913A DATA TEST SET
DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section describes the 913A Data Test Set (parallel adapter) physically and functionally. The test set is used to test 402-type data systems and type 5 DATASPEED® services. Systems employing Data Sets 401-type may also be tested when the 913A Data Test Set is used in conjunction with an interface adapter such as the 901B Data Test Set. Typical test connections are illustrated, but for detailed connections and operations in testing a particular data system, refer to the test section for that service. This section also contains instructions for testing and maintaining the 913A Data Test Set. For a more detailed description of the functions of the test set, refer to CD- and SD-73048-01.

1.02 This section is reissued to revise the testing procedure and to make minor changes in the text. The title has been changed to agree with the standard format of Bell System Practices. Due to the amount of changes, arrows have been omitted.

2. DESCRIPTION

GENERAL DESCRIPTION

2.01 The 913A Data Test Set is a test set which, by acting as a parallel adapter, permits dynamic testing of low-speed parallel data systems with serial-type test sets (Fig. 1). The test set provides the following functions.

(a) ***Transmitter:***

(1) At the transmit station, it converts a single serial voltage interface signal from a 903-type Data Test Set into eight contact closure interface signals for input to Data Sets 402-type.

(2) It supplies timing for Data Set 402-type.

(3) It provides necessary control functions to condition Data Set 402-type for transmitting.

(4) It provides visual indications for monitoring the control circuits of Data Set 402-type.

(5) It provides capability for testing of answer-back and reverse-channel features of the Data Set 402-type system under test.

(b) ***Receiver:***

(1) At the receiving station, it converts contact closure interface signals from the data set to Electronic Industries Association (EIA) voltage interface signals and supplies these signals to 902-type Data Test Sets for comparison with local 63-bit word or dot signals generated by 903-type Data Test Sets.

(2) It makes the following two comparisons.

- It compares all eight data channels of a Data Set 402-type simultaneously with a locally generated word and causes character errors (one or more bit errors per character)

to be counted by the 902-type Data Test Sets.

- It permits comparison of the output of each of the eight data channels with a locally generated word and causes bit errors in that channel to be counted on the 902-type Data Test Sets.

(3) It supplies a clock signal which it has converted from contact closure to EIA voltage to trigger the 902-type Data Test Sets when testing a data service.

(4) It provides visual indications for monitoring the control circuits of the Data Set 402-type system under test.

(5) It provides capability for testing the answer-back and reverse-channel features of the Data Set 402-type system under test.

2.02 The test set is made of two integral units —the control circuitry and power supply unit J79913A, and the transmit and receive unit J79913AA. The J79913AA is a plug-in unit.

2.03 The test set will operate within a temperature range of 40 to 120°F and in a relative humidity range of 20 to 94 percent.

2.04 The test set will operate on a power source which provides 18 watts of 117-volt, 60-Hz ac power from a 3-wire ac outlet.

PHYSICAL DESCRIPTION

2.05 The 913A Data Test Set is enclosed in a dark gray case and has dimensions as shown in Fig. 2. It weighs 9 pounds.

2.06 To gain access to the dials and indicators, remove the data test set cover by releasing the latches and removing the cover (Fig. 2). This cover provides storage for cable ED 73243.

2.07 The front panel (Fig. 3), part of J79913A, is gray anodized aluminum and has switches, terminal jacks, and lamps. Each of the switches, terminal jacks, and lamps is designated according to its respective function. The other front panel, part of J79913AA, is also gray anodized aluminum and has the interface plugs and switches to condition the signals to be tested. On the rear of this panel are two circuit boards—CP1, which is the transmitter board, and CP2, which is the receiver board.

3. FUNCTIONAL DESCRIPTION

3.01 Functionally, the 913A Data Test Set is composed of four basic circuits which are power supply, control circuitry, transmit circuitry, and receive circuitry (Fig. 4).

(a) ***Power Supply:*** The power supply converts 117-volt, 60-Hz ac into two regulated 12-volt dc outputs. The outputs are connected directly to the control circuit and through internal connector J1 to the transmit and receive data circuits.

(b) ***Control Circuitry:*** All interface control leads of Data Set 402-type are under the control of appropriately designated switches of the control circuitry. The control circuitry makes it possible for signals from the data set interface control leads to operate the appropriately designated lamps of the test set.

(c) ***Transmit Circuitry:*** The transmit portion of the data test set supplies a clock of 75 bps to a transmitting data set and 903-type Data Test Set. At the 75-bps rate, the test set can advance or retard the Data Set 402-type timing by 1.5 msec. Clock rates of 10 bps and 20 bps are provided for testing Data Sets 401- and 403-type. At the transmitting station, the transmit circuitry converts the voltage interface signal (EIA) of the 903-type Data Test Set to contact closure interface signals for compatibility between the 903-type Data Test Set and Data Set 402-type.

(d) ***Receive Circuitry:*** At the receiving station, the receiving circuitry converts the contact closure timing channel signal of the receiving Data Set 402-type to bipolar voltage interface signals to drive the 902- and 903-type Data Test Sets. The receiver circuitry can compare the eight data channels of a receiving Data Set 402-type with a locally generated word and cause a single error to be counted on a 902-type Data Test Set for each bit interval, when one or more channels differ from the local word. The circuitry also permits any single channel to be selected for comparison with the local word by the 902-type Data Test Set.

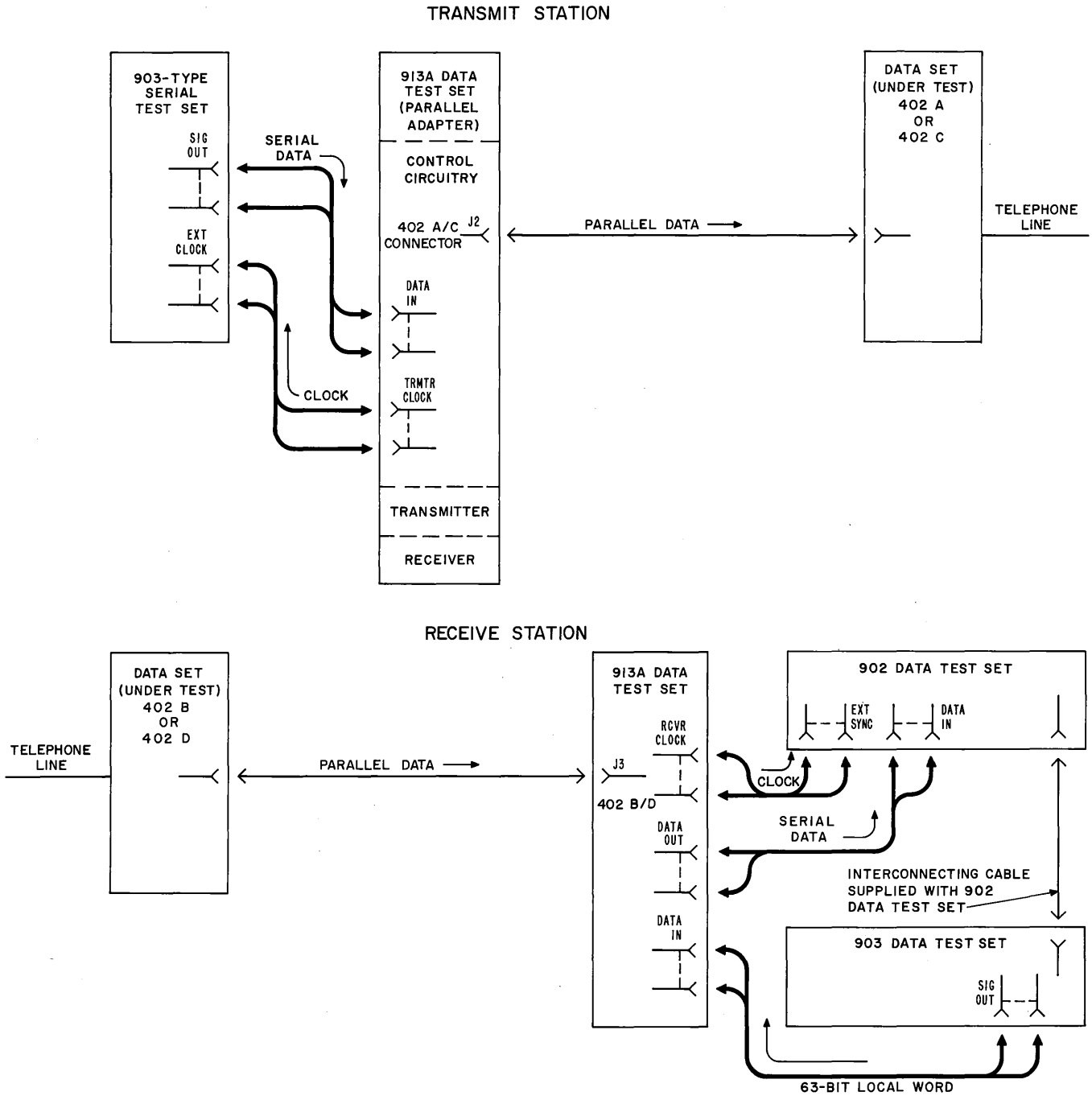

Fig. 1—Connection Diagram for End-to-End Testing of Low-speed Parallel Data Systems Using Serial Data Test Sets in Conjunction With a Parallel Adapter (913A Data Test Set)

3.02 ***Transmitter:*** The transmit data circuitry contains a timing generator, timing channel generator, timing amplifier, data channel dotting generator, TEST MODE switch, and channel output drivers (Fig. 5).

(a) The timing generator is a multivibrator under the control of the TRMTR CLOCK switch which provides speeds of 10, 20, and 75 bps for testing Data Sets 401-, 402- and 403-type. The TRMTR CLOCK switch provides three

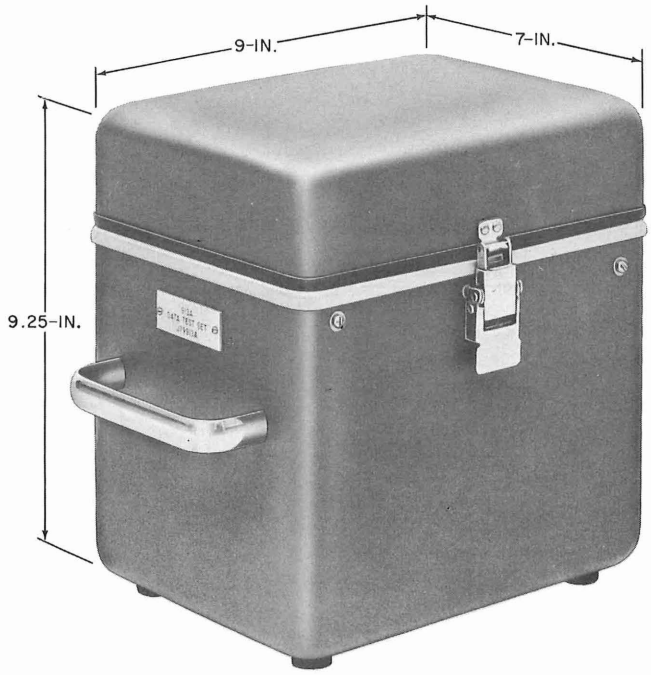

Fig. 2—913A Data Test Set (Parallel Adapter), Front View

positions at the 75-bps speed (retarded, normal, and advanced) to vary the phase of the timing channel with respect to the data channels of Data Set 402-type.

(b) The timing channel generator converts a signal received from the timing generator to an alternate mark-space dotting signal, which is required for keying the Data Set 402-type timing channel. This signal can be advanced or retarded by 1.5 msec at 75 bps with respect to the data signals presented to Data Set 402-type.

(c) The timing amplifier accepts the output of the timing channel generator, inverts the signal, and converts it into an EIA voltage output which is supplied to the TRMTR CLOCK output terminals of the test set.

(d) The data channel dotting generator is a binary counter which converts the data channel timing signal of the timing generator to a dotting signal. The phase of the generated dotting signal is maintained opposite the dotting signal generated by the timing channel generator. The output of the data channel dotting generator is applied to the data channel output drivers selected by the TEST MODE switch.

(e) The TEST MODE switch controls the test modes of the test set transmitter and receiver circuits. At the transmitter, two basic transmitting test modes plus two special purpose test modes are provided.

(1) To test all eight channels individually or simultaneously, position the TEST MODE switch to ALL RDM. This action compares all the data channel outputs to the signal supplied by 903-type Data Test Set.

(2) For a test of interaction between other data channels and any single data channel, position the TEST MODE switch to the desired channel indicated CHAN 1, 2, 3, 4, 5, 6, 7, or 8. This action connects the channel to be tested to the DATA IN terminals of the 913A Data Test Set to which the 903-type Data Test Set 63-bit word output is connected. The remaining channels are fed by the dotting generator. As a result, the channel under test changes state randomly with respect to the adjacent channels.

(3) Positioning the TEST MODE switch to ALL SPC provides one of the special purpose modes. This mode provides constant spacing on all data channels. This mode is required to condition the Data Set 402-type receiver prior to the transmission of valid data.

(4) The second special purpose mode is provided by positioning the TEST MODE switch to the ALL DOT mode. This mode provides a dotting signal to all channels by the channel dotting generator.

(f) The channel output drivers 0D0 through 0D8 convert EIA signals produced by the 913A Data Test Set and 903-type Data Test Set into a contact closure-type output and provide the proper capacitance and resistance to match the Data Set 402-type. The output drivers are resistively loaded in order to test data set performance under a marginal condition.

3.03 ***Receiver:*** The receiver data circuitry (Fig. 6) contains two contact to voltage converters, a receiving TEST MODE switch, a character error

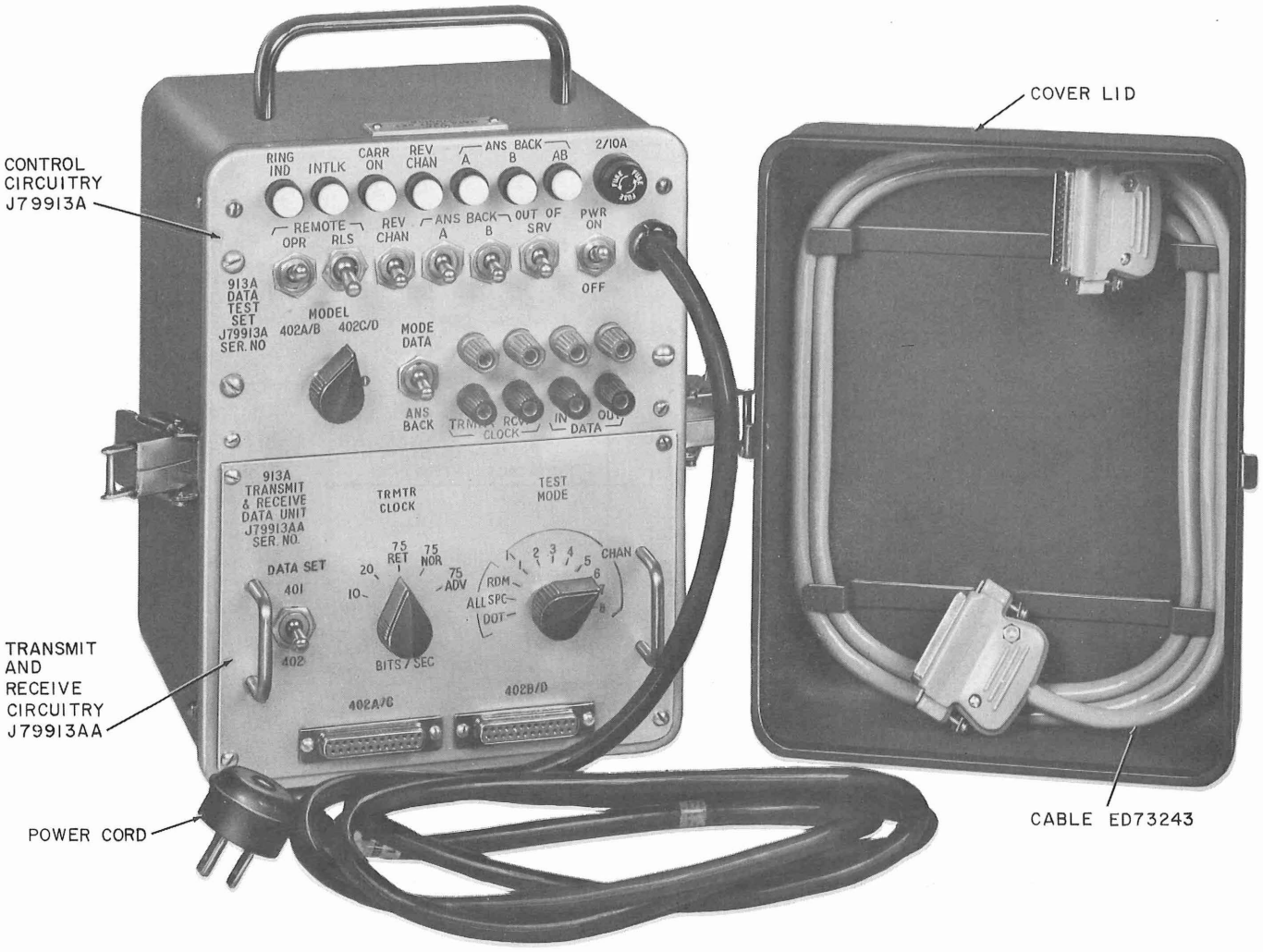

Fig. 3—913A Data Test Set, Component Complement

detector, and a monopulser which is under control of the DATA SET switch.

(a) When a 402-type Data System is tested, the timing channel converts a contact closure output from the data set into an EIA voltage output which appears at the 913A Data Test Set RCVR CLOCK terminals.

(b) The receive data circuits of the 913A Data Test Set are arranged by the TEST MODE switch to provide use of two basic test modes—individual channel testing (CHAN 1 through CHAN 8), and all-channel testing (ALL RDM).

(1) ***To Test All Eight Channels Simultaneously:*** When the TEST MODE switch is positioned to the ALL RDM position at both the transmit and receive stations, all eight data channels are connected to the character error detector. The detector output is fed to the converter where it is converted into EIA interface voltage and passed through the DATA OUT terminals to the 902-type Data Test Set. If the words are not alike, errors are passed to the DATA OUT terminal and to the 902-type Data Test Set where the errors are counted.

(2) ***To Test a Single Channel:*** The 63-bit word or dot signal must be sent from the transmitting station on the channel being

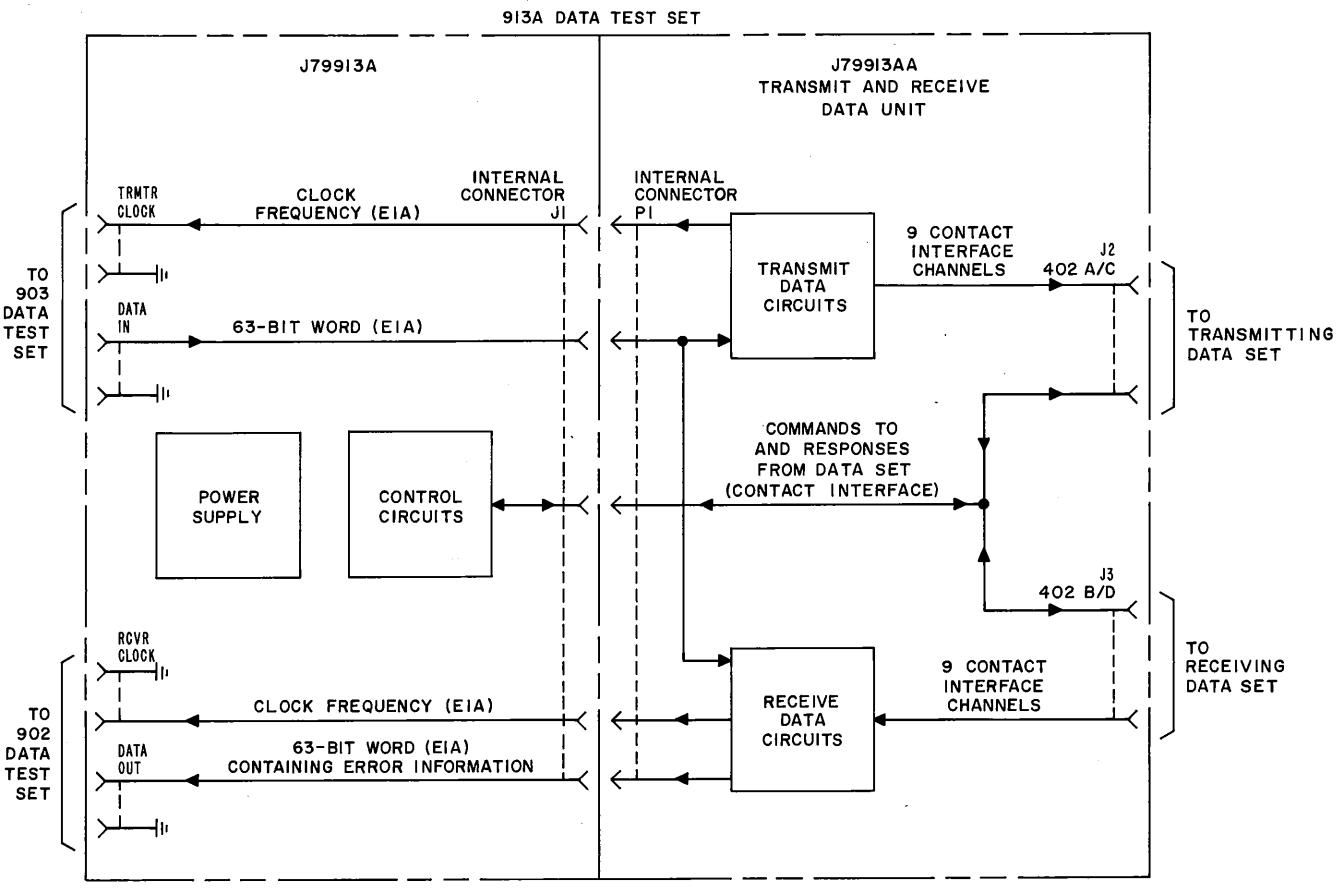

Fig. 4—Functional Block Diagram of 913A Data Test Set (Parallel Adapter)

tested. The transmitting TEST MODE switch may be positioned to the channel being tested or to the ALL RDM position. The channel selected is converted from contact closure signals into EIA voltage signals by the receiving test set converter. The output of the converter is supplied to the 902-type Data Test Set for comparison with the locally generated word through the DATA OUT terminal.

4. OPERATION

4.01 Figure 1 illustrates connections for a typical end-to-end test using the 913A Data Test Set. Refer to the test section of the particular data service being tested for connections of a particular data set.

4.02 Refer to Fig. 7 and Table A for a functional description of the 913A Data Test Set, toggle switches, and lamps.

4.03 Refer to Fig. 8 and Table B for a functional description of the 913A Data Test Set, rotary switches, terminals, and fuse.

5. DATA TEST SET TESTING

5.01 The following test should be performed on the 913A Data Test Set if trouble is suspected or at least once a year. The following equipment is needed for this test:

- One KS-14510 Multimeter
- Two 903-type Data Test Sets (a transmitter and a receiver)
- One 902-type Data Test Set
- One 913A Data Test Set to be tested
- One 901B Data Test Set cover (interface adapter).

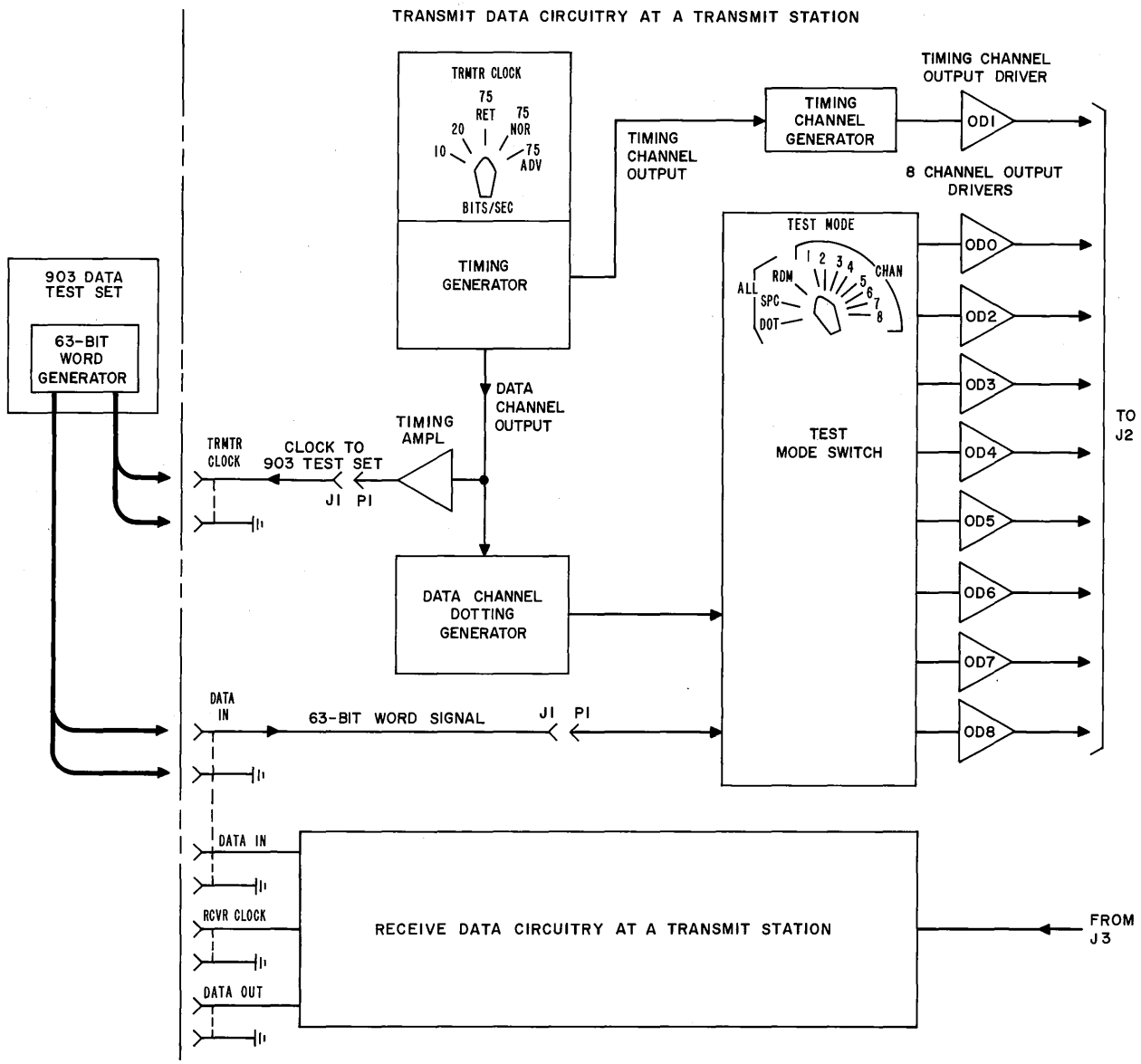

Fig. 5—Functional Block Diagram of the Transmit Data Circuitry of the 913A Data Test Set

5.02 ***Procedure:***

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

(a) Before connecting the test sets for the test, positon the switches on the 913A Data Test Set as follows:

MODEL switch—402A/B

REMOTE OPR switch—Down

REMOTE RLS switch—Down

REV CHAN switch—Down

ANS BACK A switch—Down

ANS BACK B switch—Down

OUT OF SRV switch—Down

MODE switch—ANS BACK.

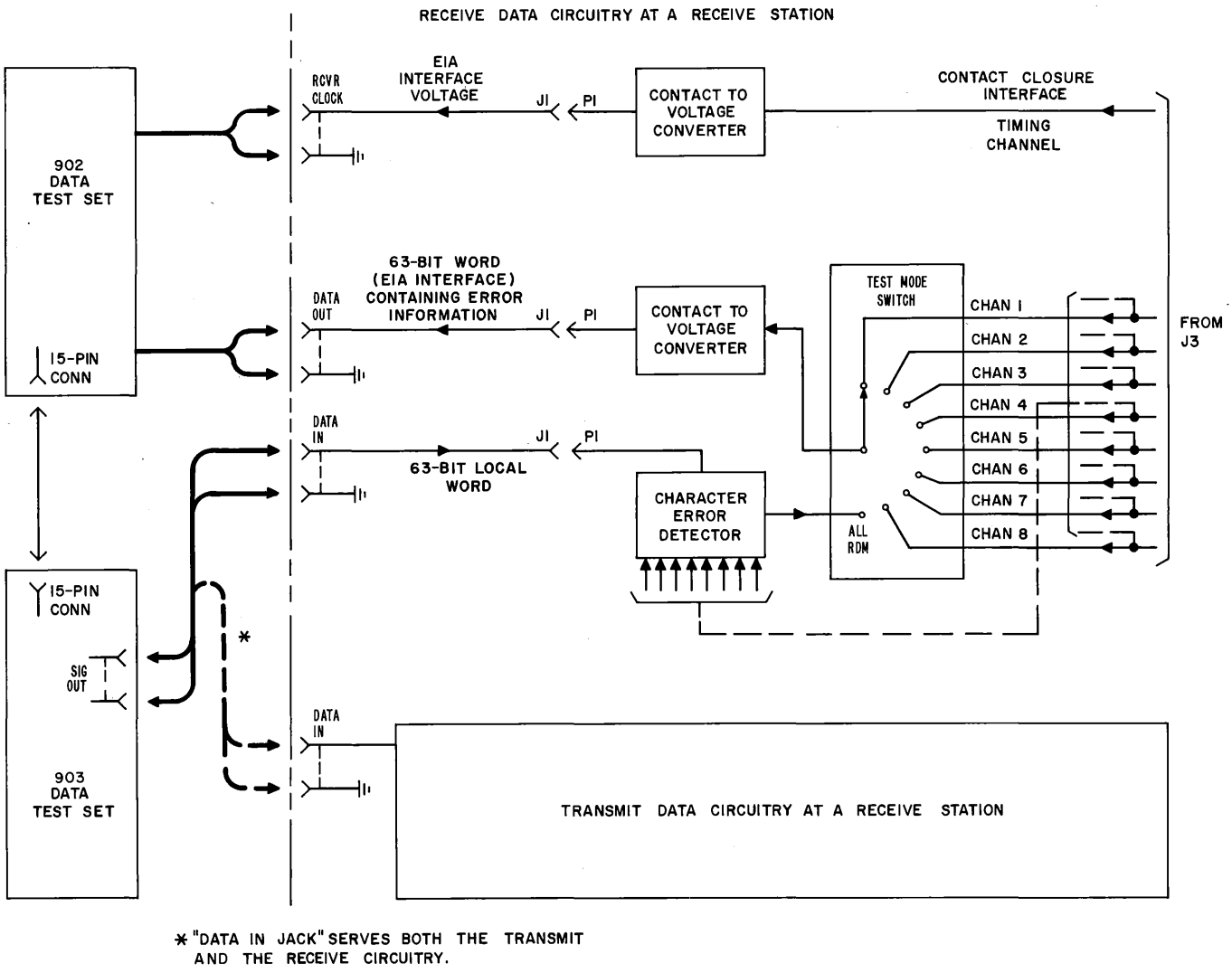

Fig. 6—Functional Block Diagram of the Receiver Circuitry of the 913A Data Test Set

(b) Interconnect the data test sets as shown in Fig. 9, and perform the steps in Table C. Verify that all links of 901B test adapter are secure and that no additional straps are connected.

6. MAINTENANCE

6.01 No field maintenance should be attempted on the 913A Data Test Set, with the exception of lamp and fuse replacement. If the test malfunctions, complete the return card and return it to the local distributing house as local arrangements permit.

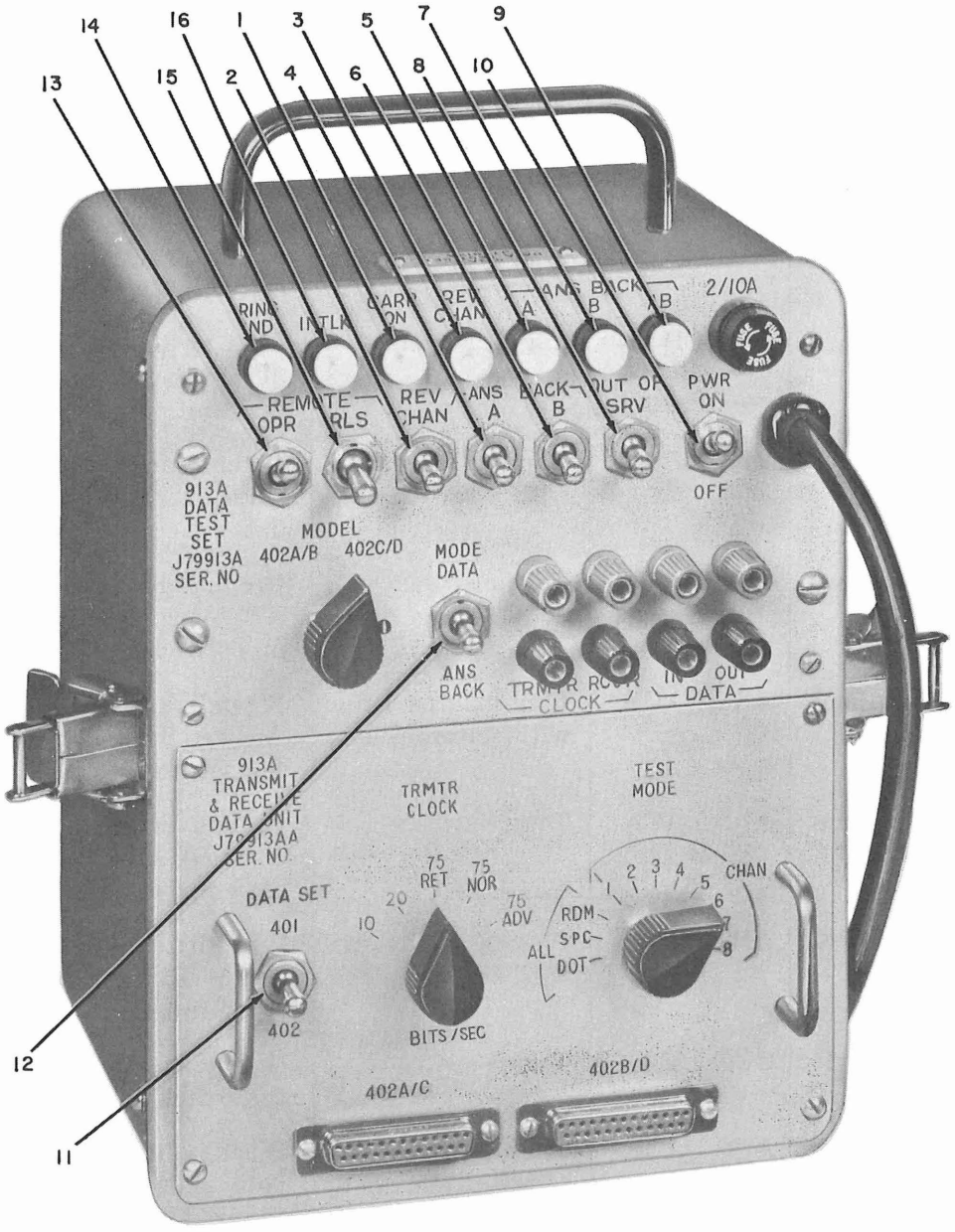

Fig. 7—913A Data Test Set, Toggle Switch, and Lamp Functions

TABLE A

913A DATA TEST SET, TOGGLE SWITCH, AND LAMP FUNCTIONS

KEY TO FIGURE	CONTROL OR INDICATOR	APPARATUS DESIGNATION	TYPE	FUNCTION
1	Carrier On lamp	CARR ON	Plug-in type lamp with screw-on lens	When lighted, this lamp indicates that an all space code or data is being received by the data set.
2	Reverse-Channel	REV CHAN	Toggle switch	This switch energizes the Data Set 402D reverse-channel and causes it to transmit.
3	Reverse-Channel lamp	REV CHAN	Plug-in type lamp with screw-on lens	When lighted, this lamp indicates reverse-channel is being received by the data set.
4	Answer-Back A switch	ANS BACK A	Toggle switch	Ground is applied to (Answer-Back A) AB-A lead when the switch is in the up position.
5	Answer-Back A lamp	ANS BACK A	Plug-in type lamp with screw-on lens	When lighted, this lamp indicates that Answer-Back A is being received by the data set.
6	Answer-Back B switch	ANS BACK B	Toggle switch	Ground is applied to the (Answer-Back B) AB-B lead when switch is in the up position.
7	Answer-Back B lamp	ANS BACK B	Plug-in type lamp with screw-on lens	When lighted, this lamp indicates that Answer-Back B is being received by the data set.
8	Out of Service	OUT OF SRV	Toggle switch	Ground is applied to the OS lead when the switch is in the up position.
9	Answer-Back AB lamp	ANS BACK AB	Plug-in type with screw-on lens	When lighted, this lamp indicates that both Answer-Back A and B are being received by the data set.
10	Line Power switch	ON-OFF	Toggle switch	This switch supplies and removes ac power to the data test set.
11	Data Set Selector switch	DATA SET 401 402	Toggle switch	This switch adapts the timing circuit for Data Set 401 in order that these systems may be tested. *Note:* The 401 position of this switch is to be used only when the Data Set 401-type is properly interfaced with a 901-type Data Test Set (interface adapter).

TABLE A (Cont)

KEY TO FIGURE	CONTROL OR INDICATOR	APPARATUS DESIGNATION	TYPE	FUNCTION
12	Data set MODE switch	MODE DATA ANS BACK	Toggle switch	This switch selects the mode of operation (forward data transmission or transmission of Answer-Back signal) of the data sets. This switch must be in the same mode at the transmit and receive station for operation.
13	Remote Operate switch	REMOTE OPR	Toggle switch	This switch enables the unattend-answer feature of Data Sets 402C and 402D.
14	Ring Indicator lamp	RING IND	Plug-in type lamp	This lamp lights when the data set detects ringing.
15	Remote Release	REMOTE RLS	Spring loaded toggle switch	This switch terminates calls on Data Sets 402C and 402D.
16	Interlock lamp	INTLK	Plug-in type lamp with screw-on lens	This lamp is lighted when the data set is in the data mode.

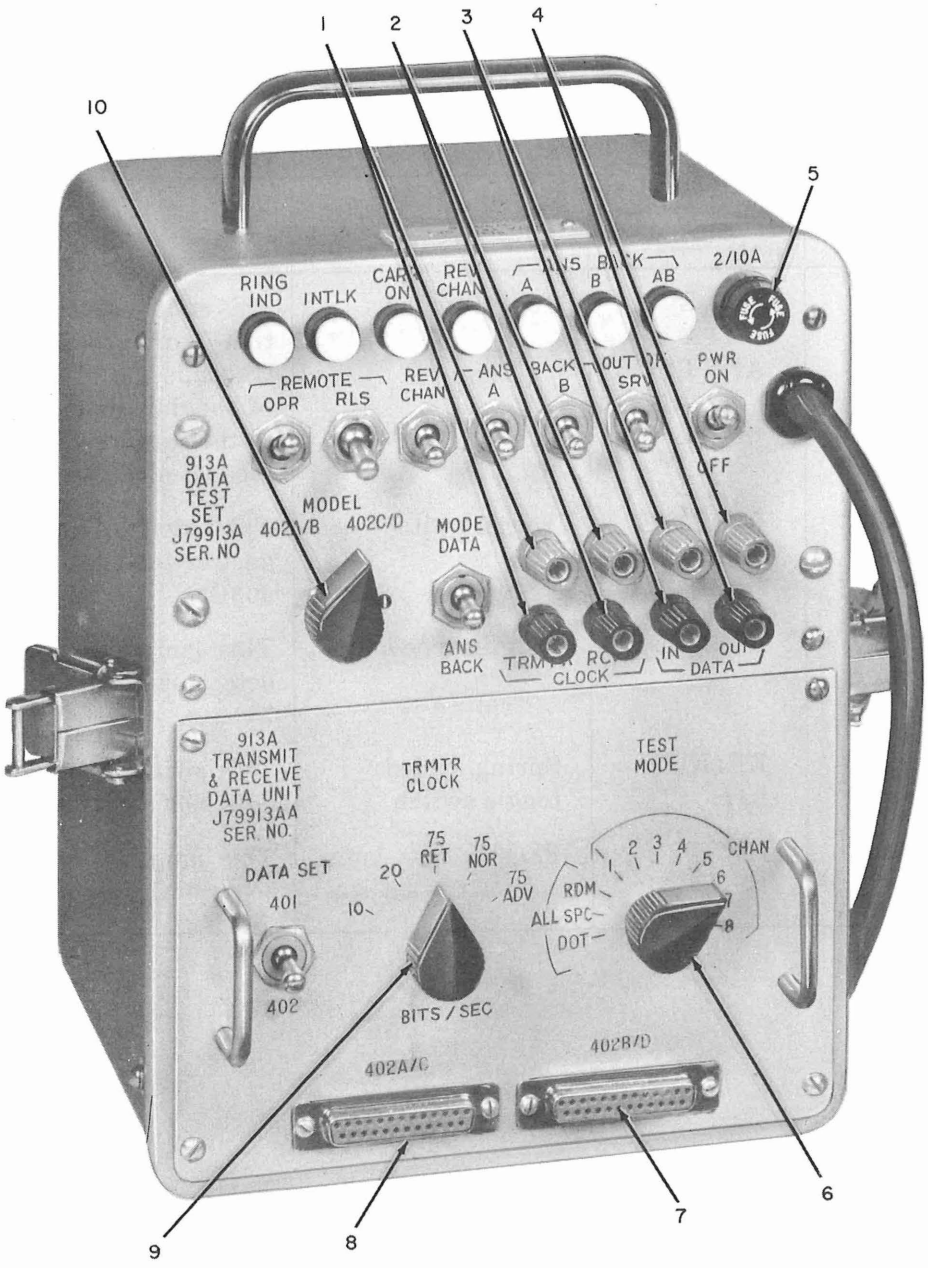

Fig. 8—913A Data Test Set—Rotary Switch, Terminals, and Fuse Functions

TABLE B

KEY TO FIGURE	CONTROL OR INDICATOR	APPARATUS DESIGNATION	TYPE	FUNCTION
1	Transmitter Clock Terminal	TRMTR CLOCK	Terminal posts	This is the output for the transmitter timing generated by 913A Data Test Set.
2	Receiver Clock Terminal	RCVR CLOCK	Terminal posts	This is the output for the clock signals received by the data set receiver.
3	Data Input Terminal	DATA IN	Terminal posts	This is the input for signals from 903-type Data Test Set. The test set sends signals in accordance with RCVR or TRMTR clock.
4	Data Output Terminal	DATA OUT	Terminal posts	This is the output that is to be examined by 902-type Data Test Set.
5	Fuse	2/10A	Slo-Blo type fuse	This is the 2/10 amp line fuse which affords protection from line surges.
6	Test Mode switch	TEST MODE	Rotary switch	This switch selects the data to be transmitted by the eight data channels, and allows the same channels to be selected on the receive channel to be tested.
7	Jack	402 B/D J3	25-pin sub miniature type	This connector provides proper interface connections for Data Set 402B or 402D (receivers).
8	Jack	402 A/C J2	25-pin sub miniature type	This connector provides proper interface connections for Data Set 402A or 402C (transmitters).
9	Transmitter Clock	TRMTR CLOCK	Rotary switch	This switch selects the timing channel alignment and bit rate for the transmitter.
10	Data Set Model	MODEL 402 A/B 402 C/D	Rotary switch	This switch selects the interface connectors for the Data Set 402A, 402B, 402C, or 402D to be tested.

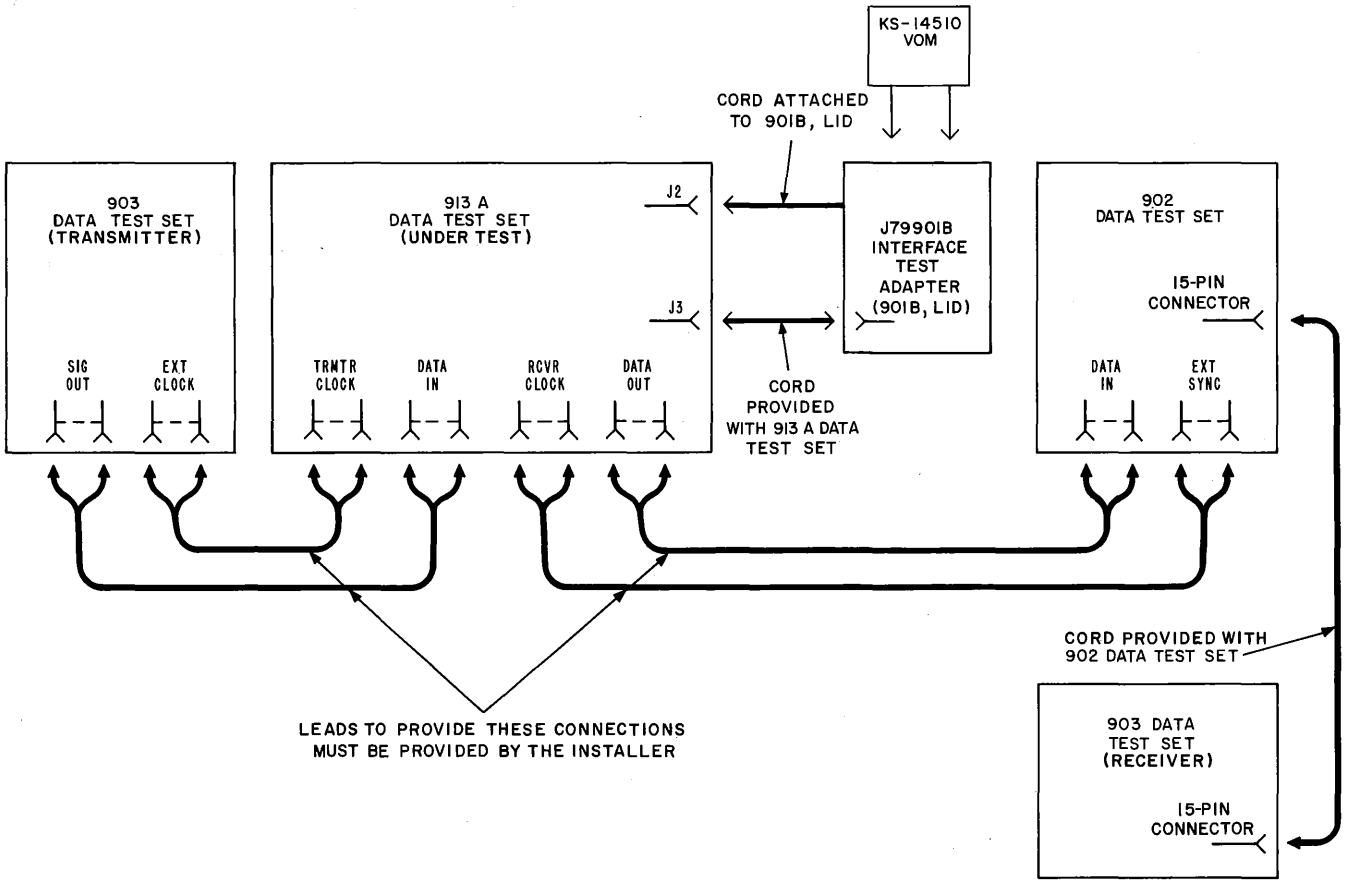

Fig. 9—Connection Diagram for Testing the 913A Data Test Set

TABLE C

STEP	DATA TEST SET	SWITCH DESIGNATION	POSITION AND OBSERVATION
1	913A	TRMTR CLOCK switch	10 BPS
2	913A	DATA SET switch	401
3	913A	ON-OFF switch	ON
4	913A	TEST MODE switch	CHAN 1
	Note: Apply the power to both 903-type Data Test Sets.		
5	903 (on both test sets)	BIT RATE switch	EXT CLOCK
6	903 TRMTR	TRIGGER switch	+
7	903 RCVR	TRIGGER switch	−
8	903	RANDOM DOT switch	RANDOM
9	902	BIT RATE switch	EXT SYNC
10	902	TRIGGER switch	+
11	902	METER SELECTION switch	PHASE ADJ
	Note: Depress the START button on both 903-type Data Test Sets.		
12	902	WORD SYNC & RESET switch	Depress and hold 7 seconds.
13	902	Counter lamps	Extinguish and remain extinguished.
14	903 (receiver)	START switch	Momentarily depress.
15	902	Counter lamps	Flicker to count.
16	913A	TRMTR CLOCK switch	20 BPS
17	902	WORD SYNC & RESET	Depress and hold 4 seconds.
18	902	Counter lamps	Extinguish and remain extinguished.
19	903 (receiver)	START switch	Momentarily depress.
20	902	Counter lamps	Flicker to count.
21	913A	TRMTR CLOCK switch	75 RET
	Note: Remove the connection between the RCVR CLOCK terminals of the 913A Data Test Set and the EXT SYNC terminals of the 902-type Data Test Set.		
22	902	BIT RATE switch	75 BITS/SEC
	Note: If the 902C Data Test Set is used, set the BIT RATE switch to 150.		

TABLE C (Cont)

STEP	DATA TEST SET	SWITCH DESIGNATION	POSITION AND OBSERVATION
23	903 (receiver)	TRIGGER switch	+
24	902	TRIGGER switch	—
	Note: Rotate selector switch of the 902-type Data Test Set to DIST ADJ, VOLT ADJ, and PHASE ADJ; and zero the meter for each selection by rotating the DISTORTION, VOLTS, and PHASE adjustments, respectively, and observing a 0 reading on the meter.		
25	902	Meter selection switch	DIST MEAS
26	902	Meter	Makes constant reading below 10%.
	Note: If the 902C Data Test Set is used, connect leads from the EXT SYNC terminals of the 902C Data Test Set to the TRMTR CLOCK terminals of the 913A Data Test Set. Set the BIT RATE switch of the 902C Data Test Set to EXT SYNC.		
27	902	WORD SYNC & RESET	Depressed
28	903	Counter lamps	Extinguish
29	913A	TRMTR CLOCK switch	75 NOR
30	902	WORD SYNC & RESET switch	Depressed
31	903	Counter lamps	Extinguish
32	913A	TRMTR CLOCK switch	75 ADV
33	902	WORD SYNC & RESET switch	Depressed
34	903	Counter lamps	Extinguish
35	913A	TEST MODE switch	Position the switch from CHAN 2 through CHAN 8 positions, and depress the WORD SYNC & RESET of 902-type Data Test Set for each position. The counter lamps of 903-type Data Test Set should remain extinguished for each position.
36	913A	TEST MODE switch	ALL RDM
37	902	WORD SYNC & RESET switch	Depressed
38	903	Counter lamps	Remain extinguished.
39	Temporarily disconnect cable from J2 of the 913A Data Test Set.		902-type Data Test Set counts errors.

TABLE C (Cont)

STEP	DATA TEST SET	SWITCH DESIGNATION	POSITION AND OBSERVATION
40	Reconnect cable to J2. Remove leads between TRMTR CLOCK terminals of the 913A Data Test Set and EXT CLOCK terminals of the transmitting 903-type Data Test Set and EXT SYNC terminals of the 902C Data Test Set, if used. Connect leads from RCVR CLOCK terminals of 913A Data Test Set to transmitting 903 Data Test Set EXT CLOCK terminals and to the 902 Data Test Set EXT SYNC terminal.		
41	913A	DATA SET switch	402
42	913A	TRMTR CLOCK switch	75 RET
43	913A	TEST MODE switch	CHAN 1
44	902	BIT RATE switch	EXT SYNC
45	903 (transmit)	START switch	Depress
46	902	Counter lamps	Flicker and continue to count.
47	902	WORD SYNC & RESET switch	Depress and hold 4 seconds.
48	902	Counter lamps	Extinguish
49	913A	TRMTR CLOCK switch	75 NOR
50	Repeat Steps 45 and 46.		
51	902	WORD SYNC & RESET switch	Depress and hold 4 seconds.
52	902	Counter lamps	Remain extinguished.
53	913A	TRMTR CLOCK switch	75 ADV
54	Repeat Steps 45 and 46.		
55	902	WORD SYNC & RESET switch	Depress and hold 4 seconds.
56	902	Counter lamps	Remain extinguished.
57	14510 Multimeter	Voltage Scale Switch	12 Vdc
		Positive (+) lead	Connect to Pin 3 of 901B Data Test Set (cover).
		Negative (—) lead	Connect to Pin 1 of 901B Data Test Set (cover).
	14510 Multimeter	Scale	Reads 5.4 to 6.6 V
58	913A	TEST MODE switch	ALL DOT

TABLE C (Cont)

STEP	DATA TEST SET	SWITCH DESIGNATION	POSITION AND OBSERVATION
59	14510 Multimeter Scale		Reads 5.4 to 6.6 V
60	14510 Multimeter Voltage Scale Switch		60 Vdc
61	913A	TEST MODE switch	ALL SPC
62	14510 Multimeter Scale		Reads 10.8 to 13.2 V
63	913A	TEST MODE switch	CHAN 2
	14510 Multimeter Voltage Scale Switch		12 Vdc
		Positive (+) lead	Connect to Pin 2 of 901B Data Test Set (cover).
		Negative (—) lead	Connect to Pin 1 of 901B Data Test Set (cover).
	14510 Multimeter Scale		Reads 5.4 to 6.6 V
64	Repeat Step 62 for CHAN 3 through CHAN 8 positions of the TEST MODE switch of the 913A Data Test Set. The readings should be the same.		
65	901B (cover)		Place a strap from EQ22 to EQ13 and EQ15.
66	913A	REMOTE OPR switch	Operate; RING IND and INTLK lamps light.
67	913A	REMOTE OPR switch	Turn off.
68	913A	REV CHAN switch	Operate; REV CHAN lamp lights.
69	913A	REV CHAN switch	Turn off.
70	913A	ANS BACK A switch	Operate; ANS BACK A lamp should light.
71	913A	ANS BACK A switch	Turn off.
72	913A	ANS BACK B switch	Operate; ANS BACK B lamp should light.
73	913A	MODEL switch	Position to 402 C/D; ANS BACK AB lamp should light.
74	913A	OUT OF SRV switch	Operate; CARR ON lamp should light.
75	913A	MODEL switch	Position to 402 A/B; CARR ON and ANS BACK AB lamps extinguish.
76	913A	OUT OF SRV switch and ANS BACK B switch	Turn off.
	All Sets	POWER OFF	