATT key to UNATT.						
s	RD	20	5	IC	OFF	3.0 (±0.5)	4.6 (±0.5)
t	RDTX	18	5	IC	OFF	6.2 (±0.5)	0

* The voltage will switch to <0.25 approximately five seconds after the B TEST switch is set to 3.

TABLE B

REMOTE TEST

LEAD TESTED	A TEST POSITION
TSS	1
RSS2	17
SCRA	19
RD	20

(e) Remove the connection between 9 and EQ 11 on the test set cover.

4.19 Check the frequency of the receiver clock (SCRA) by using the following procedure:

(a) Position the A TEST switch on the 901B-type test set to 19 and the B TEST switch to 3.

(b) Connect a 1011-type handset between terminals B and C on the test set.

Caution: Keep handset away from ear.

(c) Rotate the BIT RATE switch to each of the following positions: 2400, 1200, 600, 300, and 150.

(d) In the 2400-bps mode, a 2400-Hz tone should be heard.
In the 1200-bps mode, a 1200-Hz tone should be heard.
In the 600-bps mode, a 600-Hz tone should be heard.
In the 300-bps mode, a 300-Hz tone should be heard.
In the 150-bps mode, a 150-Hz tone should be heard.

4.20 Check the frequency of the uncorrected receiver clock (SCA) by using the following procedure:

(a) Position the A TEST switch on the 901B-type test set to 23 and the B TEST switch to 3.

(b) Repeat 4.19 (b) and 4.19 (c).

(c) If the data set is internally timed (207B2 or C2), then the results given in 3.19 (d) should be obtained.

(d) If the data set is externally timed (207B1 or C1), each position of the BIT RATE switch should produce a tone at a frequency equal to that of the externally provided timing source.

(e) Position the BIT RATE switch to 1200 and disconnect the handset from the 901B-type test set.

4.21 Test the effectiveness of the transmitter timing, receiver timing, and external receiver timing circuits as follows:

(a) Position the UNATT-ATT key to ATT.

(b) Open shorting clip 24 (SCTE) and connect 10 (−18I) to EQ 24 (SCTE) on the test set cover. This disconnects SCA from SCTE and applies −18.0 vdc to SCTE.

(c) Connect a clip lead between test point TP7-C19 (SCRE') and the metal frame. This inhibits corrections to the external receiver timing chain due to the external timing source if it is provided.

(d) Position the A TEST switch on the 901B-type test set to 22 and the B TEST switch to 3. This connects DTI to terminal A and applies the 00 code to the SD lead.

(e) Condition the KS-16979 test meter to measure 15 vac full scale. Connect one meter test lead to terminal A and the other test lead to the red RECEIVE CLOCK terminal on the 901B-type test set.

(f) The voltage indicated on the meter should be a constant between 0 and 13 vac.

(g) Connect a clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32) on the data set. This causes a delete correction to be made to the transmitter timing chain at every 64-dibit interval.

(h) The indication on the meter should continuously vary between a voltage less than 4.0 vac and a voltage greater than 10.0 vac.

(i) Position the B TEST switch to 4. This applies the 11 code to the SD lead. The test meter indication should remain constant and be less than 3.0 vac.

(j) Position the B TEST switch to 3 on the 901B-type test set. The indication on the meter should vary continuously between a voltage less than 4.0 vac and a voltage greater than 10.0 vac.

(k) Connect a clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C) on the data set. This allows the external receiver clock to frequency lock to the transmitter clock. The voltage indicated on the test meter should be a constant between 0 and 13 vac.

(l) Remove the clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C) on the data set.

(m) Remove the clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32). Connect a clip lead between test points TP12-A03 (E32'G) and TP11-B01 (TAR) on the data set. This causes an add correction to be made to the transmitter timing chain at every 64-dibit interval.

(n) Repeat 4.20 (h).

(o) Repeat 4.20 (i).

(p) Repeat 4.20 (j).

(q) Repeat 4.20 (k).

(r) Remove all clip leads connected to test points on the data set. Remove the connection between 10 (−18I) and EQ 24 (SCTE), and replace shorting clip 24 on the test set cover.

Back-to-Back Test

4.22 Perform a back-to-back test by using the following procedure:

(a) Remove power to the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) Condition data set strapping options as follows:

(1) On C21-AR161, strap 2 to 3 on each option.

(2) On C15-AR152, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12.

(d) Arrange the 901B-type, 902B, and two 903B test sets to provide random data at 2400 bps. Condition the equipment as follows:

●901B-type test set

SELECTOR switch to 3

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT key to ATT

Test set cover—Open shorting clip 23 (SCRB). Connect the test set cover to the data set test jack J1. Plug the 901B-type cord into the test cover connector.

●902B test set

BIT RATE to EXT SYNC

SELECTOR switch to DIST MEAS

TRIGGER to − (minus).

●903B test sets (both No. 1 and No. 2)

BIT RATE to EXT CLOCK

RANDOM-DOT to RANDOM

TRIGGER to + (plus)

POWER to OFF.

Note: For the following connections, mate red to red and black to black.

(e) Connect the SIGNAL OUT terminals of the No. 1 903B test set to the TRANSMIT DATA terminals on the 901B-type test set.

(f) Connect the EXT CLOCK terminals of the No. 1 903B test set to the TRANSMIT CLOCK terminals on the 901B-type test set.

(g) Connect the DATA IN terminals of the 902B test set to the RECEIVE DATA terminals on the 901B-type test set.

(h) Connect the EXT SYNC terminals on the 902B test set to the RECEIVE CLOCK terminals on the 901B-type test set.

(i) Connect the No. 2 903B test set to the 902B test set with the provided connector cord.

(j) Connect both 903B test set power cords to the ac voltage supply and turn each POWER switch to ON.

(k) Apply power to the data set and perform the back-to-back test by using the following sequence of operations.

(l) Momentarily press the START switch on both No. 1 and No. 2 903B test sets.

(m) Momentarily press the WORD SYNC & RESET switch on the 902B test set.

(n) The TOTAL ERRORS lamps on the 902B test set will indicate errors as they occur. To obtain total errors, add the values indicated by all illuminated lamps. The bottom lamp will be illuminated when the error capacity of the counter has been exceeded and the indicated count is erroneous.

(o) To be sure that the 902B test set is counting errors, momentarily press the START switch of the No. 2 903B test set. The 902B test set will illuminate the bottom lamp which indicates maximum errors.

(p) Momentarily press the WORD SYNC & RESET switch on the 902B test set. Allow the test to continue for five minutes. No errors should be recorded. If an error count is indicated, replace the data set. If the test is satisfactory, disconnect test equipment and remove power. Restore options in the data set as required by the service order before releasing for normal operation.

B. End-to-End Test

4.23 If possible, it is desirable to make an end-to-end test with a distant data station. This test is similar to the back-to-back test except that transmission between data set stations is tested in both directions simultaneously. Identical test equipment must be used at both stations. At the local station, a 903B test set provides signals through a 901B-type test set and cover to drive the data set. The signals are transmitted to the distant station data set through a 901B-type test set and cover to a connected 902B test set. Both local and distant stations have a second 903B test set which generates a comparison signal and connects into the 902B test set. The 902B test set can synchronize the two signals and count the number of errors in the received data. The following test set arrangement allows simultaneous checking of data set transmission and reception.

4.24 Condition the data set at both local and distant stations as follows:

(a) Remove power to the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—OFF

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) Condition data set strapping options as indicated in 4.08 (d) and 4.08 (e) except strap E2 to E3 on C21-AR161.

4.25 Arrange the 901B-type, 902B, and two 903B test sets at both local and distant stations as follows:

●901B-type test set

SELECTOR switch to 3

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT switch to ATT

Test set cover—Same as for back-to-back test. [See 4.22 (d).]

●902B test set

BIT RATE to EXT SYNC

SELECTOR switch to DIST MEAS

TRIGGER to – (minus).

●903B test set (both sets at both stations)

BIT RATE to EXT CLOCK

RANDOM-DOT to RANDOM

TRIGGER to + (plus)

POWER to OFF.

Note: For the following connections, mate red to red and black to black.

(a) Connect the SIGNAL OUT terminals of the No. 1 903B test set to the TRANSMIT DATA terminals on the 901B-type test set.

(b) Connect the EXT CLOCK terminals of the No. 1 903B test set to the TRANSMIT CLOCK terminals on the 901B-type test set.

(c) Connect the DATA IN terminals of the 902B test set to the RECEIVE DATA terminals on the 901B-type test set.

(d) Connect the EXT SYNC terminals on the 902B test set to the RECEIVE CLOCK terminals on the 901B-type test set.

(e) Connect the No. 2 903B test set to the 902B test set with the provided connector cord.

(f) Connect the 901B-type test set to the interface adapter (on the 901B-type test set cover).

(g) At each station, connect both 903B test set power cords to the ac voltage and position both POWER switch controls to ON.

(h) Apply power to both data sets.

4.26 Perform the end-to-end test by using the following sequence of operations. If possible, both local and distant stations should perform steps (a), (b), and (c) simultaneously.

(a) Momentarily press the START switch on the No. 1 903B test set.

(b) Momentarily press the START switch on the No. 2 903B test set.

(c) Momentarily press the WORD SYNC & RESET switch on the 902B test set.

(d) The TOTAL ERRORS lamps on the 902B test set will indicate errors as they occur. To obtain total errors, add the values indicated by all illuminated lamps. The bottom lamp will be illuminated when the error capacity of the counter has been exceeded and the indicated count is erroneous.

(e) To be sure that the 902B test set is counting errors, momentarily press the START switch on the No. 2 903B test set. The 902B test set will illuminate the bottom lamp which indicates maximum errors.

(f) Momentarily press the WORD SYNC & RESET switch on the 902B test set. Allow the test to continue for five minutes, note the indicated error count, and press the WORD SYNC & RESET switch again. Operate this test for three consecutive 5-minute intervals. The error rate can be considered average if a total of 20 errors is recorded for the three test periods. If the error count approaches 100 for three test periods, the transmission parameters of the line should be checked in accordance with the section entitled Private Line Data Circuit, Voice Bandwidth Circuits for Miscellaneous Data, Overall Tests and Requirements (314-410-500). If the line requirements are not met, refer to the Plant Staff through lines of organization. If the above tests are satisfactory, remove power to the data set and disconnect test set ac power cords.

(g) Remove test equipment connections and restore original options in the data set as required by the service order before releasing for normal operation.

C. Trouble Location

4.27 This section is provided to indicate the following:

(a) Which printed circuit boards or apparatus should be replaced to clear a trouble condition

(b) Which readily performed maintenance procedures, if any, should be employed to clear a trouble condition. A trouble condition in the context of this section is defined to be a failure to obtain the required test results during the performance of installation and maintenance tests.

4.28 The procedure for clearing trouble is as follows:

(a) Find the number in 4.29 which corresponds to the paragraph of the Installation and Maintenance Tests for which the required test results are not obtained.

(b) The code and equipment location of the circuit boards or the apparatus that provides the

function under test is listed under the appropriate paragraph number. When applicable, maintenance procedures referred to in 4.27 (b) are also listed.

(c) If the circuit board equipment locations are entered in Table C, use the KS-16979 test meter to check for the proper dc voltage on the indicated test points. If the required indication provided is not obtained, replace the board and repeat the test that failed originally. If applicable, perform indicated maintenance procedures and repeat the test which failed originally.

Caution: Always be careful when removing, inserting, or handling the printed wiring boards. NEVER remove or insert a printed wiring board unless power is removed from the data set or the power unit (except for AR161 in location C21 which may be removed and inserted without removing power to the data set). Replace clip leads on test points when circuit boards are replaced. Replacement boards containing strapping options should be strapped the same as the original boards.

(d) When a replacement board or a maintenance procedure apparently corrects a trouble, retest the data set by either starting at 4.08 of the Installation and Maintenance Tests or by repeating the REMOTE TEST OF TERMINAL EQUIPMENT to be sure a new or different failure has not developed. Always tag the suspected board so that it may be identified and returned for repair.

(e) If the correct dc voltage is obtained in (c), replace the first board listed with one known to be good. Keep the original board separate and apart from other test boards.

(f) Repeat the original test.

(g) If the test still fails, replace the original board into the original location and repeat (e) and (f) for the next board listed.

(h) If the trouble cannot be cleared by replacing the listed circuit boards or by performing maintenance procedures, replace the data set.

4.29 The following list provides correlation between the Installation and Maintenance Tests and the printed circuit boards and/or apparatus which provide the function under test. When applicable, maintenance procedures are also listed.

4.10 (b)—CP1-AR215 of the 32A1 power unit (or 32B1, if it is used). Replace the power unit if the trouble cannot be cleared.

4.10 (d)—CP2-AR216 of the 32A1 power unit (or 32B1, if it is used). Replace the power unit if the trouble cannot be cleared.

4.11 (b)—Replace the power unit.

4.12—Replace the lamp; CU1-G01.

4.13 (d)—G03-AR159, C07-AR9, C13-AR158

4.13 (e)—A03-AR10, B01-AR10, A15-AR4, B13-AR10, B09-AR10, B07-AR9, B05-AR10, B03-AR9, C09-AR10, C07-AR9, D01-AR147 (if provided), D03-AR147 (if provided), D06-69A OSC, or AR160

4.13 (f)—G21-AR10, G15-AR10, G19-AR10, G17-AR9

4.13 (g)—C07-AR9, A01-AR9, A07-AR9, G17-AR9, C13-AR158, A07-AR9, A05-AR9, A03-AR10, A09-AR9, A11-AR10, A13-AR10, A15-AR4, C11-AR158, C07-AR9, G03-AR159

4.13 (h)—Same as 4.13 (g)

4.13 (i)—A01-AR9, C07-AR9, C11-AR158, A09-AR9, A11-AR10, A07-AR9, H07-AR151, H05-AR169, A05-AR9, A03-AR10

4.13 (j)—Same as 4.13 (i) and G03-AR159

4.13 (k)—A01-AR9, C07-AR9, A05-AR9, A07-AR9, C13-AR158, A09-AR9, A15-AR4

4.13 (l)—A13-AR10 and A09-AR9

4.13 (m)—A05-AR9, A11-AR10, A15-AR4

4.13 (n)—A07-AR9, A03-AR10, A05-AR9, A15-AR4, C11-AR158

4.16 (b)—G03-AR159

4.16 (d)—G03-AR159

4.17 (a)—C19-AR148, B07-AR9, B17-AR9, C21-AR161 (Visually check C21-AR161 for required

TABLE C

DC VOLTAGE READINGS

VOLTAGE	TEST POINT	EQUIPMENT LOCATIONS							
		A	B	C	D	E	F	G	H
+2.3 (±0.3)	1				01				
↓	1				03				
+4.7 (±0.5)	12			15					
+6.2 (±0.6)	8	01	01	03		01	15	15	
↓	8	03	03	05		03	17	17	
	8	05	05	07		05	19	19	
	8	07	07	09		07		21	
	8	09	09	11		09			
	8	11	11	13		11			
	8	13	13			13			
	8	15	15			15			
	8		17			17			
	8					19			
	8					21			
	11								05
	2			15					
	3			17	01				
	3			19	03				
	14						01		
	6						07		
	6						11		
↓	5							03	
+8.2 (±0.8)	1		19						
↓	5				06				
	12								05
+12.0 (±1.5)	1							07	07
↓	3								09
	8								15
	8								17
↓	11							01	
−6.2 (±0.6)	5			15					
↓	6			17					
	6			19					
−8.2 (±0.8)	3						07		
↓	3						11		
−12.0 (±1.5)	7								15
↓	10						05		
	11							03	07
	11							07	
	12								19
↓	14								09

straps and arrange if necessary.) If the data set is conditioned for external timing, observe that terminals D1 to D2 on C21 are strapped. Perform the following test to ensure that the customer is providing timing on interface lead SCRE'.

(1) Connect the negative test meter lead to the metal frame on the data set and the positive lead to test point TP8-C17.

(2) Condition the meter to read 15 vdc full scale. The voltage should measure less than 0.5 vdc.

(3) Condition the meter to read 15 vac full scale. The voltage should be 6.2 ($\pm$2.0) vac.

4.17 (b)—C19-AR148, G03-AR159, A05-AR9

4.17 (c)—C13-AR158, A11-AR10, A09-AR9, G03-AR159, A15-AR4, C07-AR9, C15-AR152

4.17 (d)—Same as 4.17 (c)

4.17 (e)—C15-AR152, C07-AR9, C21-AR161, A07-AR9, E07-AR10, H19-AR162, H07-AR151, H09-AR168, H15-AR153, B07-AR9, B19-AR3

4.17 (f)—C17-AR148, C21-AR161 (Check for required strapping before replacing.), C09-AR10, E03-AR10, E01-AR10, E07-AR10, E05-AR9, F19-AR9, E13-AR9, G17-AR9

4.17 (g)—C13-AR158, A13-AR10, A09-AR9, A07-AR9, A15-AR4

4.17 (h)—C11-AR158, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, F17-AR9, F01-AR5, F05-AR6

4.17 (i)—C11-AR158, H05-AR169, H07-AR151, G03-AR159, B19-AR3

4.17 (k)—Same as 4.17 (i)

4.17 (l)—C11-AR158, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, B07-AR9, F17-AR9, F01-AR5, F05-AR6, G01-CU1 (should be conditioned for terminator operation), G03-AR159, B15-AR10, B13-AR10, B11-AR9, B07-AR9, B17-AR9, A01-AR9, C05-AR149, C03-AR9, F15-AR4

4.17 (n)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E05-AR9, B15-AR10, B07-AR9, B17-AR9, B15-AR10, B13-AR10, B11-AR9, A01-AR9

4.17 (o)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E17-AR9, E13-AR9, E15-AR10, E11-AR9, E09-AR10, E05-AR9, E03-AR10, F17-AR9, F15-AR4, F07-AR1, F11-AR1, F01-AR5, F05-AR6, B19-AR3, B15-AR10, B17-AR9, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

4.17 (p)—C15-AR152, C07-AR9, C05-AR149, C03-AR9, C09-AR10, C07-AR9, F19-AR9, B17-AR9, F17-AR9, F15-AR4, E03-AR10, E05-AR9, E07-AR10, B19-AR3, B15-AR10, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

4.17 (q)—Same as 4.17 (p)

4.17 (s)—H19-AR162, H09-AR168, A01-AR9, C13-AR158, C21-AR161 (Check for required strapping before replacing.)

4.17 (t)—C13-AR158, A13-AR10, A09-AR9, A07-AR9, A15-AR4

4.18—G03-AR159, C07-AR9, C13-AR158

4.18 (c)—Visually inspect relays K3 and K1 for bent springs, contacts, etc.

4.19 (d)—C21-AR161 (Check for required strapping before replacing.)

4.20 (c)—Same as 4.17 (a)

4.20 (d)—Same as 4.17 (a)

4.21 (f)—B03-AR9, B01-AR10, B07-AR9, B09-AR10, B05-AR10, E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9, F17-AR9, F15-AR4, G21-AR10, G19-AR10, G17-AR9, G15-AR10

4.21 (h)—F15-AR4, B01-AR10, B03-AR9, B07-AR9, B11-AR9, B13-AR10

4.21 (i)—E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9

4.21 (j)—Same as 4.21 (i)

4.21 (k)—G21-AR10, G19-AR10, G17-AR9, G15-AR10, F17-AR9, F15-AR4

4.21 (n)—Same as 4.21 (h)

4.21 (o)—Same as 4.21 (i)

4.21 (p)—Same as 4.21 (j)

4.21 (q)—Same as 4.21 (k)

4.21 (r)—Replace the data set.

5. TERMINAL EQUIPMENT TEST USING 914B DATA TEST SET

5.01 In this series of tests, the 914B DTS is used to check the clock, control, and data signals of the data set. The following tests are to be made at the time of installation and may be used for clearing routine trouble conditions. The tests are divided into the following parts:

- Installation and maintenance tests
- End-to-end test.

5.02 The following test equipment is required to perform these tests:

1—914B Data Test Set

1—903-type Data Test Set

1—KS-16979 Volt-ohm-milliammeter (VOM) or equivalent

6—Clip leads with insulated alligator clips for connections to test points on data set printed wiring boards.

5.03 The tests are divided in two parts. The first part is for testing a data set arranged as terminal equipment. The second part is for testing a data set in the regenerative arrangement. Do only the test which is applicable to the data station equipment. Read Part 2 (CAUTIONS) before proceeding with the test.

A. Installation and Maintenance Tests

5.04 The following tests are to be made when a DTC is not available or under conditions given in 3.13 through 3.17.

> ***Note:*** This test cannot be used to perfrom a timing accuracy check. Disregard the ALARM lamp on the switch control panel which may be illuminated or extinguished during any test unless otherwise stated.

5.05 If the data set under test is a 207C-type, the front panel RFI shield and the rear power terminal access cover must be removed in accordance with the section entitled Data Set 207-Type, Transmitter-Receiver, Installation Instructions (592-020-200).

5.06 The following preparation procedures include instructions for preparing the data set for succeeding tests and for conditioning selected control leads to provide the desired operation. Control settings of the 914B DTS are described in sequence

5.07 Voltages applied to interface control leads through test jack J1 require a minimum of +3.5 to a maximum of +25 vdc for an ON voltage or a maximum of +2.2 to a minimum of −25 vdc for an OFF voltage.

5.08 Prepare the data set as follows:

(a) Disconnect the power from the data set.

(b) Check that the interface adapters A1 and A2 are inserted in their connectors on the rear of the data set. For Data Set 207C-type, the data access box cover must be removed before adapters A1 and A2 can be checked. Be sure that the cover is replaced after test requirements are complete.

(c) Check that terminal SG1 is strapped to terminal FG1 located below the switch panel on the data set. If not, inform the customer that safety precautions require that data set frame ground be connected to the signal ground system (FG1 to SG1).

(d) Carefully remove circuit board AR161 (strap circuit) from slot location C21 and condition the straps as follows: A2 to A3, B2 to B3, C2 to C3, E1 to E2, G2 to G3, J2 to J3, K1 to K2,

M1 to M2, N2 to N3, and R2 to R3. Terminals D, F, H, and P should be strapped as required by the service order. Carefully reinsert circuit board AR161 in slot location C21.

(e) Strap connections on the following circuit boards should be made as required by a service order: B19-AR3, F01-AR5, C15-AR152, G03-AR159.

(f) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—1200

TERMINAL—RESTRICTED

LAMP TEST—OFF

REC CARRIER—ON

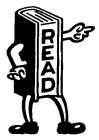
TRAN CARRIER—ON

RD TRANSITIONS—ON

SD TRANSITIONS—ON.

(g) Disconnect the cord and plug from test jack J1.

(h) Apply power to the data set. If the 32A1 or 32B1 power unit is used, position the AC INPUT and the ±18 vdc circuit breakers to ON.



In the following tests, if the indication specified is not obtained, proceed to Trouble Location.

Power Test

5.09 Measure the power supply voltages appearing on TS7 as follows:

(a) On the 914B DTS, set the FUNCTION switch to VOLT/OHM EXT. Set the RANGE switch to DCV-30 and the POLARITY switch to NOR.

(b) Using the input leads supplied with the 914B DTS, connect the negative input terminal (block) to the metal frame.

(c) Connect the positive (red) terminal to TS7-3 (+18). Measure the positive power supply voltage.

Requirement: +18 (±0.9) volts dc

(d) Disconnect the positive lead and move the POLARITY switch to REV.

(e) Connect the positive test lead to TS7-5. Measure the negative power supply voltage.

Requirement: −18.0 (±0.9) volts dc

(f) Disconnect the meter leads. If the data set is equipped with the 69A oscillator (207B2 or 207C2), position the 18VAC circuit breaker to ON. If the data set is not equipped with the 69A oscillator, proceed to 5.10.

(g) Condition the VOM to measure 150 volts ac.

(h) Connect either meter test lead to TS7-1 (18AG) and the other test lead to TS7-2 (18AC). Measure the ac power supply voltage.

Requirement: 16.2 (+3.0 −4.0) volts ac

(i) Disconnect both meter test leads from TS-7.

5.10 Momentarily set the LAMP TEST switch to the ON position. The lamp shall be illuminated while the switch is in the ON position and shall extinguish when the switch is released.

Equipment Setup and Interface Test

5.11 Check the data set remote test logic by using the following procedure:

(a) Disconnect power from the data set. Disable the receive signal sensor by connecting a clip lead between TP9-E07 (CSD) and the metal frame. Place the REC CARRIER switch in the AUTO position.

(b) Disable the transmitter by connecting a clip lead between test point TP5-B19 (TL) and the metal frame.

(c) Clamp RD to the 11 code by connecting a clip lead between test point TP12-C07 (RD') and the metal frame.

(d) Set up the 914B DTS to measure dc volts by placing the RANGE switch to DCV-10 and placing the FUNCTION switch to VOLT/OHM EXT. The POLARITY switch should be set to NOR.

(e) Cause relay K3 to operate and relay K1 to release by connecting a clip lead between test point TP13-C13 (DLT') and the metal frame.

(f) Using the leads supplied with the 914B DTS, connect the negative test lead to the data set frame and connect the positive test lead to test point TP1-A03 (E128). Apply power to the data set. The voltage should vary continuously between a value not less than +2.0 volts and a value not greater than +4.0 volts.

Note: The 914B DTS does not need to be connected to ac power.

(g) Connect the positive test lead to test point TP9-G21 (EC4). The voltage should be +3.2 (±0.7) volts.

(h) On the 914B DTS, move the RANGE switch to DCV-3.

(i) Move the positive test lead to test point TP4-A01 (SD'3). The voltage shall be less than +0.25 volts.

(j) Maintain the connection specified in (i) and move the RD TRANSITIONS switch to AUTO. The voltage indication shall switch to +1.7 (±0.5) volts approximately 3.0 seconds after the switch is operated.

(k) On the 914B DTS, move the RANGE switch to DCV-10.

(l) Position the TRAN CARRIER switch to AUTO. Position both the REC CARRIER and RD TRANSITIONS switches to ON. The voltage reading shall be +6.2 (±1.2) volts.

(m) Move the TRAN CARRIER switch to ON. The voltage indication shall switch to +3.1 (±0.8) volts.

(n) Position the REC CARRIER switch to AUTO. The voltage indication will switch immediately to +6.2 (±1.2) volts and then approximately 2 seconds after the switch is operated, the voltage indication shall switch to less than +0.5 volts.

(o) Position the RD TRANSITIONS switch to AUTO. The voltage indication shall switch to +6.2 (±1.2) volts approximately 3.0 seconds after the switch is operated.

(p) Position the SD TRANSITIONS switch to AUTO. The voltage indication shall switch to less than +0.5 volt approximately 5 seconds after the switch is operated.

(q) Position the REC CARRIER switch to ON. Momentarily connect a clip lead between test point TP13-A03 and the metal frame. The voltage indication shall be +1.7 (±0.5) volts.

(r) Remove all clip leads connected to test points, disconnect the meter, and move the FUNCTION switch to OFF.

5.12 The following is a test of interface leads which appear on the test jack J1. The equipment is set up and the test is conducted as follows:

(a) Disconnect power from the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

REC CARRIER—AUTO

TRAN CARRIER—AUTO

RD TRANSITIONS—AUTO

SD TRANSITIONS—AUTO.

(c) Disable the transmitter by connecting a clip lead between test point TP5-B19 (TL) and the metal frame.

(d) On the C16-AR152 board, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12. This selects the ±6 volt data terminator and driver.

(e) On the C21-AR161 board, strap E2 to E3.

(f) Connect the Data Set 207 test jack (J1) to connector A on the 914B DTS.

(g) Condition the 914B DTS by inserting matrix pins and setting switches as shown on Fig. 1.

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

(i) Move the FUNCTION switch to VOLTS INT. Measure the negative power supply voltage.

Requirement: −18 (±0.9) volts

(j) Move the FUNCTION switch to OFF. Move the VERTICAL MONITOR switch to 9 and move the POLARITY switch to NOR.

(k) Move the FUNCTION switch to VOLTS INT and measure the positive power supply voltage.

Requirement: +18 (±0.9) volts

(l) Disable the coherent detector by connecting a clip lead between test points TP3-C07 (CSD'1) and TP4-H19 (COGB').

5.13 Use the voltmeter on the 914B DTS to measure dc voltages as shown in Table D. The VERTICAL MONITOR switch is placed as indicated in the table. To measure dc voltages less than 10 volts, move the RANGE switch to DCV-10. To measure voltages less than 1 volt, move the RANGE switch to DCV-1. The DS lamp ON indication for Steps a, b, d, h, and u verifies the presence of ac voltage on the lead being tested. For other steps, disregard the condition of the DS lamps.

5.14 On the 914B DTS, move switch S5 to ON. Relay K3 should operate and relay K1 should release. Relay contacts K3 and K1 should open interface driver leads TSS, RSS2, RD, and SCRA. Check that these leads are opened by using the following procedure:

(a) Move the FUNCTION switch to VOLT/OHM EXT. Move the RANGE switch to ACV-1.

(b) Using the meter leads provided with the 914B DTS, measure for ac voltage between the following leads and ground: 3, 6, 8, and 17. No ac voltage should be present on these leads.

(c) Move the FUNCTION switch to OFF. Move switch S5 to OFF.

5.15 Check the frequency of the receiver clock (SCRA) by using the following procedure:

(a) On the 914B DTS, move the VERTICAL MONITOR switch to 7 and move the FUNCTION switch to SPKR.

(b) Move the RANGE switch to db-0 and move the matrix pin from 2-SD to 2-S1. Switch S1 must be in the OFF position.

(c) Connect the meter input leads between interface selector switch 17 and ground.

(d) On the Data Set 207, rotate the BIT RATE switch to each of the following positions: 2400, 1200, 600, 300, and 150.

(e) In the 2400-bps mode, a 2400-Hz tone should be heard.
In the 1200-bps mode, a 1200-Hz tone should be heard.
In the 600-bps mode, a 600-Hz tone should be heard.
In the 300-bps mode, a 300-Hz tone should be heard.
In the 150-bps mode, a 150-Hz tone should be heard.

5.16 Check the frequency of the uncorrected receiver clock (SCA) by using the following procedure:

(a) Connect the meter input leads between interface selector switch 15 and ground.

(b) On the Data Set 207, rotate the BIT RATE switch to each of the following positions: 2400, 1200, 600, 300, and 150.

(c) If the data set is internally timed (207B2 or 207C2), then the results given in 5.15 (e) should be obtained.

(d) If the data set is externally timed (207B1 or 207C1), each position of the BIT RATE switch should produce a tone at the frequency of the externally provided timing source.

(e) Move the FUNCTION switch to OFF and disconnect the input leads.

5.17 Test the effectiveness of the transmitter timing, receiver timing, and external receiving timing circuits as follows:

(a) Move the matrix pin from 2-SD to 2-S1. Switch S1 should be OFF, S2 ON, S3 OFF, S4 OFF, S5 OFF, and S6 OFF. Place matrix pin in 24-S6.

(b) Connect a clip lead between test point TP7-C19 (SCRE') and the metal frame. This inhibits corrections to the external receiver timing chain due to the external timing source if it is provided.

(c) Condition the KS-16979 test meter to measure 15 volts ac full scale. Connect one meter lead to interface selector switch 16 (DTI) and the other lead to interface selector switch 17 (SCRA).

(d) The voltage indicated on the meter should be a constant between 0 and 13 volts ac.

(e) Connect a clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32) on the data set. This causes a delete correction to be made to the transmitter timing chain at every 64-dibit interval.

(f) The indication on the meter should continuously vary between a voltage less than 4.0 volts ac and a voltage greater than 10.0 volts ac.

(g) Move switch S1 to ON. This applies the 11 code to the SD lead. The test meter indication should remain constant and be less than 3.0 volts ac.

(h) Move switch S1 to OFF. The indication on the meter should vary continuously between a voltage less than 4.0 volts ac and a voltage greater than 10.0 volts ac.

(i) On the Data Set 207, connect a clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C). This allows the external receiver clock to frequency lock to the transmitter clock.

(j) The voltage indicated on the test meter should be a constant between 0 and 13 volts ac.

(k) Remove the clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C) on the data set.

(l) Remove the clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32). Connect a clip lead between test points TP12-A03 (E32'G) and TP11-B01 (TAR) on the data set. This causes an add correction to be made to the transmitter timing chain at every 64-dibit interval.

(m) The indication on the meter should continuously vary between a voltage less than 4.0 volts ac and a voltage greater than 10.0 volts ac.

(n) Move switch S1 to ON. The test meter indication should remain constant and be less than 3.0 volts ac.

(o) Move switch S1 to OFF. The indication on the meter should vary continuously between a voltage less than 4.0 volts ac and a voltage greater than 10.0 volts ac.

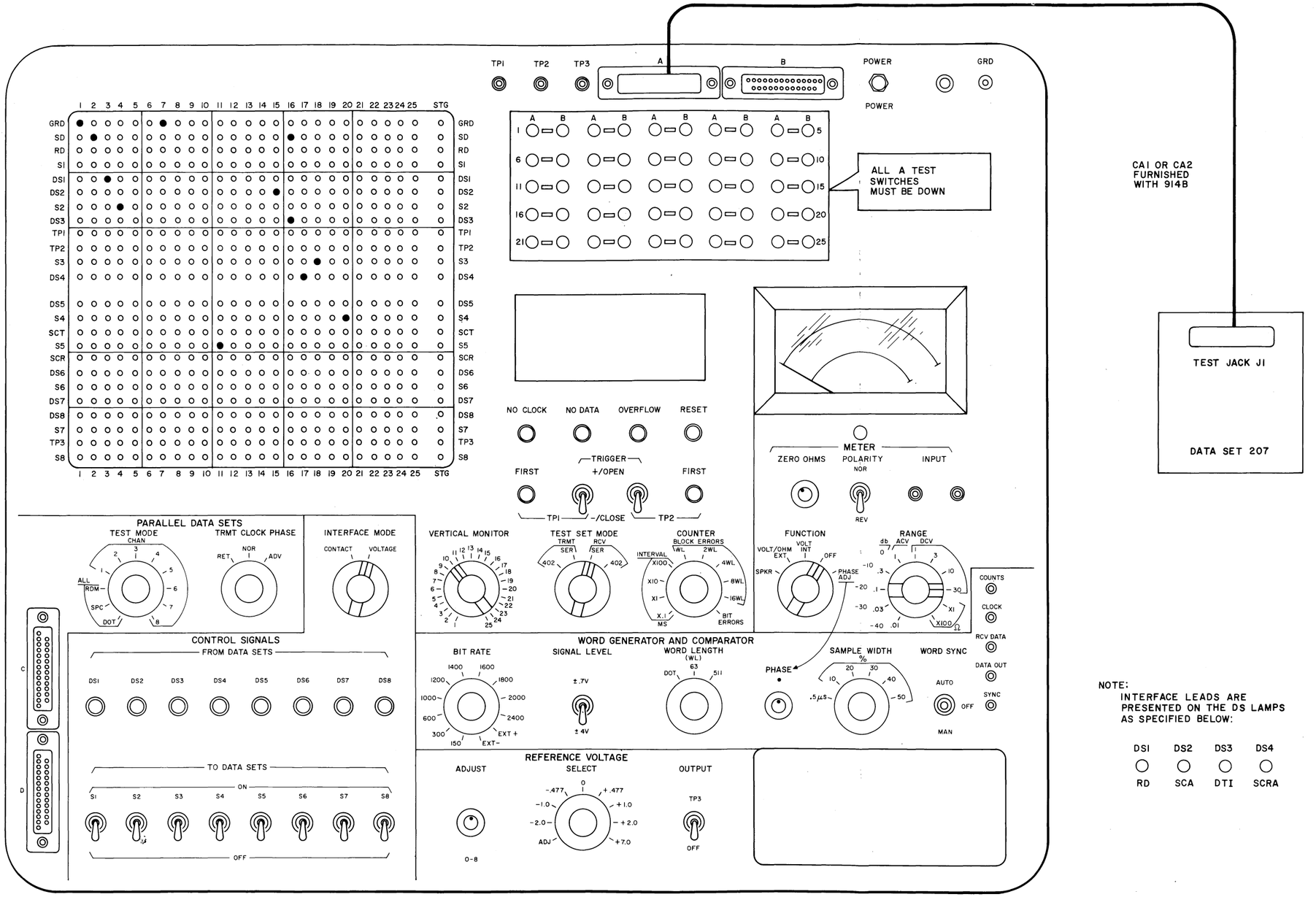
(p) Connect a clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C) on the data set. The voltage indicated on the meter should be a constant between 0 and 13 volts ac.

(q) Remove all clip leads connected to test points on the data set. Remove the matrix pins from the 914B DTS and disconnect the test meter from the 914B DTS.

Back-to-Back Test

5.18 In this test, the data set transmitter is being driven by the 903 DTS. This signal is fed to the transmitter and then is looped back locally into the receiver. The received data is fed to the 914B DTS where it is compared with a signal generated by the 914B DTS. Any errors in received data are counted on the counter of the 914B DTS. The equipment is set up and the test is performed as follows:

(a) Remove power to the data set.



CA1 OR CA2 FURNISHED WITH 914B

TEST JACK J1

DATA SET 207

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

DS1	DS2	DS3	DS4
RD	SCA	DTI	SCRA

Fig. 1—Interface Test of Terminator Data Set

TABLE D

INTERFACE REQUIREMENTS

3.58 STEP	LEAD TESTED	VERTICAL MONITOR SWITCH	METER READING DC VOLTS	DS LAMP ON	SEND DATA CODE	ALARM LAMP
a	SCA	15	<0.5	DS2	10	ON
b	DTI	16	<0.5	DS3	10	ON
c	SDTX	5	+6.2 (±0.5)	—	10	ON
d	RD	3	<0.5	DS1	10	OFF
e	Move matrix pin from 2-SD to 2-S1.					
f	SDTX	5	<0.25*	—	00	ON
g	RD	3	+6.2 (±0.5)	—	00	ON
h	SCRA	17	<0.5	DS4	00	ON
i	RDTX	19	<0.25	—	00	ON
j	RSS2	8	<0.25	—	00	ON
k	TSS	6	<0.25	—	00	ON
l	Remove clip lead between TP5-B19 and frame.					
m	TSS	6	+6.2 (±0.5)	—	00	ON
n	RSS2	8	+6.2 (±0.5)	—	00	ON
o	Remove clip lead between TP4-H19 and TP3-C07.					
p	RSS2	8	<0.25	—	00	ON
q	Move switch S1 to ON.					
r	RSS2	8	+6.2 (±0.5)	—	11	ON
s	RD	3	+6.2 (±0.5)	—	11	ON
t	Move matrix pin from 2-S1 to 2-SD, and move S3 to ON.					
u	RD	3	+3.0 (±0.5)	DS1	IC	OFF
v	RDTX	19	+6.2	—	IC	OFF

*Allow a few seconds for the voltage to switch to <0.25 volts.

(b) Condition the Data Set 207 switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) On card C21-AR161, strap 2 to 3 on each option.

(d) On card C15-AR152, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12.

(e) Set up the test equipment as shown in Fig. 2.

(f) The 903 DTS switches should be set as follows:

BIT RATE switch to 2400

RANDOM-DOT switch to RANDOM

TRIGGER switch to plus (+).

(g) Apply power to the data set, to the 914B, and to the 903 DTS. Momentarily depress the START button on the 903 DTS and the RESET button on the 914B DTS. The counter on the 914B DTS will indicate zero errors. Momentarily move the WORD LENGTH switch to DOT. The counter should count rapidly. Move the WORD LENGTH switch back to 63 and depress the RESET button.

(h) Allow the test to continue for five minutes. No errors should be indicated. If an error count is indicated, replace the data set. If the test results are satisfactory, remove power and disconnect the test equipment. Restore options in the data set as required by the service order before releasing the data set for normal operation.

B. End-to-End Test

5.19 If possible, it is desirable to make an end-to-end test with a distant data station. This test checks the operation of the data set and also tests the condition of the data transmission facilities connecting the two data sets. If the data set has been tested, is in good operating condition, and errors are detected in an end-to-end test, the transmission facilities should be tested.

5.20 Identical test equipment must be used at both data stations. The data transmitter is driven by the word generator in the 914B DTS. This signal is transmitted to the distant data station which is equipped with a word generator and comparator. The received signal is compared with the locally generated signal and any errors are indicated on the counter. To test the second direction of transmission, the distant data station transmits and the local data station receives and counts errors.

5.21 Condition the near-end and far-end data sets as follows:

(a) Remove power from the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) Carefully remove circuit board AR161 (strap circuit) from slot C21 and condition the straps as follows: A2 to A3, B2 to B3, C2 to C3, E2 to E3, G2 to G3, J2 to J3, K2 to K1, M2 to M1, N2 to N3, R2 to R3. The following terminals should be strapped as required by the service order: D, F, H, and B. Carefully reinsert the circuit board in its slot.

(d) Straps on the following circuit boards should be made as required by a service order: B19-AR3, F01-AR5, C15-AR152, and G03-AR159.

5.22 Arrange the 914B DTS at the transmitting side as follows:

(a) Set the switches as follows:

INTERFACE MODE switch to VOLTAGE

TEST SET MODE switch to TRMT SER

BIT RATE switch to EXT +

SIGNAL LEVEL switch to $\pm$4V

COUNTER switch to BIT ERRORS

WORD LENGTH switch to 63

WORD SYNC switch to AUTO

Switch S1 to ON.

(b) Insert matrix pins as follows: 1-GRD, 7-GRD, 2-SD, 3-RD, 4-S1, 15-SCT, 17-SCR.

5.23 Arrange the 914B DTS at the receiving side the same as at the transmitting side except that the TEST SET MODE switch must be in the RCV SER position.

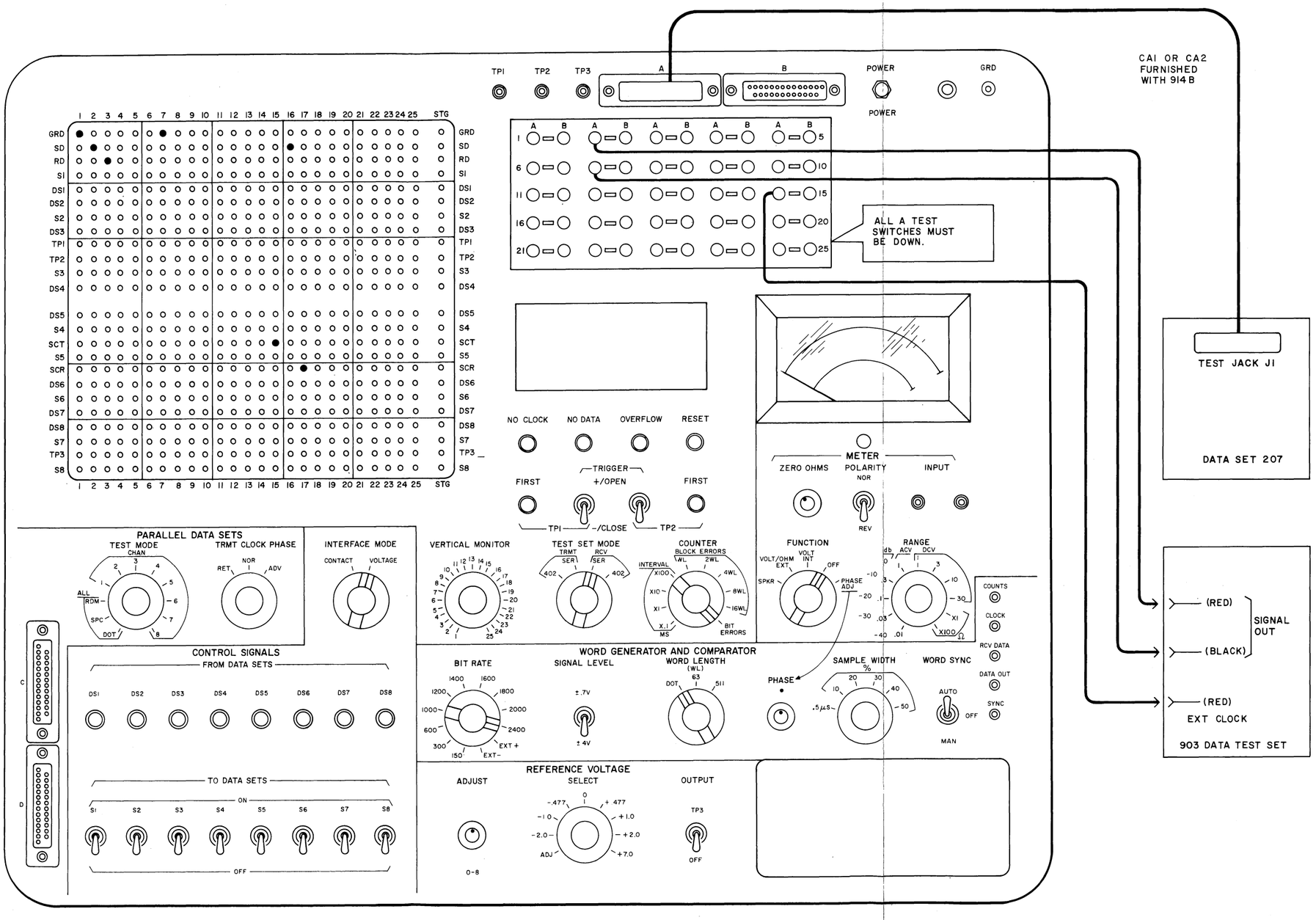


Fig. 2—Back-to-Back Test of Terminator Data Set

5.24 Apply power to the 914B DTS and to the Data Set 207. Depress the RESET button. The counter should read zero errors. Allow the test to continue for five minutes, note the indicated error count, and press the RESET button. Operate this test for three consecutive 5-minute intervals. The error rate can be considered average if a total of 20 errors is recorded for the three test periods. If the error count approaches 100 for three test periods, the transmission parameters of the line should be checked in accordance with the section entitled Private Line Data Circuits, Voice Bandwidth Circuits for Miscellaneous Data, Overall Tests and Requirements (314-410-500). If the line requirements are not met, refer to the Plant Staff through lines of organization. If the above tests are satisfactory, disconnect power from the data set and 914B DTS.

5.25 Disconnect the 914B DTS from the data set. Restore original options in the data set as required by the service order before releasing it for normal operation.

C. Trouble Location

5.26 This section is provided to indicate the following:

(a) Which printed circuit boards or apparatus should be replaced to clear a trouble condition.

(b) Which readily performed maintenance procedures, if any, should be employed to clear a trouble condition. A trouble condition in the context of this section is defined to be a failure to obtain the required test results during the performance of the installation and maintenance tests using the 914B DTS.

5.27 The procedure for clearing a trouble condition is as follows:

(a) Find the number in 5.28 which corresponds to the paragraph of the Installation and Maintenance Tests using the 914B Data Test Set for which the required test results are not obtained.

(b) The code and equipment location of the circuit boards or the apparatus that provide the function under test is listed under the appropriate paragraph number. When applicable, maintenance procedures referred to in 5.26 (b) are also listed.

(c) If the circuit board equipment locations are entered in Table C, use the meter on the 914B DTS to check for the proper dc voltage on the indicated test points. Use the external INPUT terminals and the leads provided with the 914B DTS. Set the FUNCTION switch to VOLT/OHM EXT and set the RANGE switch for the voltage to be measured.

(d) If the required indication in Table C is not obtained, replace the circuit board and repeat the test that failed originally.

Caution: Always be careful when removing, inserting, or handling the printed wiring boards. NEVER remove or insert a printed wiring board unless power is removed from the data set or the power unit (except for AR161 in location C21 which may be removed and inserted without disconnecting power). Replace clip leads on test points when circuit boards are replaced. Replacement boards containing strapping options should be strapped the same as the original boards.

(e) When a replacement board or a maintenance procedure apparently corrects a trouble, retest the data set by either starting at 5.08 of the Installation and Maintenance Tests or by repeating the REMOTE TEST OF TERMINAL EQUIPMENT to be sure a new or different failure has not developed. Always tag the suspected board so that it may be identified and returned for repair.

(f) If the correct dc voltage is obtained in (c), replace the first board listed in Table C with one known to be good. Keep the original board separate and apart from the other test boards.

(g) Repeat the test that failed originally.

(h) If the test still fails, replace the original board into the original location and repeat (f) and (g) for the next board listed.

(i) If the trouble cannot be cleared by replacing the listed circuit boards or by performing maintenance procedures, replace the data set.

5.28 The following list provides correlation between the Installation and Maintenance Tests and the printed circuit boards and/or apparatus

which provide the function under test. When applicable, maintenance procedures are also listed.

5.09 (b)—CP1-AR215 of the 32A1 power unit (or 32B1, if it is used). Replace the power unit if the trouble cannot be cleared.

5.09 (d)—CP2-AR216 of the 32A1 power unit (or 32B1, if it is used). Replace the power unit if the trouble cannot be cleared.

5.09 (g)—Replace the power unit.

5.10—Replace the lamp CU1-G01.

5.11 (e)—G03-AR159, C07-AR9, C13-AR158

5.11 (f)—A03-AR10, B01-AR10, A15-AR4, B13-AR10, B09-AR10, B07-AR9, B05-AR10, B03-AR9, C09-AR10, C07-AR9, D01-AR147 (if provided), D03-AR147 (if provided), D06-69A OSC or AR160

5.11 (g)—G21-AR10, G15-AR10, G19-AR10, G17-AR9

5.11 (i)—C07-AR9, A01-AR9, A07-AR9, G17-AR9, C13-AR158, A07-AR9, A05-AR9, A03-AR10, A09-AR9, A11-AR10, A13-AR10, A15-AR4, C11-AR158, C07-AR9, G03-AR159

5.11 (j)—Same as 5.11 (i)

5.11 (l)—A01-AR9, C07-AR9, C11-AR158, A09-AR9, A11-AR10, A07-AR9, H07-AR151, H05-AR169, A05-AR9, A03-AR10

5.11 (m)—Same as 5.11 (l) and G03-AR159

5.11 (n)—A01-AR9, C07-AR9, A05-AR9, A07-AR9, C13-AR158, A09-AR9, A15-AR4

5.11 (o)—A13-AR10 and A09-AR9

5.11 (p)—A05-AR9, A11-AR10, A15-AR4

5.11 (q)—A07-AR9, A03-AR10, A05-AR9, A15-AR4, C11-AR158

5.12 (i)—G03-AR159

5.12 (k)—G03-AR159

5.13 (a)—C19-AR148, B07-AR9, B17-AR9, C21-AR161 (Visually check C21-AR161 for required straps and arrange if necessary.) If the data set is conditioned for external timing, observe that terminals D1 to D2 on C21 are strapped. Perform the following test to ensure that the customer is providing timing on interface lead SCRE:

(1) Connect the negative test meter lead to the metal frame on the data set and the positive lead to test point TP8-C17.

(2) Condition the meter to read 12 vdc full scale. The voltage should measure less than 0.5 vdc.

(3) Condition the meter to read 12 vac full scale. The voltage should be 6.2 ($\pm$2.0) vac.

5.13 (b)—C19-AR148, G03-AR159, A05-AR9

5.13 (c)—C13-AR158, A11-AR10, A09-AR9, G03-AR159, A15-AR4, C07-AR9, C15-AR152

5.13 (d)—C15-AR152, C07-AR9, C05-AR149, C03-AR9, C09-AR10, B07-AR9, F19-AR9, B17-AR9, F17-AR9, F15-AR4, E03-AR10, E05-AR9, E07-AR10, B19-AR3, B15-AR10, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

5.13 (f)—Same as 5.13 (c)

5.13 (g)—C15-AR152, C07-AR9, C21-AR161, A07-AR9, E07-AR10, H19-AR162, H07-AR151, H09-AR168, H15-AR153, B07-AR9, B19-AR3

5.13 (h)—C17-AR148, C21-AR161 (Check for required strapping before replacing.), C09-AR10, E03-AR10, E01-AR10, E07-AR10, E05-AR9, F19-AR9, E13-AR9, G17-AR9

5.13 (i)—C13-AR158, A13-AR10, A09-AR9, A07-AR9, A15-AR4

5.13 (j)—C11-AR158, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, F17-AR9, F01-AR5, F05-AR6

5.13 (k)—C11-AR158, H05-AR169, H07-AR151, G03-AR159, B19-AR3

5.13 (m)—Same as 5.13 (k)

5.13 (n)—C11-AR158, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, B07-AR9, F17-AR9, F01-AR5, F05-AR6, G01-CU 1 (should be conditioned for terminator operation), G03-AR159, B15-AR10, B13-AR10, B11-AR9, B07-AR9, B17-AR9, A01-AR9, C05-AR149, C03-AR9, F15-AR4

5.13 (p)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E05-AR9, B15-AR10, B07-AR9, B17-AR9, B15-AR10, B13-AR10, B11-AR9, A01-AR9

5.13 (r)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E17-AR9, E13-AR9, E15-AR10, E11-AR9, E09-AR10, E05-AR9, E03-AR10, F17-AR9, F15-AR4, F07-AR1, F11-AR1, F01-AR5, F05-AR6, B19-AR3, B15-AR10, B17-AR9, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

5.13 (s)—C15-AR152, C07-AR9, C05-AR149, C03-AR9, C09-AR10, B07-AR9, F19-AR9, B17-AR9, F17-AR9, F15-AR4, E03-AR10, E05-AR9, E07-AR10, B19-AR3, B15-AR10, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

5.13 (u)—H19-AR162, H09-AR168, A01-AR9, C13-AR158, C21-AR161 (Check for required strapping before replacing.)

5.13 (v)—C13-AR158, A13-AR10, A09-AR9, A07-AR9, A15-AR4

5.14—G03-AR159, C07-AR9, C13-AR158

5.14 (b)—Visually inspect relays K3 and K1 for bent springs, contacts, etc.

5.15 (e)—C21-AR161 (Check for required strapping before replacing.)

5.16 (c)—Same as 5.13 (a)

5.16 (d)—Same as 5.13 (a)

5.17 (d)—B03-AR9, B01-AR10, B07-AR9, B09-AR10, B05-AR10, E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9, F17-AR9, F15-AR4, G21-AR10, G19-AR10, G17-AR9, G15-AR10

5.17 (f)—F15-AR4, B01-AR10, B03-AR9, B07-AR9, B11-AR9, B13-AR10

5.17 (g)—E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9

5.17 (h)—Same as 5.17 (g)

5.17 (j)—G21-AR10, G19-AR10, G17-AR9, G15-AR10, F17-AR9, F15-AR4

5.17 (m)—Same as 5.17 (f)

5.17 (n)—Same as 5.17 (g)

5.17 (o)—Same as 5.17 (h)

5.17 (p)—Same as 5.17 (j)

5.17 (q)—Replace the data set.

6. REMOTE TEST OF REGENERATION EQUIPMENT

6.01 A complete 4-wire regenerative repeater may consist of:

(a) Two Data Sets 207-type or,

(b) One Data Set 207-type and one compatible data set made by another manufacturer.

For the purposes of the following tests, configuration (a) will be referred to as a regen and will include both data sets. The Data Set 207-type in configuration (b) will be referred to as a half regen.

6.02 The remote test can determine the condition of a regen or a half regen. During the remote test of a half regen, the non-207 type equipment is completely isolated and does not take part in the test sequence. The remote test of a regen checks both data sets simultaneously and cannot determine which of the two data sets is in trouble.

6.03 In preparation for a remote test of a regen or half regen, the switches on the data set (or sets) must be positioned as follows:

MODEM LOOP TEST—OFF

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

6.04 Use the following procedure for placing a half regen in the remote test mode:

(a) If possible, make a busy test and utilize whatever means available to lock out the associated trunk.

(b) Upon request of the operator of a 904-type Data Test Center (DTC) arranged for Data Set 207-type, place the half regen in the remote test mode by setting the MODEM LOOP TEST switch to the DIGITAL position.

(c) The digital loop test mode completely isolates the non-207 type equipment from the half regen.

6.05 A regen, located in a gateway office, is placed in the remote test mode from the office test panel when an attendant uses the following procedures:

(a) Notify the distant end to busy out the associated trunk.

(b) Busy out the local end of the associated trunk.

(c) Gain access to the trunk circuit side of the regen to be tested by establishing a connection through the office.

(d) Make the patch that connects the DTC to the trunk side data set.

(e) Upon request of the DTC operator, place the regen in the remote test mode by using a key switch located on the test panel. A lamp will light on the test panel to indicate that the regen is in the test condition.

Note: The key switch located on the test panel places the regen in the test mode by applying an ON voltage to the line loop test (LLT) interface lead of the line side data set (data set facing away from the DTC). This connects the transmitter to the receiver and enables the remote test logic of the line side data set.

6.06 If for some reason the regen cannot be placed in the remote test mode from the test panel, the remote test mode can be achieved by placing the MODEM LOOP TEST switch on the line side data set to the LINE position.

6.07 If a DTC is not available, proceed to Installation and Maintenance Tests.

6.08 During the remote test, the DTC can check the following:

(a) Data set performance at all speeds from 150 to 2400 bps

(b) Operation of the compatible signal sensor and its associated alarm

(c) Operation of the bypass circuits

(d) Effectiveness of the transmitter and receiver synchronization recovery circuits

(e) Effectiveness of the external receiver timing circuit of the data set facing the DTC (trunk side) when the data set is externally timed

(f) Timing source accuracy for a half regen or regen which is self-timed or externally timed.

6.09 Data Sets 207-type may be supplied with one of three types of oscillators:

(a) 65A Oscillator

(b) 69A Oscillator

(c) 72A Oscillator.

The 65A and 72A oscillators assure an outage holdover of six seconds. The 69A oscillator provides a 30-minute outage holdover.

6.10 If the regenerator data set is equipped with the 69A oscillator, the oscillator must be calibrated at the time of installation and thereafter as follows:

(a) 30 days after installation

(b) 30 days plus six months after installation

(c) Annually thereafter.

6.11 If the terminator data set is equipped with the 65A or 72A oscillator, the oscillator must be calibrated at the time of installation and at least once every three years thereafter.

> ***Note:*** The local oscillator shall be adjusted only when instructed to do so by the DTC operator. When the DTC requests adjustment of the oscillator, refer to the procedure in 6.12 and 6.13.

6.12 ***69A Oscillator:*** The oscillator is enclosed in a metal case and occupies slot locations D06 through D21. The adjusting potentiometer is accessible through an opening located at the left front of the oscillator case. The opening is covered by a rectangular metal plate which is held in place by four machine screws.

> ***Note:*** The data set must have had power on continuously for at least one hour prior to the determination of the accuracy of the local oscillator frequency.

One revolution of the oscillator potentiometer screw varies the oscillator frequency by not more than 0.065 parts per million (PPM).

(a) To increase the oscillator frequency, turn the screw clockwise.

(b) To decrease the oscillator frequency, turn the screw counterclockwise.

> ***Note:*** Only the DTC determines when the local 69A oscillator is in calibration.

6.13 ***65A or 72A Oscillator:*** The oscillator adjustment potentiometer is located at the top and to the front of the 65A or 72A oscillator. One revolution of the oscillator potentiometer screw varies the oscillator frequency by approximately 5.5 PPM. The data set under test must have had power on for at least 15 minutes prior to the determination of frequency by the data test center. To increase the oscillator frequency, turn the screw clockwise. To lower the oscillator frequency, turn the screw counterclockwise.

6.14 Only the DTC determines when the local 69A oscillator is in calibration.

6.15 If the remote test is successful, no further testing is required. Restore the data set to normal operation and condition the switches as indicated on the service order. Complete the installation as instructed in the section entitled Data Set 207-Type, Transmitter-Receiver, Installation Instructions (592-020-200).

6.16 If the remote test is not successful and the regen or half regen is self-timed (207B4 or C4), restore the regen or half regen to normal operation and proceed to Installation and Maintenance Tests.

6.17 If the regen or half regen is externally timed (207B3 or C3) and fails ***only*** the accuracy test, perform one of the following; otherwise, restore the regen or half regen to normal operation and proceed to Installation and Maintenance Tests:

(a) If the external timing is provided by another self-timed Data Set 207-type located in the same office, perform a remote test on the self-timed set. If this remote test fails, no further testing should be performed on the externally timed set until the trouble on the set providing timing is cleared. If the remote test on the self-timed set passes, assume that the externally timed set (or sets) is in trouble. Restore to normal operation and proceed to Installation and Maintenance Tests.

(b) If the external timing is provided by a source other than another Data Set 207-type, request that the accuracy of the external source be checked. If the accuracy of the external timing source meets requirements (not more than $\pm$0.058 PPM), assume that the half regen or regen is in trouble. Restore to normal operation and proceed to Installation and Maintenance Tests.

6.18 If the external timing source does not meet requirements, no further testing of the half regen or regen should be performed until the accuracy is corrected to be within $\pm$0.058 PPM.

7. REGENERATION EQUIPMENT TEST USING 901-, 902-, AND 903-TYPE DATA TEST SETS

7.01 The following tests are to be made when either a DTC is not available or under conditions given in 6.15 and 6.16.

> *Note:* This test cannot be used to perform a timing accuracy check. Disregard the ALARM lamp on the switch control panel, which may be illuminated or extinguished during any test, unless otherwise stated.

7.02 If the data set under test is a 207C-type, the front panel RFI shield, data set access cover, and the rear power terminal access cover must be removed in accordance with the section entitled Data Set 207-Type, Transmitter-Receiver, Installation Instructions (592-020-200).

7.03 The equipment required to perform these tests is listed as follows:

1—901-type Data Test Set (DTS)

1—902-type Data Test Set

2—903-type Data Test Sets

1—KS-16979 Volt-ohm-milliammeter (VOM) or equivalent

1—1011-type handset

6—Clip leads with insulated alligator clips for connection to test points on data set printed wiring boards.

7.04 Always be aware of the following test equipment limitations:

(a) When voltage measurements are required in the following tests, the values given as normal do not include allowances for meter tolerances. If the KS-16979 test meter is used, the following tolerances should be added to all readings:

DC—$\pm$3 percent of full scale

AC—$\pm$4 percent of full scale.

(b) In the ac mode, the KS-16979 meter detects and indicates the average of the waveform being measured. The ac voltages given in the following tests are average; therefore, if a meter is used which indicates rms, all ac voltages given in the following tests should be multiplied by a factor of 1.11.

A. Installation and Maintenance Tests

Power Test

7.05 Measure the ac line voltage between terminals L1 and L2 on terminal block TB1 on the rear of the 32A1 power unit (or 32B1 if it is used) with a KS-16979 test meter. The ac line voltage should be between 95 vac and 133 vac for 120-volt ac operation, or between 185.6 vac and 228 vac for 230-volt ac operation.

Equipment Setup and Interface Test

7.06 The following preparation procedures include instructions for both preparing the data set for succeeding tests and conditioning selected control leads to provide the desired operation. The test procedures are written for use with 900-type Data Test Sets listed in 7.03. To provide data set conditioning with equipment different from 900-type Data Test Sets, the required condition of both control and data signal inputs for each test step is given. Regardless of the test equipment used, the data set under test may be conditioned as required with the following instructions. Control settings of the 900-type Data Test Sets are described in sequence.

7.07 Voltages applied to interface control leads through test jack J1 require a minimum of +3.5 to a maximum of +25 vdc for an ON voltage, or a maximum of +2.2 to a minimum of −25 vdc for an OFF voltage.

7.08 Prepare the data set as follows:

(a) Remove ac power to the data set.

(b) Remove interface adapter A1 from connector A1 at the rear of the data set. Remove CU1-G01. Condition the board so that "REGENERATOR" is visible on the board end that mates with the connector for slot location G01.

(c) Check to see that terminal SG1 is strapped to terminal FG1 located below the switch

panel on the data set. If not, inform the customer that safety precautions require that data set frame ground be connected to the signal ground system (FG1 to SG1).

(d) Carefully remove circuit board AR161 (strap circuit) in location C21 and condition the straps as follows: A2 to A1, B2 to B3, C2 to C3, D2 to D3, E2 to E1, G2 to G3, J2 to J3, K2 to K3, L3 to L2, M2 to M1, N2 to N3, and R2 to R3. The F, H, and P terminals on AR161 should be strapped as required by the service order. Carefully reinsert circuit board AR161 in slot location C21.

(e) On G03-AR159, strap terminals 1 to 2 and 3 to 4 on the 12- and 6-dB pads.

(f) Straps on the following circuit boards should be made as required by the service order: B19-AR3, F01-AR5, and C15-AR152.

(g) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—1200

LAMP TEST—OFF

TERMINAL—RESTRICTED

REC CARRIER—AUTO

TRAN CARRIER—ON

RD TRANSITIONS—ON

SD TRANSITIONS—ON.

(h) Remove the plug from test jack J1.

(i) Apply power to the data set. If the 32A1 or 32B1 power unit is used, position the AC INPUT and the ±18 vdc circuit breakers to ON.

7.09 ***In the following tests, if the indication specified is not obtained, proceed to Trouble Location.***

7.10 Measure the −18 vdc and the +18 vdc power to the data set by using the following procedure:

(a) Condition the KS-16979 test meter to measure 30 vdc full scale. Connect the negative test lead to the metal frame.

(b) Connect the positive test lead to TS7-3 (+18). The voltage should be 18 (±0.9) vdc. Disconnect the test leads.

(c) Connect the positive test lead to the metal frame.

(d) Connect the negative test lead to the TS7-5 (−18). The voltage should be 18 (±0.9) vdc. Disconnect the test leads.

7.11 If the data set is equipped with a 69A oscillator (207B2 or C2), position the 18VAC circuit breaker to ON and measure the 18 vac power to the data set by using the following procedure. (If the data set is not equipped with a 69A oscillator, proceed to 7.12.)

(a) Condition the KS-16979 test meter to measure 150 vac full scale.

(b) Connect either meter test lead to TS7-1 (18AG) and the other test lead to TS7-2 (18AC). The voltage should be 16.2 (+3.0, −4.0) vac. Disconnect the meter test leads.

7.12 If the data set under test is part of a regen, make the following test. Momentarily set the LAMP TEST switch to the ON position. The lamp shall remain illuminated while the switch is held in the ON position and shall extinguish when the switch is released.

7.13 Remove power to the data set.

7.14 Check the remote test logic with the following procedure:

(a) Disable the receive signal sensor by connecting a clip lead between TP9-E07 (CSD) and the metal frame.

(b) Disable the transmitter by connecting a clip lead between TP5-B19 (TL) and the metal frame.

(c) Clamp RD to the 11 code by connecting a clip lead between TP12-C07 (RD') and the metal frame.

(d) If optional circuit boards are stored in locations A09 (AR9), A11 (AR10), and A13 (AR10), remove them.

(e) If the data set under test is a half regen, proceed to (f). If the data set under test is a regen, connect and prepare the 901B-type test set as follows:

(1) Position the SELECTOR switch to 3.

(2) Position both A TEST and B TEST switches to OFF.

(3) Position the UNATT-ATT switch to ATT.

(4) On the test set cover (interface adapter), check to see that each EQ terminal is connected to its respective TST terminal with a shorting clip, then make the following straps on the test set cover:

Connect 2 (SD) to 3 (RD), 4 (TSSE) to 6 (TSS), 8 (RSS2) to 20 (RSSE), and 12 (RSS1) to 18 (IC).

(5) Connect the 901B-type test set cord to the jack on the test set cover. Connect the test set cover cord to test jack J1 on the data set.

(f) Apply power to the data set.

(g) Condition the KS-16979 test meter to read 30 vdc full scale. Connect the negative test lead to the metal frame on the data set.

(h) Connect the positive test lead to TP3-B01 (E32). The voltage should be 3.2 ($\pm$0.7) vdc.

(i) Connect the positive test lead to TP9-G21 (EC4). The voltage should be 3.2 ($\pm$0.7) vdc.

(j) Connect the positive test lead to TP4-A01 (SD'3). The voltage shall be 3.2 ($\pm$0.7) vdc.

(k) Enable the remote test logic as follows:

(1) If the data set under test is a half regen, connect a clip lead between TP13-C13 (DLT') and the metal frame. This should cause relay K3 to operate and relay K1 to release.

(2) If the data set under test is part of a regen, connect 7 (SG) to 25 (TSEN) on the test set cover.

(l) The test meter should indicate 1.7 ($\pm$0.5) vdc.

(m) Position the TRAN CARRIER switch to AUTO. Position the REC CARRIER switch to ON. The voltage shall be 6.2 ($\pm$1.2) vdc.

(n) Position the TRAN CARRIER switch to ON. The voltage should switch to 3.2 ($\pm$0.7) vdc.

(o) Position the REC CARRIER switch to AUTO. The voltage should switch to 6.2 ($\pm$1.2) vdc.

(p) Position the REC CARRIER switch to ON. Momentarily connect TP13-A03 (TSEQ') to the metal frame. The voltage should read 1.7 ($\pm$0.5) vdc.

(q) Cause relays K4 and K5 to release by connecting a clip lead between TP11-C07 (RBR) and the metal frame. The voltage should switch to less than 0.5 vdc.

7.15 Disconnect power to the data set. Remove all clip leads connected to test points on the data set. Remove the connections made on the test set cover if it has been used [7.14 (e) (4)].

7.16 Prepare the data set for the following test:

(a) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

REC CARRIER—AUTO

TRAN CARRIER—AUTO

RD TRANSITIONS—ON

SD TRANSITIONS—ON.

(b) Disable the transmitter by connecting a clip lead between TP5-B19 (TL) and the metal frame.

(c) On C21-AR161, strap E2 to E3.

7.17 Connect and prepare the 901B-type test set as follows:

(a) Position the SELECTOR switch to 3.

(b) Position both the A TEST and B TEST switches to OFF.

(c) Position the UNATT-ATT key to ATT. This key is used to control RSSE. With the key in the ATT position, an OFF indication is applied to the RSSE interface lead.

(d) Check to see that each EQ terminal is connected to the respective TST terminal on the test set cover and then make the following changes on the test set cover:

(1) Open shorting clips 4 (TSSE), 14 (SCRE'), 18 (IC), 19 (RDTX), and 23 (SCRB).

(2) Strap 9 (+18I) to TST 19 and 6 (TSS) to TST 18.

(e) Connect the 901B-type test cord to the jack on the test set cover (interface adapter). Connect the test set cover cord to test jack J1 on the data set.

7.18 Apply power to the data set and measure the ±18 vdc as follows:

(a) Condition the KS-16979 test meter to measure 30 vdc full scale. Connect the negative test lead to terminal A (on the 901B-type test set) and the positive test lead to terminal C.

(b) Position B TEST to 1. The test meter should indicate 18 (±0.9) vdc.

(c) Disconnect the meter test leads and position B TEST to 2.

(d) Connect the positive test lead to terminal A and the negative test lead to terminal C. The test meter should indicate 18 (±0.9) vdc.

(e) Disable the coherent detector by connecting a clip lead between test points TP3-C07 (CSD'1) and TP4-H19 (COGB').

7.19 Using the test meter, measure the dc and ac interface voltages listed in Table E. DC measurements are made between terminals A and C on the 901B-type test set. Terminal C is always at ground potential. Connect the negative test lead to terminal C. AC measurements are made between terminals B and C on the test set. For each lead tested, position the A TEST and B TEST switches as indicated in the table. The B TEST switch is used to apply the appropriate code to the SD lead. The A TEST switch is used to connect the lead to be tested to terminals A and, through a capacitor, to terminal B on the test set.

7.20 Test the bypass relays with the following procedure:

(a) Position the UNATT-ATT switch to ATT.

(b) Disconnect the test meter from the 901B-type test set. Condition the meter to read 1.0 vac full scale.

(c) Connect one of the meter test leads to test point TP3-G09 (TB) and the other test lead to test point TP2-G09 (RB). The voltage should be 0 vac.

(d) Position the UNATT-ATT switch to UNATT. The voltage should switch to greater than 0.5 vac.

(e) Strap 9 (+18I) to EQ 4 (TSSE) on the 901B-type test set cover. The voltage should switch to 0 vac.

(f) Disconnect the meter and remove the strap between 9 (+18I) and EQ 4 (TSSE) on the test set cover.

7.21 Perform the following test only if the data set under test is a half regen.

(a) Connect a clip lead between test point TP13-C13 (DLT') and the metal frame on the data set. Relay K3 should operate and relay

TABLE E

INTERFACE REQUIREMENTS

4.31	LEAD TESTED	SWITCH POSITION		SEND DATA CODE	METER READING	
		A TEST	B TEST		DC (VDC)	AC (VAC)
a	SCA	23	3	00	<0.5	5.8 (±0.5)
b	DTI	22	3	00	<0.5	6.0 (±0.5)
c	RD	20	3	00	6.2 (±0.5)	0
d	SCRA	19	3	00	<0.5	5.8 (±0.5)
e	TSS	18	3	00	<0.25	0
f	Remove clip lead between TP5-B19 (TL) and frame.					
g	TSS	18	3	00	6.2 (±0.5)	0
h	RSS2	17	3	00	<0.25	0
i	Set UNATT-ATT key to UNATT.					
j	RSS2	17	3	00	6.2 (±0.5)	0
k	Remove clip lead between TP4-H19 (COGB') and TP3-C07 (CSD'1).					
l	RSS2	17	3	00	<0.25	0
m	RSS2	17	4	11	6.2 (±0.5)	0
n	RD	20	4	11	6.2 (±0.5)	0

K1 should release. Relay contacts K3 and K1 should open interface driver leads TSS, RSS2, RD, and SCRA. Check to see that these leads are opened with the following procedure.

(b) Condition the KS-16979 test meter to read 1.0 vac full scale.

(c) Position B TEST switch to OFF.

(d) Connect one test lead to terminal A and the other test lead to terminal C on the 901B-type test set. Measure the voltage for each position of the A TEST switch given in Table F. The voltage should be 0 vac at each position.

(e) Remove the connection between test point TP13-C13 (DLT') and the metal frame.

(f) Disconnect the meter.

(g) Remove power to the data set.

(h) Insert interface adapter A1 into connector A1 on the rear of the data set.

TABLE F

REMOTE TEST

LEAD TESTED	A TEST POSITION
RD	20
SCRA	19
TSS	18
RSS2	17

(i) On C21-AR161, strap option D as required by the service order.

(j) Apply power to the data set.

7.22 Test the frequency of the receiver clock (SCRA) with the following procedure:

(a) Set the A TEST switch to 19 and the B TEST switch to 3 on the 901B-type test set.

(b) Connect a 1011-type handset between terminals B and C on the test set.

Caution: Keep handset away from ear.

(c) Rotate the BIT RATE switch to positions 2400, 1200, 600, 300, and 150.

(d) In the 2400-bps mode, a 2400-Hz tone should be heard.
In the 1200-bps mode, a 1200-Hz tone should be heard.
In the 600-bps mode, a 600-Hz tone should be heard.
In the 300-bps mode, a 300-Hz tone should be heard.
In the 150-bps mode, a 150-Hz tone should be heard.

(e) On the C21-AR161, strap B1 to B2. A 1200-Hz tone should be heard at each position of the BIT RATE switch.

(f) Return the BIT RATE switch to 2400.

7.23 Check the frequency of the uncorrected receiver clock (SCA) with the following procedure:

(a) Position the A TEST switch on the 901B-type test set to 23 and the B TEST switch to 3.

(b) Repeat 7.22 (b) and 7.22 (c).

(c) If the data set is internally timed (207B4 or C4), then the results given in 7.22 (d) should be obtained.

(d) If the data set is externally timed (207B3 or C3), each position of the BIT RATE switch should produce a tone at a frequency equal to that of the externally provided timing source.

(e) Position the BIT RATE switch to 2400 and disconnect the handset from the 901B-type test set.

(f) Remove power to the data set and remove interface adapter A1 from connector A1 on the rear of the data set.

7.24 Apply power to the data set and test the effectiveness of the transmitter timing, receiver timing, and external receiver timing circuits as follows:

(a) Position the UNATT-ATT switch to UNATT.

(b) Open shorting clip 24 (SCTE) and connect 10 (−18I) to EQ 24 (SCTE) on the test set cover. This disconnects SCA from SCTE and applies −18.0 vdc to SCTE.

(c) Connect a clip lead between test point TP7-C19 (SCRE') and the metal frame.

(d) Position the A TEST switch on the 901B-type test set to 22 and the B TEST switch to 3. This connects DTI to terminal A and applies the 00 code to the SD lead.

(e) Condition the KS-16979 test meter to measure 15 vac full scale. Connect one meter test lead to terminal A and the other test lead to the red RECEIVE CLOCK terminal on the 901B-type test set.

(f) The voltage indicated on the meter should be a constant between 0 and 13 vac.

(g) Connect a clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32) on the data set. This causes a delete correction to be made to the transmitter timing chain at every 64-dibit interval.

(h) The indication on the meter should vary continuously between a voltage less than 4.0 vac and a voltage greater than 10.0 vac.

(i) Position the B TEST switch on the 901B-type test set to 4. This applies the 11 code to the SD lead. The indication on the meter should remain constant and be less than 3.0 vac.

(j) Position the B TEST switch on the 901B-type test set to 3. The indication on the meter should vary continuously between a voltage less than 4.0 vac and a voltage greater than 10.0 vac.

(k) Connect a clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C) on the data set. This allows the external receiver clock to frequency lock to the transmitter clock. The voltage indicated on the meter should be a constant between 0 and 13 vac.

(l) Remove the clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C) on the data set.

(m) Remove the clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32). Connect a clip lead between test points TP12-A03 (E32'G) and TP11-B01 (TAR) on the data set. This causes an add correction to be made to the transmitter timing chain at every 64-dibit interval.

(n) Repeat 7.24 (h)

(o) Repeat 7.24 (i)

(p) Repeat 7.24 (j)

(q) Repeat 7.24 (k)

(r) Remove all clip leads connected to test points from the data set. Remove the connection between 10 (−18I) and EQ 24 (SCTE) and replace shorting clip 24 on the test set cover. Be sure that each EQ terminal is connected to each TST terminal on the 901B-type test set cover.

Back-to-Back Test

7.25 Perform a back-to-back test by using the following procedure:

(a) Remove power to the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) Condition data set strapping options as follows:

(1) On C21-AR161, strap E1 to E2 and G1 to G2. Strap 2 to 3 on all other options.

(2) On C15-AR152, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12.

(d) Arrange the 901B-type, 902B, and two 903B Data Test Sets to provide random data at 2400 bps. Condition the equipment as follows:

●901B-type test set

SELECTOR switch to 3

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT switch to ATT

Test set cover—Open shorting clip 23 (SCRB). Connect 6 (TSS) to 20 (RSSE) and 8 (RSS2) to 4 (TSSE). Connect the test set cover to the data set test jack J1. Plug the 901B-type cord into the test set cover socket.

●902B test set

BIT RATE to EXT SYNC

SELECTOR switch to DIST MEAS

TRIGGER to − (minus).

●903B test sets (both No. 1 and No. 2)

BIT RATE to EXT CLOCK

RANDOM-DOT to RANDOM

TRIGGER to + (plus)

POWER to OFF.

Note: For the following connections, mate red to red and black to black.

(e) Repeat 4.22 (e) through 4.22 (p).

B. End-to-End Test

7.26 If possible, it is desirable to make an end-to-end test with a distant data station. This test is similar to the back-to-back test except that transmission between data set stations is tested in both directions simultaneously. Identical test equipment must be used at both stations. At the local station, a 903B test set provides signals through a 901B-type test set and cover to drive the data set. The signals are transmitted to the

distant data set through a 901B-type test set and cover to a connected 902B test set. Both local and distant stations have a second 903B test set which generates a comparison signal and connects into the 902B test set. The 902B test set can synchronize the two signals and count the number of errors in the received data. The following test set arrangement allows the simultaneous checking of data set transmission and reception.

7.27 Condition the data set at both local and distant stations as follows:

(a) Remove power to the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—OFF

BIT RATE—2400

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) Condition data set strapping options as indicated in 7.25 (c). In addition, strap G03-AR159 as indicated on the service order.

(d) Check to see that interface adapters A1 and A2 are inserted into their respective connectors on the rear of the data set.

7.28 Arrange the 901B-type, 902B, and two 903B test sets at both local and distant stations as follows:

●901B-type test set

SELECTOR switch to 3

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT switch to ATT

Test set cover—Same as for back-to-back test. [See 7.25 (d).]

●902B test set

BIT RATE to EXT SYNC

SELECTOR switch to DIST MEAS

TRIGGER to – (minus).

●903B test set (both sets at both stations)

BIT RATE to EXT CLOCK

RANDOM-DOT to RANDOM

TRIGGER to + (plus)

POWER to OFF.

Note: For the following connections, mate red to red and black to black.

(a) Repeat 4.25 (a) through (h) and 4.26.

C. Trouble Location

7.29 This section is provided to indicate the following:

(a) Which printed circuit boards or apparatus should be replaced to clear a trouble condition, and

(b) Which readily performed maintenance procedures, if any, should be employed to clear a trouble condition. A trouble condition in the context of this section is defined to be a failure to obtain the required test results during the performance of Installation and Maintenance Tests.

7.30 The procedure for clearing trouble is as follows:

(a) Find the number in 7.31 which corresponds to the paragraph of the Installation and Maintenance Tests for which the required test results are not obtained.

(b) The code and equipment location of the circuit boards or the apparatus which provide the function under test are listed under the appropriate paragraph number. When applicable, maintenance procedures referred to in 7.29 (b) are also listed.

(c) If the circuit board equipment locations are entered in Table C, use the KS-16979 test meter to check for the proper dc voltage on the indicated test points. If the required indication

is not obtained, replace the board and repeat the test which failed originally. If applicable, perform indicated maintenance procedures and repeat the test which failed originally.

Caution: Always be careful when removing, inserting, or handling the printed wiring boards. NEVER remove or insert a printed wiring board unless power is removed from the data set or the power unit (except for AR161 in location C21 which may be removed and inserted without removing power to the data set). Replace clip leads on test points when circuit boards are replaced. Replacement boards containing strapping options should be strapped the same as the original boards.

(d) When a replacement board or a maintenance procedure apparently corrects a trouble, retest the data set by starting at 7.08 of the Installation and Maintenance Tests or by repeating the remote test to be sure that a new or different failure has not developed. Always tag a suspected board so that it may be identified and returned for repair.

(e) If the correct dc voltage is obtained in (c), replace the first board listed with one known to be good. Keep the original board separate and apart from other test boards.

(f) Repeat the original test.

(g) If the test still fails, replace the original board into the original location and repeat (e) and (f) for the next board listed.

(h) If the trouble cannot be cleared by replacing the listed circuit boards or by performing maintenance procedures, replace the data set.

7.31 The following list provides correlation between the Installation and Maintenance Tests and the printed circuit boards and/or apparatus which provide the function under test. When applicable, maintenance procedures are also listed.

7.10 (b)—CP1-AR215 of 32A1 power unit (or 32B1 if it is used). Replace the power unit if the trouble cannot be cleared.

7.10 (d)—CP2-AR216 of 32A1 power unit (or 32B1 if it is used). Replace the power unit if the trouble cannot be cleared.

7.11 (b)—Replace the power unit.

7.12 (b)—Replace the lamp. If the lamp checks OK, test to see that −48 vdc is applied by an external source between interface lead 48CO and COGD by using the following procedure:

(1) Condition the test meter to read 150 vdc full scale.

(2) Connect the negative test lead to terminal X7 or Y7 (48CO) on interface adapter A2. Connect the positive test lead to terminal X8 or Y8 (COGD) on interface adapter A2.

(3) The voltage should be 48.0 ($\pm$5.0) vdc.

(4) If (1), (2), and (3) test OK, replace CU1-G01.

7.14 (h)—A03-AR10, B01-AR10, A15-AR4, B13-AR10, B09-AR10, B07-AR9, B05-AR10, B03-AR9, C09-AR10, C07-AR9, D01-AR147 (if provided), D03-AR147 (if provided), D06-69A OSC or AR160

7.14 (i)—G21-AR10, G15-AR10, G19-AR10, G17-AR9

7.14 (j)—A01-AR9, G03-AR159, C21-AR161 (Check for required straps.), C07-AR9, C15-AR152, A07-AR9

7.14 (k)—G03-AR159, C07-AR9, C13-AR158

7.14 (l)—C07-AR9, A01-AR9, A07-AR9, G17-AR9, C13-AR158, A07-AR9, A05-AR9, A03-AR10, C11-AR158, C07-AR9, G03-AR159

7.14 (m)—A01-AR9, C07-AR9, C11-AR158, A07-AR9, H07-AR151, H05-AR169, A05-AR9, A03-AR10

7.14 (n)—Same as 7.14 (m) plus G03-AR159

7.14 (o)—A01-AR9, C07-AR9, A05-AR9, A07-AR9, C13-AR158

7.14 (p)—A07-AR9, A03-AR10, A05-AR9, A15-AR4, C11-AR158

7.14 (q)—G01-CU1, G09-AR170

7.18 (b)—G03-AR159

7.18 (d)—G03-AR159

7.19 (a)—C19-AR148, B07-AR9, B17-AR9, C21-AR161 (Check for required strapping before replacing.)

7.19 (b)—C19-AR148, G03-AR159, A05-AR9

7.19 (c)—C15-AR152, C07-AR9, C21-AR161 (Check for required strapping before replacing.), A07-AR9, E07-AR10, H19-AR162, H07-AR151, H09-AR168, H15-AR153, B07-AR9, B19-AR3

7.19 (d)—C17-AR148, C21-AR161 (Check for required strapping before replacing.), C09-AR10, E03-AR10, E01-AR10, E07-AR10, E05-AR9, F19-AR9, E13-AR9, G17-AR9

7.19 (e)—C11-AR158, H05-AR169, H07-AR151, G03-AR159, B19-AR3

7.19 (g)—Same as 7.19 (e)

7.19 (h)—C11-AR158, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, F17-AR9, F01-AR5, F05-AR6

7.19 (j)—C11-AR158, C07-AR9, G09-AR170, G07-AR150, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, B07-AR9, F17-AR9, F01-AR5, F05-AR6, G01-CU1 (should be conditioned for regenerator operation), G03-AR159, G07-AR150, G09-AR170, C07-AR9, B15-AR10, B13-AR10, B11-AR9, B07-AR9, B17-AR9, A01-AR9, C05-AR149, C03-AR9, F15-AR4

7.19 (l)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E05-AR9, B15-AR10, B07-AR9, B17-AR9, B13-AR10, B11-AR9, A01-AR9

7.19 (m)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E17-AR9, E13-AR9, E15-AR10, E11-AR9, E09-AR10, E05-AR9, E03-AR10, F17-AR9, F15-AR4, F07-AR1, F11-AR1, F01-AR5, F05-AR6, B19-AR3, B15-AR10, B17-AR9, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

7.19 (n)—C15-AR152, C07-AR9, C05-AR149, C03-AR9, C09-AR10, B07-AR9, F19-AR9, B17-AR9, F17-AR9, F15-AR4, E03-AR10, E05-AR9, E07-AR10, B19-AR3, B15-AR10, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

7.20 (c)—G09-AR170, C07-AR9, C11-AR158, G07-AR150, G01-CU1

7.20 (d)—Same as 7.20 (c)

7.20 (e)—Same as 7.20 (c)

7.21 (a)—G03-AR159, C07-AR9, C13-AR158

7.21 (d)—Visually inspect relays K3 and K1 for bent springs, contacts, etc.

7.22 (d)—C21-AR161 (Check for required strapping before replacing.), E21-AR9

7.22 (e)—Same as 7.22 (d)

7.23 (c)—C19-AR148, B07-AR9, B17-AR9, C21-AR161 (Check for required strapping before replacing.)

7.23 (d)—Same as 7.23 (c) and test that the customer is providing timing on interface lead SCRE. One way to determine this is as follows:

(1) Connect the negative meter test lead to the metal frame of the data set and the positive test lead to test point TP8-C17.

(2) Condition the meter to read 1.5 vdc full scale. The voltage should be less than 0.5 vdc.

(3) Condition the meter to read 15 vac full scale. The voltage should be 6.2 ($\pm$2.0) vac.

7.24 (f)—B03-AR9, B01-AR10, B07-AR9, B09-AR10, B05-AR10, E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9, F17-AR9, F15-AR4, G21-AR10, G19-AR10, G17-AR9, G15-AR10

7.24 (h)—F15-AR4, B01-AR10, B03-AR9, B07-AR9, B11-AR9, B13-AR10

7.24 (i)—E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9

7.24 (j)—Same as 7.24 (i)

7.24 (k)—G21-AR10, G19-AR10, G17-AR9, G15-AR10, F17-AR9, F15-AR4

7.24 (n)—Same as 7.24 (h)

7.24 (o)—Same as 7.24 (i)

7.24 (p)—Same as 7.24 (j)

7.24 (q)—Same as 7.24 (k)

7.25 Replace the data set.

8. REGENERATION EQUIPMENT TEST USING 914B DATA TEST SET

8.01 In this series of tests, the 914B Data Test Set (DTS) is used to check the clock, control, and data signals of the data set. The following tests are to be made at the time of installation and may be used for clearing routine trouble conditions. The tests are divided into the following parts:

- Installation and maintenance tests
- End-to-end tests.

8.02 The following test equipment is required to perform these tests:

1—914B DTS

1—903-type DTS

1—KS-16979 Volt-ohm-milliammeter (VOM) or equivalent

6—Clip leads with insulated alligator clips for connections to test points on the data set printed wiring boards.

A. Installation and Maintenance Tests

8.03 The following tests are to be made either when a DTC is not available or under conditions given in 6.16 and 6.17.

> ***Note:*** This test cannot be used to perform a timing accuracy check. Disregard the ALARM lamp on the switch control panel which may be illuminated or extinguished during any test, unless otherwise stated.

8.04 If the data set under test is a 207C-type, the front panel RFI shield, data set access cover, and the rear power terminal access cover must be removed in accordance with the section entitled Data Set 207-Type, Transmitter-Receiver, Installation Instructions (592-020-200).

Power Test

8.05 Measure the ac line voltage between terminals L1 and L2 on terminal block TB1 on the rear of the 32A1 power unit (or 32B1, if it is used) with a KS-16979 VOM. The ac line voltage should be between 95 and 133 volts ac for 120-volt ac operation, or between 207 and 253 volts ac for 230-volt ac operation.

Equipment Setup and Interface Test

8.06 The following preparation procedures include instructions for both preparing the data set for the test and conditioning selected control leads to provide the desired operation. Voltages applied to interface control leads through test jack J1 require a minimum of +3.5 to a maximum of +25 volts dc for an ON voltage, or a maximum of +2.2 to a minimum of −25 volts dc for an OFF voltage.

8.07 Prepare the data set as follows:

(a) Disconnect ac power from the data set.

(b) Remove interface adapter A1 from connector A1 at the rear of the data set. Remove circuit board CU1-G01. Loosen the screw on the board and condition the board so that "REGENERATOR" is visible on the board end that mates with the connector for slot location G01.

(c) Check to see that terminal SG1 is strapped to terminal FG1 located below the switch panel on the data set. If not, inform the customer that safety precautions require that data set frame ground be connected to the signal ground system (FG1 to SG1).

(d) Carefully remove circuit board AR161 (strap circuit) in location C21 and condition the straps as follows: A1 to A2, B2 to B3, C2 to C3, D2 to D3, E1 to E2, G2 to G3, J2 to J3, K2 to K3, L2 to L3, M1 to M2, N2 to N3, and R2 to R3. The F, H, and P terminals on AR161 should be strapped as required by the service

order. Carefully reinsert circuit board AR161 in slot location C21.

(e) On G03-AR159, strap terminals 1 to 2 and 3 to 4 on the 12- and 6-dB pads.

(f) Straps on the following circuit boards should be made as required by the service order: B19-AR3, F01-AR5, and C15-AR152.

(g) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—1200

LAMP TEST—OFF

TERMINAL—RESTRICTED

REC CARRIER—AUTO

TRAN CARRIER—ON

RD TRANSITIONS—ON

SD TRANSITIONS—ON.

(h) Remove the plug from test jack J1.

(i) Apply power to the data set. If the 32A1 or 32B1 power unit is used, position the AC INPUT and the ±18 VDC circuit breakers to ON.

In the following tests, if the required indication is not obtained, proceed to C. Trouble Location.

8.08 Measure the −18 volt dc and the +18 volt dc power to the data set by using the following procedure:

(a) On the 914B DTS, set the FUNCTION switch to VOLT/OHM EXT. Set the RANGE switch to DCV-30.

(b) Move the POLARITY switch to NOR. Using the input leads supplied with the 914B DTS, connect the negative (black) input terminal to the metal frame of the data set.

(c) Connect the positive (red) terminal to TS7-3 (+18). Measure the positive power supply voltage.

Requirement: +17.1 to +18.9 volts dc

(d) Disconnect the positive lead and move the POLARITY switch to REV.

(e) Connect the positive terminal to TS7-5 (−18). Measure the negative power supply voltage.

Requirement: −17.1 to −18.9 volts dc

(f) Disconnect the meter leads and move the FUNCTION switch to OFF.

8.09 If the data set is equipped with the 69A oscillator (207B2 or C2), position the 18VAC circuit breaker to ON. Measure the 18-volt ac power using the KS-16979 VOM. (If the data set is not equipped with the 69A oscillator, proceed to 8.10.)

(a) Condition the VOM to measure 150 volts ac full scale.

(b) Connect either test lead to TS7-1 (18AG) and the other test lead to TS7-2 (18AC). The voltage should be 12.2 to 19.2 volts ac.

(c) Disconnect the VOM from the data set power supply.

8.10 If the data set under test is part of a regen, make the following test. Momentarily set the LAMP TEST switch to ON. The lamp shall remain illuminated while the switch is held in the ON position and shall extinguish when the switch is released.

8.11 Check the remote test logic with the following procedure:

(a) Disconnect power to the data set. Disable the receive signal sensor by connecting a clip lead between TP9-E07 (CSD) and the metal frame.

(b) Disable the transmitter by connecting a clip lead between TP5-B19 (TL) and the metal frame.

(c) Clamp RD to the 11 code by connecting a clip lead between TP12-C07 (RD') and the metal frame.

(d) If optional circuit boards are stored in locations A09 (AR9), A11 (AR10), and A13 (AR10), remove them.

(e) If the data set under test is a half regen, proceed to (h). If the data set under test is a regen, connect and prepare the 914B DTS as follows:

(1) Insert matrix pins in the 914B DTS in 1-GRD, 7-GRD, 14-GRD, 2-SD, 2-RD, 3-RD, 4-TP1, 6-TP1, 8-TP2, 20-TP2, 12-TP3, 18-TP3.

Note: All A interface selector switches must be depressed.

(f) Set the 914B DTS switches as follows:

FUNCTION switch to VOLT/OHM EXT

TP3 switch to OFF

METER POLARITY switch to NOR

RANGE switch to DCV-10.

(g) Connect the data set TEST connector to connector A on the 914B DTS.

(h) Using the leads supplied with the 914B DTS, connect the negative (black) terminal to a convenient ground. Apply power to the 914B DTS.

(i) Connect the positive (red) terminal to TP3-B01 (E32). The meter should indicate +3.2 (±0.7) volts dc.

(j) Move the positive lead to TP9-G21 (EC4). The voltage shall be +3.2 (±0.7) volts dc.

(k) Move the positive lead to TP4-A01 (SD'3). The voltage shall be +3.2 (±0.7) volts dc.

(l) If the data set under test is a half regen, connect a clip lead between TP13-C13 (DLT') and the metal frame. This should cause relay K3 to operate and relay K1 to release.

(m) If the data set under test is part of a regen, insert a matrix pin in 25-GRD.

(n) With the positive meter probe connected to TP4-A01, the voltage indication shall be +1.7 (±0.5) volts dc.

(o) Position the TRAN CARRIER switch to AUTO. Position the REC CARRIER switch to ON. The voltage shall be +6.2 (±1.2) volts dc.

(p) Position the TRAN CARRIER switch to ON. The voltage shall switch to +3.2 (±0.7) volts dc.

(q) Position the REC CARRIER switch to AUTO. The voltage shall switch to +6.2 (±1.2) volts dc.

(r) Position the REC CARRIER switch to ON. Momentarily connect TP13-A03 (TSEQ') to the metal frame. The voltage shall be +1.7 (±0.5) volts dc.

(s) Cause relays K4 and K5 to release by connecting a clip lead between TP11-C07 (RBR) and the metal frame. The voltage shall switch to less than +0.5 volts dc.

8.12 Disconnect power to the data set. Disconnect the meter leads and remove all clip leads connected to test points on the data set. Remove all matrix pins placed in the 914B DTS.

8.13 Set up the equipment for testing as follows:

(a) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE—2400

LAMP TEST—OFF

TERMINAL—NORMAL

REC CARRIER—AUTO

TRAN CARRIER—AUTO

RD TRANSITIONS—ON

SD TRANSITIONS—ON.

(b) Disable the transmitter by connecting a clip lead between TP5-B19 (TL) and the metal frame.

(c) On C21-AR161, strap E2 to E3.

(d) Set up the 914B DTS as shown in Fig. 3.

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

(f) Measure the negative power supply voltage.

Requirement: −17.1 to −18.9 volts dc

(g) Move the FUNCTION switch to OFF. Move the VERTICAL MONITOR switch to 9, and move the POLARITY switch to NOR.

(h) Move the FUNCTION switch to VOLTS INT. Measure the positive power supply voltage.

Requirement: +17.1 to +18.9 volts dc

(i) Move the FUNCTION switch to OFF. Disable the coherent detector by connecting a clip lead between test points TP3-C07 (CSD'1) and TP4-H19 (COGB').

8.14 Use the voltmeter on the 914B DTS to measure dc voltages as shown in Table G. Move the FUNCTION switch to VOLT INT. The VERTICAL MONITOR switch is placed as indicated in the table. The DS lamp ON indication for Steps a, b, and d verifies the presence of ac voltage (greater than 5 volts) on the lead being tested. For other steps, disregard the condition of the DS lamp.

8.15 Test the bypass relays with the following procedure:

(a) Move the FUNCTION switch to OFF.

(b) Condition the KS-16979 VOM to measure 15 volts ac full scale.

(c) On the 914B DTS, move switch S2 to OFF. Connect one of the VOM test leads to TP3-G09 (TB) and the other test lead to TP2-G09 (RB). The voltage shall be 0 volts ac.

(d) Move switch S2 to ON. The voltage shall switch to greater than 0.5 volts ac.

(e) Move switch S4 to ON. The voltage shall switch to 0 volts ac.

(f) Disconnect the VOM test leads and switch S4 to OFF.

8.16 Perform the following test only if the data set under test is a half regen.

(a) Connect a clip lead between test point TP13-C13 (DLT') and the metal frame on the data set. Relay K3 shall operate and relay K1 shall release. Relay contacts K3 and K1 should open interface driver leads TSS, RSS2, RD, and SCRA. Check to see that these leads are opened by proceeding as specified in (b) and (c).

(b) Move the FUNCTION switch to VOLT/OHM EXT. Move the RANGE switch to ACV-1.

(c) Using the meter leads provided with the 914B DTS, measure for ac voltage between the following leads and ground: 3, 6, 8, and 17. No ac voltage shall be present on these leads.

(d) Move the FUNCTION switch to OFF. Remove the clip lead between TP13-C13 and ground.

(e) Disconnect power to the data set and turn the 914B DTS off.

(f) Insert interface adapter A1 into connector A1 at the rear of the data set.

(g) On C21-AR161, strap option D as required by the service order.

8.17 Test the frequency of the receiver clock (SCRA) with the following procedure:

(a) On the 914B DTS, the matrix pins should be inserted as shown on Fig. 3.

(b) Set the 914B DTS switches as follows:

Switches S1 and S4 to OFF

INTERFACE MODE switch to VOLTAGE

RANGE switch to db-0

VERTICAL MONITOR switch to 11

FUNCTION switch to SPKR.

(c) Connect leads from INPUT jacks to interface selector switches 7 and 17.

(d) On Data Set 207, rotate the BIT RATE switch to positions 2400, 1200, 600, 300, and 150.

(e) In the 2400-bps mode, a 2400-Hz tone should be heard.
In the 1200-bps mode, a 1200-Hz tone should be heard.
In the 600-bps mode, a 600-Hz tone should be heard.
In the 300-bps mode, a 300-Hz tone should be heard.
In the 150-bps mode, a 150-Hz tone should be heard.

(f) On C21-AR161, strap B1 to B2. A 1200-Hz tone should be heard at each position of the BIT RATE switch.

(g) Return the BIT RATE switch to 2400.

8.18 Check the frequency of the uncorrected receiver clock (SCA) with the following procedure:

(a) Move one meter input lead from interface selector switch 17 to interface selector switch 15.

(b) On Data Set 207, rotate the BIT RATE switch to positions 2400, 1200, 600, 300, and 150.

(c) If the data set is internally timed (207B4 or 207C4), then the results given in 8.17 (e) should be obtained.

(d) If the data set is externally timed (207B3 or 207C3), each position of the BIT RATE switch should produce a tone at a frequency equal to that of the externally provided timing source.

(e) Position the BIT RATE switch to 2400 and disconnect the leads to the INPUT terminals.

(f) Disconnect power to the data set and remove interface adapter A1 from connector A1 at the rear of the data set.

(g) On the 914B DTS, move the FUNCTION switch to OFF.

8.19 Apply power to the data set and test the effectiveness of the transmitter timing, receiver timing, and external receiver timing circuits as follows:

(a) The matrix should be set up as shown in Fig. 3. Insert a matrix pin in 24-S6 and move switch S6 to OFF.

(b) Switch S1 should be OFF, switch S2 should be ON, and switches S3 to S5 should be OFF.

(c) Connect a clip lead between test point TP7-C19 (SCRE') and the metal frame.

(d) Condition the KS-16979 test meter to measure 15 volts ac full scale. Connect one meter lead to interface selector switch 16 (DTI) and the other lead to interface selector switch 17 (SCRA).

(e) The voltage indicated on the meter should be a constant between 0 and 13 volts ac.

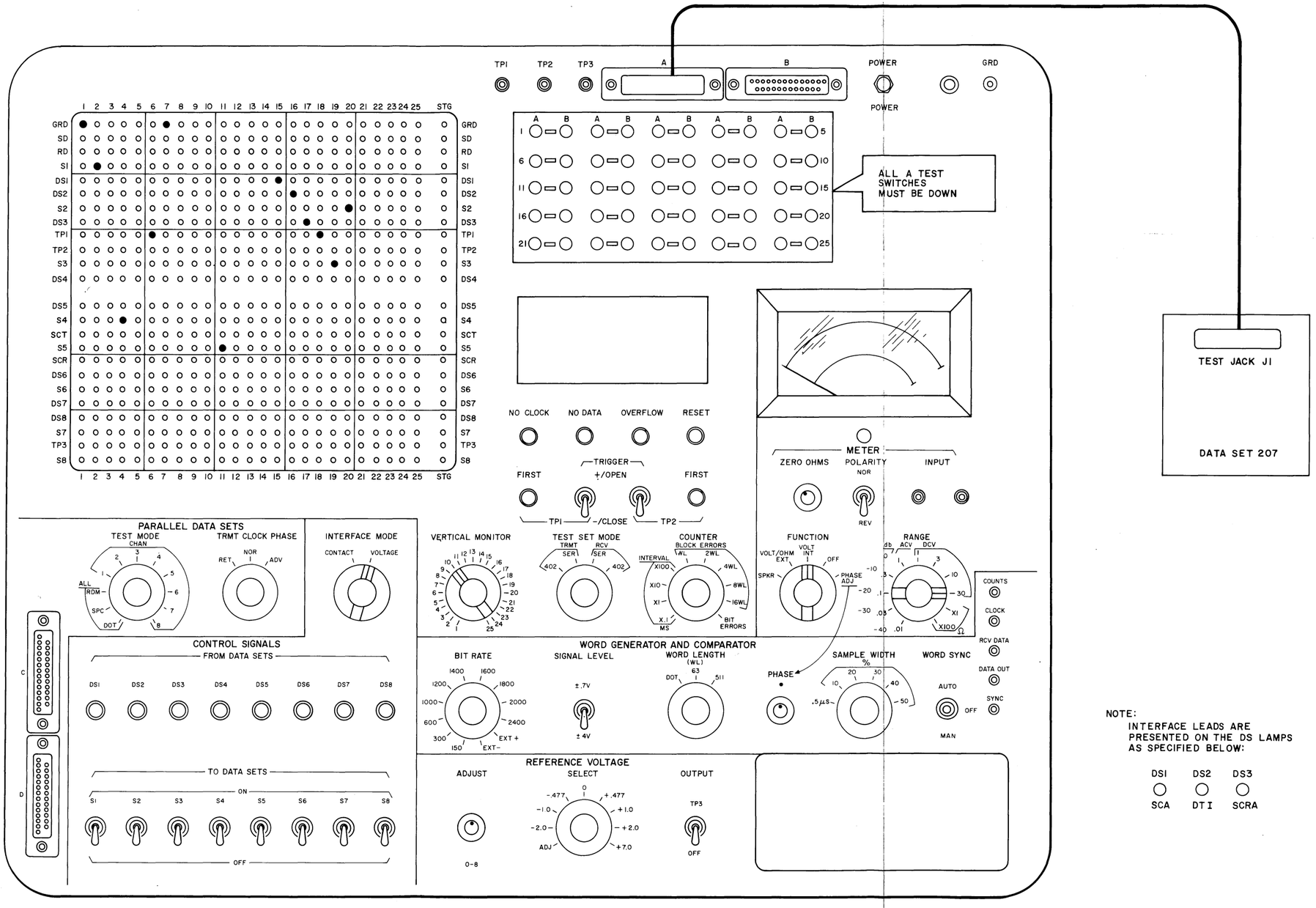
(f) Connect a clip lead between test points TP9-F15 (SXC') and TP3-B01 (E32) on the data set. This causes a delete correction to be made to the transmitter timing chain at every 64-dibit interval.

(g) The indication on the meter should vary continuously between a voltage less than 4.0 and greater than 10.0 volts ac.

(h) Move switch S1 to ON. This applies the 11 code to the SD lead.

(i) The indication on the meter should remain constant and be less than 3.0 volts ac.

(j) Move switch S1 to OFF. The indication on the meter should vary continuously between a voltage less than 4.0 volts ac and greater than 10.0 volts ac.



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

DS1	DS2	DS3
SCA	DT I	SCRA

Fig. 3—Interface Test of Regenerator Data Set

TABLE G

INTERFACE REQUIREMENTS

8.14 STEP	LEAD TESTED	VERTICAL MONITOR SWITCH	SWITCH S1 POSITION	SEND DATA CODE	METER READING DC VOLTS	DS LAMP ON
a	SCA	15	OFF	00	<0.5	
b	DTI	16	OFF	00	<0.5	
c	RD	3	OFF	00	+6.2 (±0.5)	
d	SCRA	17	OFF	00	<0.5	
e	TSS	6	OFF	00	<0.25	
f	Remove clip lead between TP5-B19 (TL) and frame.					
g	TSS	6	OFF	00	+6.2 (±0.5)	
h	RSS2	8	OFF	00	<0.25	
i	Move switch S2 to ON.					
j	RSS2	8	OFF	00	+6.2 (±0.5)	
k	Remove clip lead between TP4-H19 and TP3-C07.					
l	RSS2	8	OFF	00	<0.25	
m	RSS2	8	ON	11	+6.2 (±0.5)	
n	RD	3	ON	11	+6.2 (±0.5)	

(k) On Data Set 207, connect a clip lead between test points TP3-B09 (ST) and TP5-F15 (SCRE'C). This allows the external receiver clock to frequency lock to the transmitter clock.

(l) The voltage indicated on the meter should be a constant between 0 and 13 volts ac.

(m) Remove the clip lead between test points TP3-B09 and TP5-F15 on the data set.

(n) Remove the clip lead between test points TP9-F15 and TP3-B01 on the data set. This causes an add correction to be made to the transmitter timing chain at every 64-dibit interval.

(o) The indication on the meter should vary continuously between a voltage less than 4.0 and greater than 10.0 volts ac.

(p) Move switch S1 to ON. The test meter indication should be a constant voltage less than 3.0 volts ac.

(q) Move switch S1 to OFF. The indication on the meter should vary continuously between a voltage less than 4.0 and greater than 10.0 volts ac.

(r) Connect a clip lead between test point TP3-B09 and TP5-F15 on the data set. The voltage indicated on the meter should be a constant between 0 and 13 volts ac.

(s) Remove all clip leads connected to test points on the data set. Disconnect power to the data set and to the 914B DTS. Disconnect the test meter and remove matrix pins from the 914B DTS.

Back-to-Back Test

8.20 In this test, the data set transmitter is being driven by the 903 DTS. This signal is fed to the data transmitter and then is looped back locally into the receiver. The received data is fed to the 914B DTS where it is compared with a signal generated by the 914B DTS. Any errors in received data are counted on the counter of the

914B DTS. The equipment is set up and the test is performed as follows:

(a) Condition the data set switches as follows:

MODEM LOOP TEST—LINE

BIT RATE switch—2400

LAMP TEST—OFF

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(b) Set up the 914B DTS as shown in Fig. 4.

(c) The 903 DTS switches should be set as follows:

BIT RATE switch to 2400

RANDOM-DOT switch to RANDOM

TRIGGER switch to plus (+).

(d) On the data set circuit board C21-AR161, strap E1 to E2 and G1 to G2. Strap 2 to 3 on all other options.

(e) On the data set circuit board C15-AR152, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12.

(f) Apply power to the data set, to the 914B DTS, and to the 903 DTS. Momentarily depress the START button on the 903 DTS and the RESET button on the 914B DTS. The counter on the 914B DTS will indicate zero errors. Momentarily switch the WORD LENGTH switch to DOT. The counter will count rapidly. Move the WORD LENGTH switch back to 63 and depress the RESET button.

(g) Allow the test to continue for five minutes. No errors should be recorded. If an error count is indicated, replace the data set. If the test results are satisfactory, disconnect power and disconnect the test equipment. Restore options in the data set as required by the service order before releasing the data set for normal operation.

B. End-to-End Test

8.21 If possible, it is desirable to make an end-to-end test with a distant data station. This test checks the operation of the data set and also tests the condition of the data transmission facilities connecting the two data sets. If the data set has been tested, is in good operating condition, and errors are detected during an end-to-end test, the transmission facilities should be tested.

8.22 Identical test equipment is used at both data stations. The data transmitter is driven by the word generator in the 914B DTS. This signal is transmitted to the distant data station which is equipped with a word generator and comparator. The received signal is compared with the locally generated signal and any errors are indicated on the counter. To test the second direction of transmission, the distant data station transmits and the local data station receives and counts errors.

8.23 Set up the equipment as follows:

(a) Remove power to the data set.

(b) Condition the data set switches as follows:

MODEM LOOP TEST—OFF

BIT RATE—2400

TERMINAL—NORMAL

SENSOR OUTPUTS—AUTO.

(c) On data set circuit board C21-AR161, strap E1 to E2 and G1 to G2. Strap 2 to 3 on all other options.

(d) On data set circuit board C15-AR152, strap 1 to 2, 5 to 6, 7 to 8, and 11 to 12.

(e) Strap circuit board G03-AR159 as indicated on the service order.

(f) Check to see that interface adapters A1 and A2 are inserted into their respective connectors on the rear of the data set.

(g) Set up the 914B DTS at the transmitting end as shown in Fig. 5.

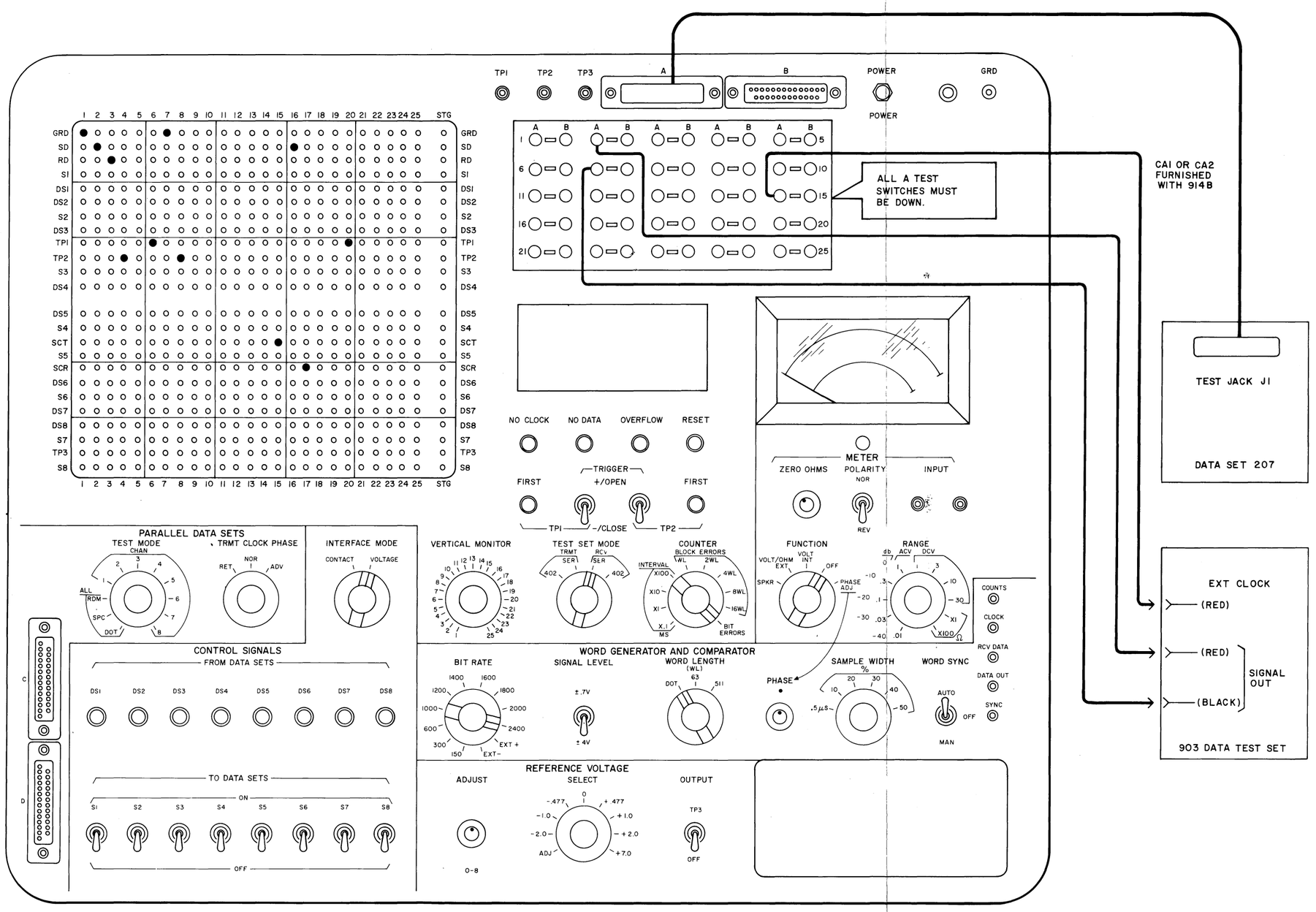


Fig. 4—Back-to-Back Test of Regenerator Data Set

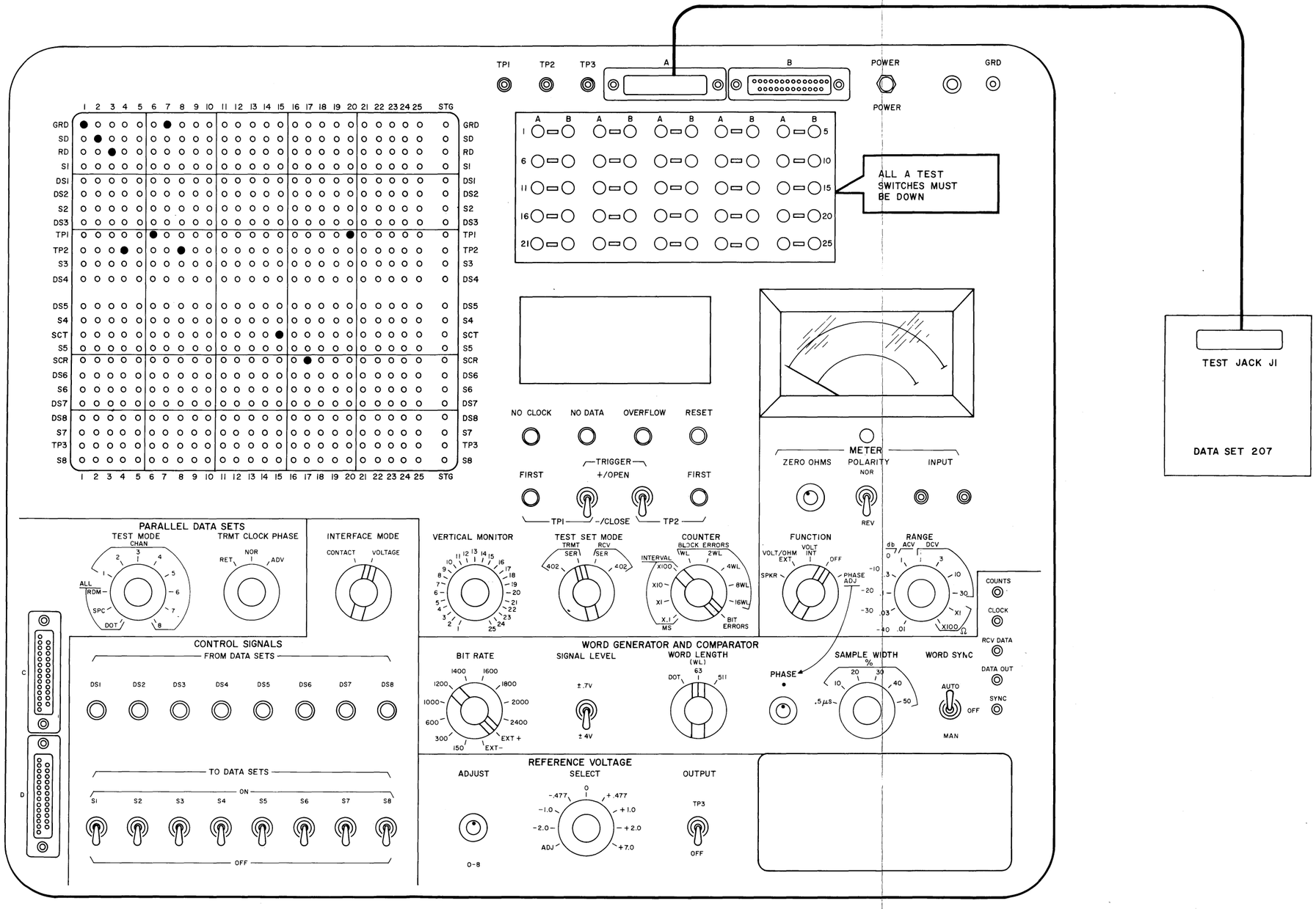


Fig. 5—End-to-End Test of Regenerator Data Set

Note: Arrange the 914B DTS at the receiving end the same as at the transmitting end, except that the TEST SET MODE switch must be in the REC SER position.

8.24 Apply power to the data set and to the 914B DTS. Depress the RESET button. The counter should read zero errors. Allow the test to continue for five minutes, note the indicated error count, and press the RESET button. Conduct this test for three consecutive 5-minute intervals. The error rate can be considered average if a total of 20 errors is recorded for the three test periods. If the error count approaches 100 for the three test periods, the parameters of the line should be checked in accordance with the section entitled Private Line Data Circuits, Voice Bandwidth Circuits for Miscellaneous Data, Overall Tests and Requirements (314-410-500). If the line requirements are met, refer to the Plant Staff through lines of organization. If the above tests are satisfactory, disconnect power from the data set and 914B DTS.

8.25 Disconnect the 914B DTS from the data set. Restore original options in the data set as required by the service order before releasing it for normal operation.

C. Trouble Location

8.26 This section is provided to indicate the following:

(a) Which printed circuit boards or apparatus should be replaced to clear a trouble condition.

(b) Which readily performed maintenance procedures, if any, should be employed to clear a trouble condition. A trouble condition in the context of this section is defined to be a failure to obtain the required test results during the performance of the Installation and Maintenance Tests using the 914B DTS.

8.27 The procedure for clearing a trouble condition is as follows:

(a) Find the number in 3.73 which corresponds to the paragraph of the Installation and Maintenance Tests using the 914B Data Test Set for which the required test results are not obtained.

(b) The code and equipment location of the circuit boards or the apparatus that provide the function under test is listed under the appropriate paragraph number. When applicable, maintenance procedures referred to in 3.71 (b) are also listed.

(c) If the circuit board equipment locations are entered in Table C, use the meter on the 914B DTS to check for the proper dc voltage on the indicated test points. Use the external INPUT terminals and the leads provided with the 914B DTS. Set the FUNCTION switch to VOLT/OHM EXT and set the RANGE switch for the voltage to be measured.

(d) If the required indication in Table C is not obtained, replace the circuit board and repeat the test that failed originally.

Caution: Always be careful when removing, inserting, or handling the printed wiring boards. NEVER remove or insert a printed wiring board unless power is removed from the data set or the power unit (except for AR161 in location C21 which may be removed and inserted without disconnecting power). Replace clip leads on test points when circuit boards are replaced. Replacement boards containing strapping options should be strapped the same as the original boards.

(e) When a replacement board or a maintenance procedure apparently corrects a trouble, retest the data set by either starting at 8.08 of the Installation and Maintenance Tests or by repeating the REMOTE TEST to be sure a new or different failure has not developed. Always tag the suspected board so that it may be identified and returned for repair.

(f) If the correct dc voltage is obtained in (c), replace the first board listed in Table C with one known to be good. Keep the original board separate and apart from the other test boards.

(g) Repeat the test that failed originally.

(h) If the test still fails, replace the original board into the original location and repeat (f) and (g) for the next board listed.

(i) If the trouble cannot be cleared by replacing the listed circuit boards or by performing maintenance procedures, replace the data set.

8.28 The following list provides correlation between the Installation and Maintenance Tests and the printed circuit boards and/or apparatus which provide the function under test. When applicable, maintenance procedures are also listed.

8.08 (b)—CP1-AR215 of 32A1 power unit (or 32B1 if it is used). Replace the power unit if the trouble cannot be cleared.

8.08 (d)—CP2-AR216 of 32A1 power unit (or 32B1 if it is used). Replace the power unit if the trouble cannot be cleared.

8.09 (b)—Replace the power unit.

8.10 (b)—Replace the lamp. If the lamp checks OK, test to see that −48 vdc is applied by an external source between interface lead 48CO and COGD by using the following procedure:

(1) Condition the test meter to read 150 vdc full scale.

(2) Connect the negative test lead to terminal X7 or Y7 (48CO) on interface adapter A2. Connect the positive test lead to terminal X8 or Y8 (COGD) on interface adapter A2.

(3) The voltage should be 48.0 (±5.0) vdc.

(4) If (1), (2), and (3) test OK, replace CU1-G01.

8.11 (i)—A03-AR10, B01-AR10, A15-AR4, B13-AR10, B09-AR10, B07-AR9, B05-AR10, B03-AR9, C09-AR10, C07-AR9, D01-AR147 (if provided), D03-AR147 (if provided), D06-69A OSC or AR160

8.11 (j)—G21-AR10, G15-AR10, G19-AR10, G17-AR9

8.11 (k)—A01-AR9, G03-AR159, C21-AR161 (Check for required straps.), C07-AR9, C15-AR152, A07-AR9

8.11 (l)—G03-AR159, C07-AR9, C13-AR158

8.11 (n)—C07-AR9, A01-AR9, A07-AR9, G17-AR9, C13-AR158, A07-AR9, A05-AR9, A03-AR10, C11-AR158, C07-AR9, G03-AR159

8.11 (o)—A01-AR9, C07-AR9, C11-AR158, A07-AR9, H07-AR151, H05-AR169, A05-AR9, A03-AR10

8.11 (p)—Same as 8.11 (o) plus G03-AR159

8.11 (q)—A01-AR9, C07-AR9, A05-AR9, A07-AR9, C13-AR158

8.11 (r)—A07-AR9, A03-AR10, A05-AR9, A15-AR4, C11-AR158

8.11 (s)—G01-CU1, G09-AR170

8.13 (f)—G03-AR159

8.13 (h)—G03-AR159

8.14 (a)—C19-AR148, B07-AR9, B17-AR9, C21-AR161 (Check for required strapping before replacing.)

8.14 (b)—C19-AR148, G03-AR159, A05-AR9

8.14 (c)—C15-AR152, C07-AR9, C21-AR161 (Check for required strapping before replacing.), A07-AR9, E07-AR10, H19-AR162, H07-AR151, H09-AR168, H15-AR153, B07-AR9, B19-AR3

8.14 (d)—C17-AR148, C21-AR161 (Check for required strapping before replacing.), C09-AR10, E03-AR10, E01-AR10, E07-AR10, E05-AR9, F19-AR9, E13-AR9, G17-AR9

8.14 (e)—C11-AR158, H05-AR169, H07-AR151, G03-AR159, B19-AR3

8.14 (g)—Same as 8.14 (e)

8.14 (h)—C11-AR158, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, F17-AR9, F01-AR5, F05-AR6

8.14 (j)—C11-AR158, C07-AR9, G09-AR170, G07-AR150, C21-AR161 (Check for required strapping before replacing.), H19-AR162, H07-AR151, H09-AR168, H15-AR153, H19-AR162, B07-AR9, F17-AR9, F01-AR5, F05-AR6, G01-CU1 (should be conditioned for regenerator operation), G03-AR159, G07-AR150, G09-AR170, C07-AR9, B15-AR10, B13-AR10, B11-AR9, B07-AR9, B17-AR9, A01-AR9, C05-AR149, C03-AR9, F15-AR4

8.14 (l)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E05-AR9, B15-AR10, B07-AR9, B17-AR9, B15-AR10, B13-AR10, B11-AR9, A01-AR9

8.14 (m)—C07-AR9, E07-AR10, E21-AR9, E19-AR10, E17-AR9, E13-AR9, E15-AR10, E11-AR9,

E09-AR10, E05-AR9, E03-AR10, F17-AR9, F15-AR4, F07-AR1, F11-AR1, F01-AR5, F05-AR6, B19-AR3, B15-AR10, B17-AR9, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

8.14 (n)—C15-AR152, C07-AR9, C05-AR149, C03-AR9, C09-AR10, B07-AR9, F19-AR9, B17-AR9, F17-AR9, F15-AR4, E03-AR10, E05-AR9, E07-AR10, B19-AR3, B15-AR10, B13-AR10, B11-AR9, B07-AR9, A01-AR9, C05-AR149, C03-AR9

8.15 (c)—G09-AR170, C07-AR9, C11-AR158, G07-AR150, G01-CU1

8.15 (d)—Same as 8.15 (c)

8.15 (e)—Same as 8.15 (c)

8.16 (a)—G03-AR159, C07-AR9, C13-AR158

8.16 (c)—Visually inspect relays K3 and K1 for bent springs, contacts, etc.

8.17 (e)—C21-AR161 (Check for required strapping before replacing.), E21-AR9

8.17 (f)—Same as 8.17 (e)

8.18 (c)—C19-AR148, B07-AR9, B17-AR9, C21-AR161 (Check for required strapping before replacing.)

8.18 (d)—Same as 8.18 (c) and test that the customer is providing timing on interface lead SCRE. One way to determine this is as follows:

(a) Connect the negative meter test lead to the metal frame of the data set and the positive test lead to test point TP8-C17.

(b) Condition the meter to read 12 vdc full scale. The voltage should be less than 0.5 vdc.

(c) Condition the meter to read 12 vac full scale. The voltage should be 6.2 ($\pm$2.0) vac.

8.19 (e)—B03-AR9, B01-AR10, B07-AR9, B09-AR10, B05-AR10, E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9, F17-AR9, F15-AR4, G21-AR10, G19-AR10, G17-AR9, G15-AR10

8.19 (g)—F15-AR4, B01-AR10, B03-AR9, B07-AR9, B11-AR9, B13-AR10

8.19 (i)—E01-AR10, E03-AR10, E05-AR9, E07-AR10, E09-AR10, E11-AR9, E13-AR9, E15-AR10, E17-AR9, E19-AR10, E21-AR9

8.19 (j)—Same as 8.19 (i)

8.19 (k)—G21-AR10, G19-AR10, G17-AR9, G15-AR10, F17-AR9, F15-AR4

8.19 (o)—Same as 8.19 (g)

8.19 (p)—Same as 8.19 (i)

8.19 (q)—Same as 8.19 (j)

8.19 (r)—Same as 8.19 (k)

8.20 Replace the data set.