

1000A DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

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1. GENERAL		
1.01 This section contains information required for installing and maintaining 1000A data coupler (Fig. 1). Detailed information is contained in SD- and CD-1D205-01.		1.05 The data coupler provides the interface for connecting the customer equipment directly to local loop facilities, key telephone system station lines, or to PBX station lines.
1.02 This section is reissued to:		
● Include information concerning the 503C-61 and 2503C-61 telephone sets.		
● Delete the information in the test procedures dealing specifically with a VTVM.		
1.03 The 1000A data coupler is a line-powered unit which permits customer-provided data apparatus to be connected to the switched telecommunications network for data and voice communications. The unit plus an associated telephone set provides the data access arrangement (DAA) as described in appropriate tariffs. The uniform service order code (USOC) for the coupler is CDT.		1.06 The service offering in which the data coupler is used provides the customer with essentially the same end-to-end transmission performance characteristics as are provided in DATA-PHONE® service. Because the customer apparatus over which the Bell System has no control may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of the transmitted data. The end-to-end facilities, including the local loop, will be engineered and maintained to the equivalent DATA-PHONE service requirements. These requirements are specified in Section 314-205-501 for local loops, and Section 314-205-500 for the DDD network.

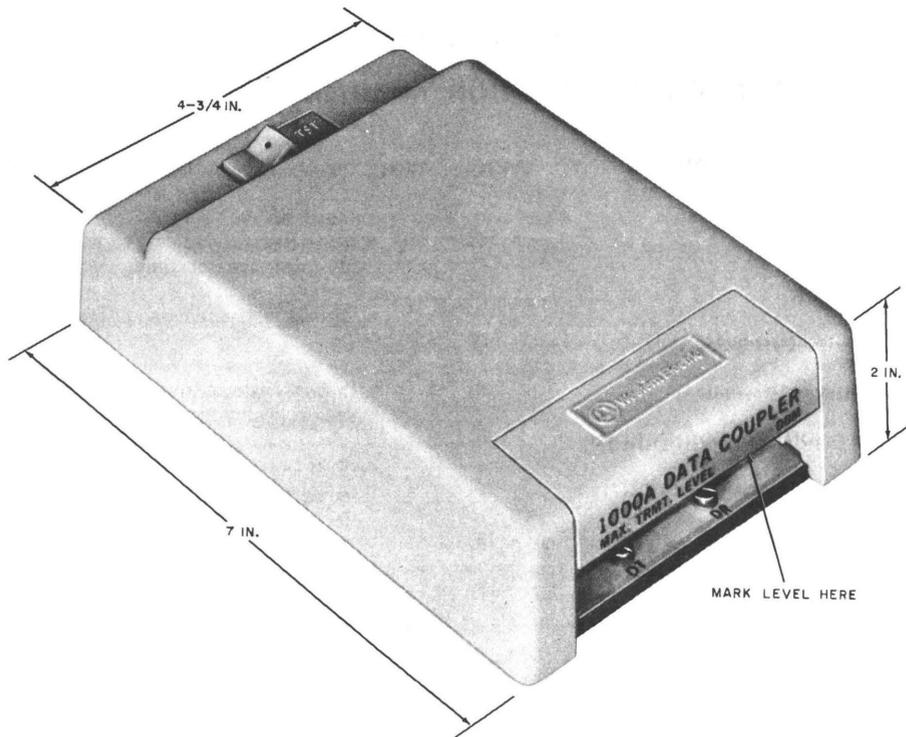


Fig. 1— ♦ 1000A Data Coupler ♦

2. DESCRIPTION

A. Physical Description

2.01 The data coupler is a wall-mounted unit which weighs approximately 1-1/2 pounds and is 4-3/4 inches wide, 7 inches high, and 2 inches deep.

2.02 The coupler consists of a printed circuit pack mounted on a dark gray plastic base, enclosed by a light gray plastic cover assembly. Two screw terminals are provided under the hinged portion of the cover for the interface connection to the customer apparatus or equipment. Two additional screw terminals are provided on the circuit pack for connection to the associated telephone apparatus. Two holes are provided in the base for mounting the coupler on a wall or other vertical surface.

2.03 The data coupler will operate properly with all standard central offices over a range of

20° to 120°F and with a relative humidity of up to 95 percent.

2.04 A test key is provided at the top of the coupler for testing the unit and line. The test oscillator, in conjunction with the level control circuit, will hold its output to ± 1 dBm over the temperature range of 20° to 120°F.

2.05 Terminals located on the printed circuit pack are strapped by the installer for adjusting the operation level of the data coupler.

2.06 ♦A 502A/B or 558F telephone set, hereafter referred to as tel set, is available with the coupler as a standard option. A 503C-61 tel set is available as an option which must be specified.

2.07 The 503C-61 tel set provides the customer with a mode indication of the telephone line (voice or data) and the means to audibly monitor the data transmission. The TOUCH-TONE® version of the 503C-61 tel set is coded 2503C-61. Both

sets are in light gray housing; however, they may be enclosed in standard 500- or 2500-type housings if another color is required. These sets are intended for use on individual lines only.¶

B. Functional Description

2.08 General: The data coupler is a bi-directional, network protective unit designed to interface a customer-provided data modem. The coupler protects the telephone network by limiting the total customer data signal power to a prescribed maximum limit. To determine when the limiting function is required, the coupler continuously monitors the output level of the customer equipment. Whenever the total signal power averaged over any 3-second interval exceeds the maximum limit, a limiting circuit is activated and a loss is automatically inserted in the transmission path to attenuate the signal to the prescribed limit. The loss inserted in the transmission path will attenuate the customer signals in both directions of transmission, and the distortion introduced is negligible. The limiting circuit is activated as long as the rms output from the customer equipment exceeds the permissible level.

2.09 The customer must be informed at the time the coupler is installed of the prescribed maximum permissible signal power output for his data equipment. The maximum output level may vary between 0 and -10 dBm, in 1-dB steps, depending upon the 1000-Hz loss of the local loop including the nominal 2-dB insertion loss presented by the coupler. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load.

Note: The prescribed maximum limit must be marked on the data coupler at the time of installation.

2.10 The telephone line interface of the data coupler is a standard, common battery loop-current termination that can be associated with standard network control signaling arrangements. The network control functions may be provided for the coupler by an associated tel set or key telephone equipment. The associated apparatus is used to manually originate, answer, and disconnect calls, and to provide the data key through which the coupler connects to the telephone line. The data key may be an exclusion switch on the

telephone set or a designated key associated with the key telephone equipment, and is used to transfer between the talk and data modes of operation. Either the coupler or the associated network controlling apparatus must always be on-line to hold the connection.

2.11 The data coupler provides two modes of operation: a data mode and a test mode. A functional diagram of the coupler is shown in Fig. 2. The following describes the interconnecting effect between each functional block within the two operating modes.

2.12 Data Mode: In response to incoming ringing or the desire to initiate a call, the customer must establish the connection using the associated apparatus. When ready to transmit or receive data, the external data key is operated to place the coupler in the data mode.



When the exclusion key on an associated telephone set is used as the data key, the telephone handset must remain off-hook when the coupler is in the data or test mode.

2.13 A transformer couples the data signals to the telephone line and provides a protective function in both directions (ie, hazardous voltages, surge protection, and longitudinal isolation). The signals are coupled through one of two secondary windings on the transformer.

2.14 A level-adjusting network is connected across the signal output and produces an input to the buffer amplifier whenever the signal exceeds the preset level. An input to the amplifier activates the limiting circuit of the coupler.

2.15 The step-up transformer increases the output of the amplifier to drive the full-wave rectifier and rms network. The rectifier and network develop a voltage proportional to the rms value of the signal. The rms voltage is averaged over any 3-second interval by the integrator. If the average exceeds the permissible level, the output of the integrator activates the current amplifier, which in turn conducts current through the other secondary winding of the coupling transformer and a series-connected thermistor.

2.16 The line signal is the difference of the signals on the two opposing secondary windings.

The general requirements for DAA are covered in Section 314-205-501. The requirements for the 1000A data coupler are as follows:

(a) **Loop Loss:** Maximum 1000-Hz insertion loss is 10 dB excluding the coupler.

(b) **Set Classification:** The installation measurements to be made should have been determined by the design engineer from the type of data modem information provided by the customer and specified on the service order. When the modem type cannot be determined, high-speed requirements should be specified. When type of modem can be obtained from customer, the following guidelines should be used:

- (1) For all analog modems, high-speed requirements should be specified.
- (2) For all other modems, requirements based on speed of modem (same as for DATA-PHONE service) should be specified.
- (3) If the type of modem is known to be similar to a Bell System DATA-PHONE data set, use the requirements for that particular data set.

3.03 When test or demonstration calls are made at the time of installation, refer to Section 010-250-001 for proper procedure for crediting charges.

3.04 The installation of the coupler should comply with general practices to ensure an orderly station arrangement.

3.05 The location of the coupler shall be determined by the following conditions:

- The coupler should normally be mounted vertically on the wall or other smooth vertical surface.
- The coupler must be within range of the interface cord supplied by the customer.
- The location of the coupler should provide easy access for operation of the test key by the customer attendant.

Note: In general, there is no restriction on the length of the customer interface cord

providing the transmission path between the data apparatus and the coupler. The Bell System responsibility terminates at the interface terminals of the coupler. The inside wiring connection between the coupler and the telephone line connecting block is restricted only to the presentation of a neat station appearance.

3.06 The data key or associated telephone set should be positioned so the operator can easily operate the key and the controls on the customer apparatus.

3.07 Install the coupler on the wall or vertical surface as follows:

- (1) Remove the tape securing the cover to the base pan. Retain the screw envelope that is secured under the tape.
- (2) Remove the snap-off cover assembly from the coupler and lift up the circuit board from the base pan.
- (3) Position the base pan vertically against the wall with the keyhole slot end up and at least 3 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base with two screws.
- (4) Route the inside wiring through the slots and pins on the base as shown in Fig. 3. Attach the circuit pack to the base using the four screws provided. Connect the two leads to terminals T and R on the printed wiring board.



Care should be taken not to overtighten screw terminals or stripping will result.

Note: Do not replace cover at this time.

3.08 When a tel set is associated with the coupler, the exclusion key leads in the set must be rewired to provide the necessary control functions of the data key. Typical wiring diagrams in Fig. 4, 5, and 6, show rewiring and connections required when using the 502A/B, 503C, or 558F tel set. The rewiring permits the tel set to control the line. Location of the terminals on the coupler is shown in Fig. 3.

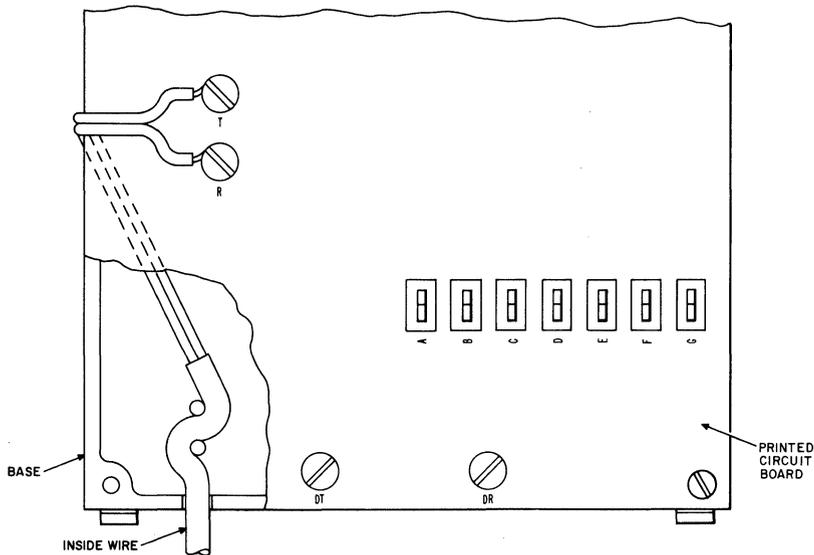


Fig. 3—Route of Station Wiring and Location of Terminals

3.09 A separate connecting block must be installed with the coupler when the 503C-type tel set is used to furnish a telephone mode indication. A connection is made between a set of the exclusion key contacts in the tel set and two terminals on the connecting block. The exclusion key contacts are closed when the line is connected to the tel set. The customer may monitor the terminals on the connecting block and obtain an indication of the mode in which the tel set is operating (closed—voice, open—data).⚡

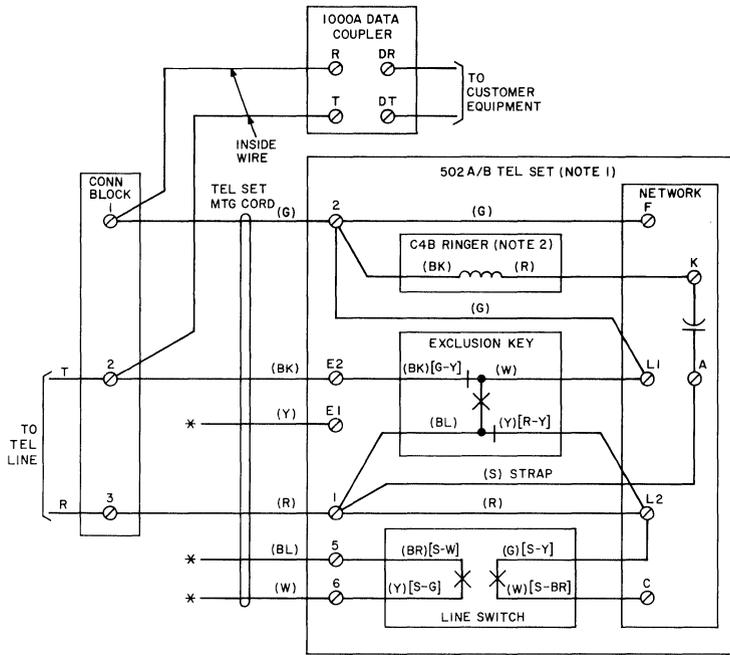
3.10 For key telephone system application, an auxiliary relay is required to switch the line to the coupler. A line key on a key telephone set is used as the data key to operate and hold the auxiliary relay. The telephone handset must be off-hook during a data call. A partial schematic of a typical key telephone arrangement is shown in Fig. 7. Use Table A with Fig. 7 for the required connections to the key telephone units that may be used as line circuits and auxiliary relays for a key telephone system.

Note: The 1A telephone set wiring will differ from that shown in Fig. 7. The SG lead

replaces the A1 lead and is used to operate the line circuit and auxiliary relays. The set must also be wired for station busy lamp. Refer to appropriate section for the tel set being used. A 15D KTU may be used with a 1A system for incoming call detection.

3.11 When the connections are completed, the data coupler must be adjusted to limit the customer signal power to a level which will not exceed a -12 dBm signal level at the serving central office. To arrive at the maximum allowable customer level, perform the insertion loss test and the impedance-matching test as outlined in Part 4.

3.12 When the two tests are completed, refer to Table B which shows the level option terminals (A through G) that may be strapped for a particular installation. The total loss of the loop and coupler measured in the insertion loss test determines the **row** to use in Table B under the INSERTION LOSS column. The value obtained from the impedance-matching test determines the **column** to use under LIMITER OPTION TERMINALS in Table B. The intersection of the **row** and **column**



* TAPE AND STORE
() CURRENT COLOR CODE
[] MD COLOR CODE

NOTES:

- REWIRE TEL SET EXCLUSION KEY AS FOLLOWS:
 - REMOVE (BL) LEAD FROM TERM. E1 AND CONNECT TO TERM. 1.
 - REMOVE (w) LEAD FROM TERM. E2 AND CONNECT TO NET. TERM. L1
 - REMOVE (BK) LEAD FROM NET. TERM. L1 AND CONNECT TO TERM. E2.
- IF C4A RINGER IS USED, REMOVE (S) STRAP BETWEEN TERM. 1 AND NET. TERM. A AND WIRE RINGER AS FOLLOWS:
 - CONNECT (BK) LEAD TO TERM. 2.
 - CONNECT (S) LEAD TO NET. TERM. K
 - CONNECT (R) LEAD TO TERM. 1.
 - CONNECT (S-R) LEAD TO NET. TERM. A

Fig. 4—Typical Connections for 1000A Data Coupler With 502A/B Tel Set

determines the proper strapping for the option terminals.



Tools such as a 714B, 756B2, etc, should not be used to install the straps or damage to the option terminals may result.

3.13 The locations of the level option terminals are shown in Fig. 3. Cut a piece of insulated, 24-gauge, solid wire to fit between appropriate

terminals. Strip the insulation from the wire ends and, using long-nose pliers, firmly seat the ends into the terminals to ensure good contact. Example of strapping: when the measured combined loss of the loop and coupler is 7.8 dB and a measured value of $\blacklozenge - 4.2 \blacklozenge$ dBm is obtained from the impedance-matching test, one strap should be placed between terminals B and C and another strap between terminals D and G. Do not permit the bare wire portion of the straps to touch any other terminal.

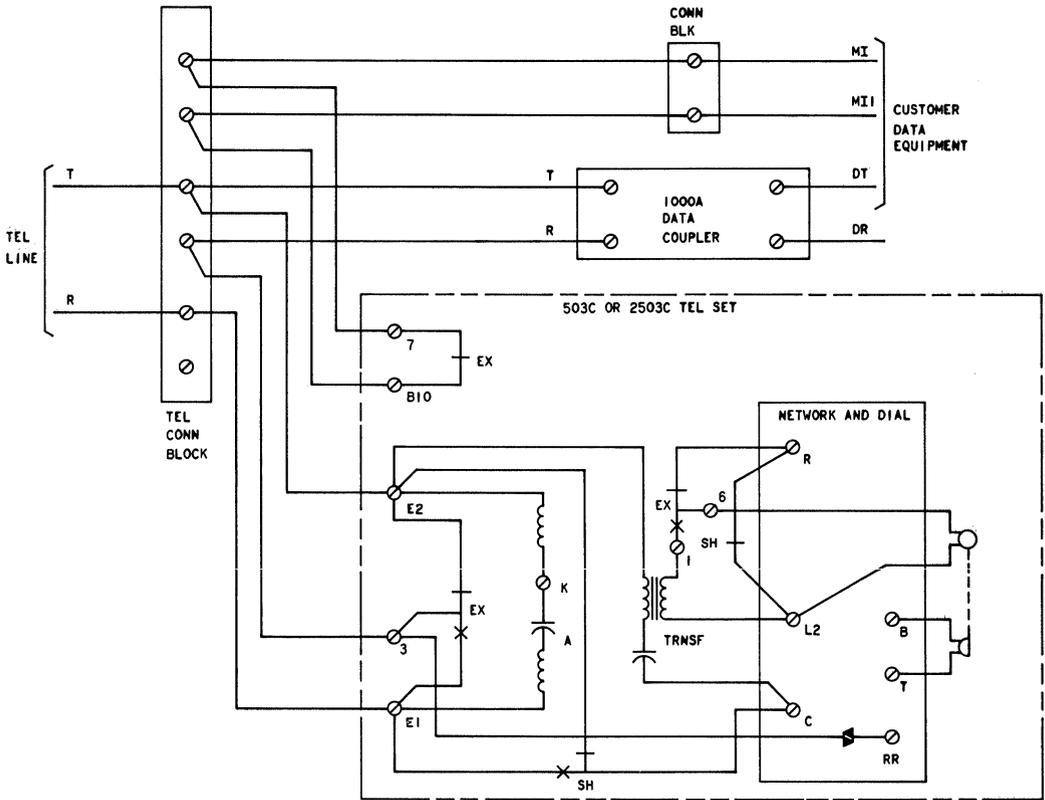


Fig. 5—Typical Connections for 1000A Data Coupler With 503C or 2503C Tel Set

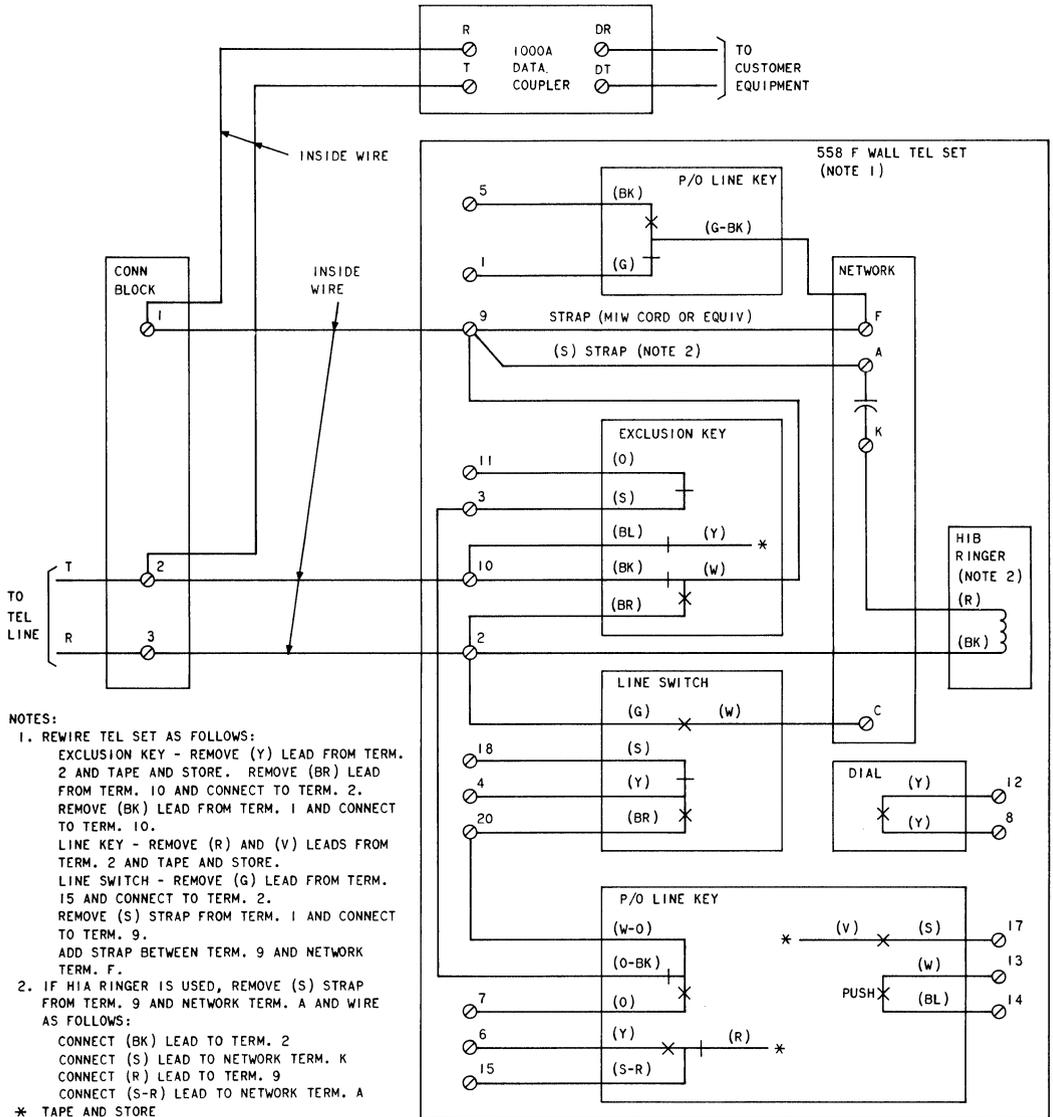


Fig. 6—Typical Connections for 1000A Data Coupler With 558F Wall Tel Set

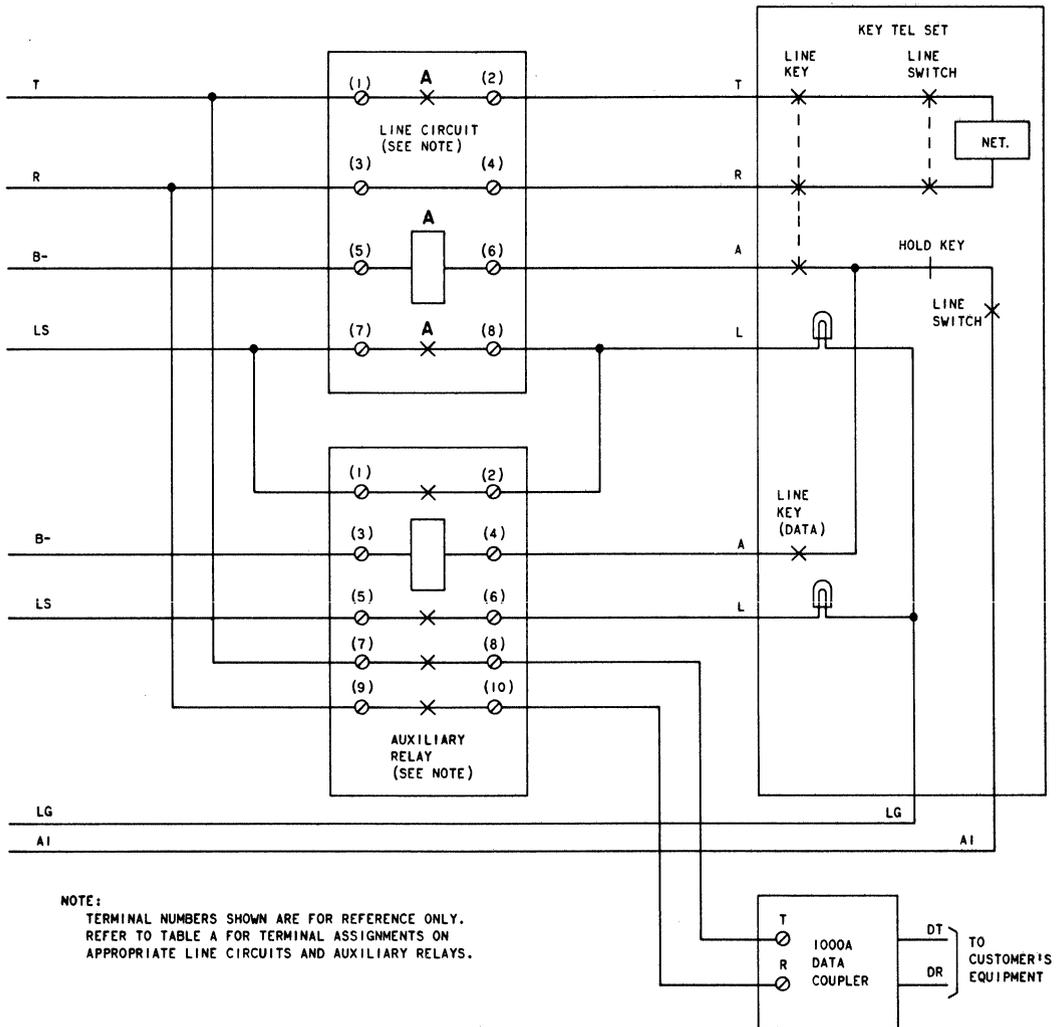


Fig. 7—Partial Schematic Connections for Key Telephone System Arrangements

3.14 The maximum allowable customer signal level is determined by the appropriate column in Table B. Record the value with pencil or ball point pen on the cover label of the coupler (Fig. 1). Using the example in 3.12, “-5” would be marked on the label.

3.15 In the event the appropriate ac power source required for the test sets is not available at the customer location for performing the installation tests, the installer must provide a data coupler that has been properly tested and known to be in good working condition. Add the 2-dB insertion

TABLE A
KEY TELEPHONE SYSTEM TERMINAL ASSIGNMENTS

KEY TELEPHONE SYSTEM		REFERENCE TERMINALS SHOWN IN FIG. 7									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1A2	400D Line Circuit	9	13	14	12	17	16	4	8	—	—
	421A Auxiliary Relay	12	16	17	1	8	13	35	23	37	27
1A1	202D Line Circuit or 239A Line Circuit	7	1	8	2	26	3	29	5	—	—
	229B Auxiliary Relay	14	4	20	10	13	3	12	2	11	1
	29A Line Circuit	1	4	12	15	7	9	2	5	—	—
1A	29A Auxiliary Relay	1	4	7	9	2	5	3	6	14	11

loss of the coupler to the estimated measured loss (EML) of the assigned loop. This combined loss of the loop and coupler is used with the NOMINAL column in Table B to determine the proper level option terminals to be strapped. Strap the appropriate terminals as indicated in 3.13.

3.16 Install cover assembly by hooking bottom end (end with small hinged cover) to base, swinging cover up and over the TST key, and pressing until cover snaps into place.

3.17 The installer should instruct the customer to raise only hinged portion of cover to gain access to interface terminals DT and DR. Also caution customer that overtightening screw terminals may cause stripping. The installer **will not** connect the interface leads to the coupler unless requested by, and under the direction of, the customer.

3.18 After the installation has been completed, perform the remote test outlined in Part 4. The value obtained determines the basis upon which future operative conditions of the coupler and local loop may be checked. If the coupler fails to meet the test requirements, either replace the coupler or request new facilities as determined appropriate.

3.19 All level measurements and test results made during installation must be recorded on a line history card, or equivalent, to assist in analyzing future trouble and to detect gradual degradation of the service. The installer shall telephone the test results to the plant service center (PSC), or equivalent test location, prior to leaving the customer location. The circuit design engineer should be advised when the actual measured loss (AML) of the loop deviates from the estimated measured loss (EML) by more than ± 1 dB.

◆ TABLE B ◆

LEVEL OPTION TERMINALS FOR 1000A DATA COUPLER

INSERTION LOSS (INSERTION LOSS TEST) DB			MAXIMUM ALLOWANCE	LIMITER OPTION TERMINALS			
LOOP LOSS	COUPLER LOSS	TOTAL OR MEASURED LOSS		CUSTOMER LEVEL DBM	LEVEL MEASURED IN IMPEDANCE-MATCHING TEST (DBM)		
			0 TO - 3.6		- 3.7 TO - 4.6	- 4.7 TO - 5.6	- 5.7 OR BELOW
0-0.9	2	2- 2.9	-10	AD, EF	AF	AF	AF
1-1.9	2	3- 3.9	-9	AC, DF	AD, EF	AF	AF
2-2.9	2	4- 4.9	-8	AC	AC, DF	AF	AF
3-3.9	2	5- 5.9	-7	AB, CD, EF	AC	AD, EF	AF
4-4.9	2	6- 6.9	-6	BC, DG	AB, CD, EF	AC, DF	AF
5-5.9	2	7- 7.9	-5	BD, EF	BC, DG	AC	AD, EF
6-6.9	2	8- 8.9	-4	BC, DE	BD, EF	AB, CD, EF	AC, DF
7-7.9	2	9- 9.9	-3	CD, EF	BC, DE	BC, DG	AC
8-8.9	2	10-10.9	-2	EF	CD, EF	BC, EF	AB, CD, EF
9-9.9	2	11-11.9	-1	None	EF	BC, DE	BC, DG
10 or more	2	12 or more	0	None	None	CD, EF	BC, EF

4. MAINTENANCE AND TESTS

4.01 The maintenance and testing procedures described in this part are to assist the employee during installation and troubleshooting visits to a data coupler station. Several of the tests contained in this part will require disconnection of customer equipment from the interface in order to make the tests and/or to replace a defective coupler. The following precautions must be taken.



Permission to disconnect the interface leads from the customer must be obtained from the customer.

A. Maintenance

4.02 All repair forces should be familiar with the tariff provisions which generally provide for a "Maintenance Service Charge" for each customer-requested repair visit to a data access arrangement installation that is terminated with an FOK (found OK) condition. When a customer requests such a repair visit and it is subsequently determined that the trouble is *not* in the telephone company equipment, the employee should advise the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

4.03 Maintenance of the coupler on the customer premises should be limited to local tests,

testing with serving or test offices, or replacing a defective unit.

Note: Do not attempt individual component repair or replacement on the printed circuit pack.

4.04 Customers using data couplers are instructed, when a trouble condition is experienced, to perform the necessary testing to sectionalize the problem. If the results of the tests indicate the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent testing bureau. All available information concerning the failure mode should be provided to the PSC.

4.05 The PSC must analyze the information provided by the customer to determine if a trouble condition does exist and the most probable cause. Available tests (ie, normal dc loop test and remote test of coupler) should be performed to determine if a craft employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and the efforts which lead to each are shown in Fig. 8.

4.06 On a maintenance visit, the employee should proceed to perform the most likely necessary tests or evaluations to isolate and clear the trouble within the station as directed by the PSC. The employee may begin with the steps shown in Fig. 8 when the test results and analysis received from the PSC lead to that particular activity. If a trouble report is not available or if the report is inconclusive, it is recommended that the employee follow the suggested sequence of activities as illustrated in Fig. 9 and described in the following.

- (1) The employee must be properly equipped with information (BSP documentation, line card details, etc), spare coupler and other parts, test equipment, etc, for locating trouble and effecting repairs at customer premises.
- (2) Upon arrival at the coupler station, the employee will question the customer to obtain any information relating to the trouble. The employee will then proceed to perform a visual and mechanical inspection of the installation. Check for disconnected or broken cords, inside wiring, or drop wire. Check for broken components or any other possible trouble causes.

If defects are not found, make a remote test (Step 7).

- (3) If any component is found defective or marginal during check of the installation, or as directed by the PSC, the employee will repair or replace the component (ie, replacing ringer, dial, handset, etc, on associated tel set when provided).
- (4) After making the necessary repairs, the employee will request the customer to verify service restoral (ie, try to exchange data with station that caused him to report the trouble).
- (5) When the customer is satisfied with the service, the employee will notify the PSC to close the trouble report.
- (6) If the customer cannot exchange data or is not satisfied with the service, the employee will proceed with the investigation (Step 7).
- (7) If the installation appears to be in order after the visual inspection, the employee will make the necessary preparations to have the local test desk or equivalent test location equipped for ac testing, such as a data test center, to make the remote test of the coupler as outlined in 4.12.
- (8) If the results of the coupler remote test are *not* satisfactory, the employee will replace the coupler with one known to be operating properly. Refer to Part 3 for the installation and connection procedures for the new coupler. Ensure that all level measurements made during the required installation tests are properly recorded on the line history card.
- (9) After the coupler has been replaced, the employee will prepare to have the remote test outlined in Part 4 made on the new unit.
- (10) If the results of the new coupler remote test are *not* satisfactory, the employee will notify the PSC of the repair work that has been completed and request instructions before continuing investigating efforts.
- (11) If the results of the new coupler remote test are satisfactory, the employee will request the customer to verify service restored

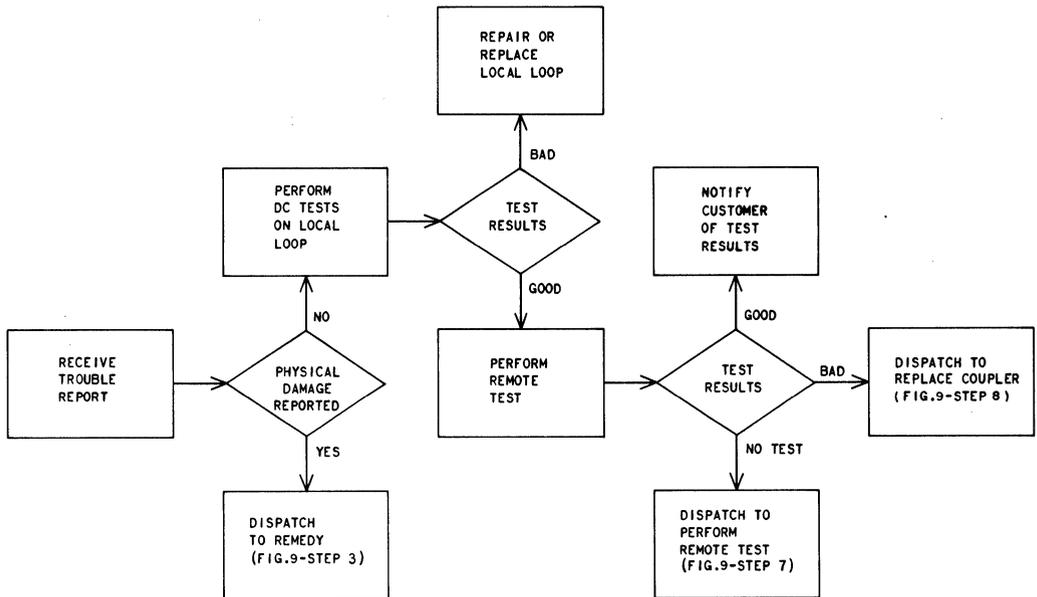


Fig. 8—Basic Activities Prior to Dispatching Employee

(ie, try to exchange data with the station that caused him to report the trouble).

(12) When the customer is satisfied with the service, the employee will notify the PSC to close the trouble report.

(13) If the customer cannot exchange data or is not satisfied with the service, the employee must continue the investigation to locate additional trouble. Proceed to Step 14.

(14) If the results of the coupler remote test are satisfactory or when replacement of the coupler does not restore service, the employee will disconnect the coupler and prepare the test equipment for a complete transmission test of the local loop.

(15) Refer to Section 314-205-501 for requirements and perform transmission test on the local loop.

(16) If the results of the loop test are satisfactory, the employee will notify the PSC that the

results of the coupler and local loop tests are satisfactory and will wait for further instructions.

Note: The preceding investigation has eliminated the coupler and local loop as possible trouble; therefore, attention must be directed to the data terminal or facilities. The PSC will notify the employee if further investigation is required at this time.

(17) If the results of the loop test are *not* satisfactory, the employee will arrange with the PSC to have the loop repaired or changed. The repaired or changed loop should meet requirements outlined in Section 314-205-501.

(18) After changing the defective loop, the employee will reconnect the coupler to the telephone line. The insertion loss and impedance-matching tests outlined in 4.09 and 4.10, respectively, must be performed to determine if maximum allowable customer level has been changed. Employee will notify customer of level change and then request customer to verify

service restoral (ie, try to exchange data with the station that caused him to report the trouble).

(19) When the customer is satisfied with the service, the employee will notify the PSC to close the trouble report.

Note: Prior to leaving customer premises, the remote test outlined in 4.12 must be performed and the new level recorded on the line history card.

(20) If the customer cannot exchange data or is not satisfied with the service, trouble may still exist in another component of the system or in the data terminal and further investigation must be pursued. The employee will notify the PSC of the repair work that has been completed and wait for further instructions.

B. Tests

4.07 The following tests are required to ensure the proper installation of the data coupler and to determine the operating condition of the unit during a maintenance visit:

- Insertion Loss Test
- Impedance-Matching Test
- Remote Test
- 503C or 2503C Tel Set Test.¶

4.08 The following test equipment is required for the tests:

- 600-ohm resistor
- ¶KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent¶
- KS-19353-L4 oscillator, or equivalent.

4.09 *Insertion Loss Test:* The insertion loss test is required to measure the combined loss of the loop and coupler. The results of the test are used to determine the level option terminals which must be strapped in the coupler. The customer apparatus must be disconnected from the coupler in accordance with procedures outlined in 4.01. The coupler must be connected to the

telephone line through the data key. Proceed with the test as follows:

- (1) Locate and remove any existing straps on level option terminals A through G (Fig. 3).
- (2) Connect the 600-ohm resistor across terminals DT and DR.
- (3) Use the associated network control signaling apparatus (tel set, key telephone equipment, etc) and dial the milliwatt supply (1000 Hz) of the serving central office.
- (4) When the tone is heard, operate the data key associated with the coupler.

Note: When an exclusion key on a tel set functions as the data key, the telephone handset must remain off-hook during the test.

- (5) Measure the level (in dBm) of the signal across the 600-ohm resistor with the VOM.
- (6) The loss in dB of the loop and coupler is determined by this measurement. Record the loss and add 0.5 dB, or the value specified on the circuit layout card, to correct the milliwatt test tone loss to the -12 dBm point (eg, if the measurement is -6.3 dBm, the corrected combined loss of the loop and coupler is 5.8 dB). The requirements are specified in Table B (3.12).
- (7) Disconnect the test equipment and restore the connection to normal. Proceed to impedance-matching test.

4.10 *Impedance-Matching Test:* The impedance-matching test is necessary to determine if the particular line impedance will require that a change be made in the nominal strapping of the level option.

4.11 This test will generally follow the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should **not** be strapped at this time. Ensure that the customer apparatus is disconnected from the data coupler in accordance with procedures outlined in 4.01. The coupler must be connected to the

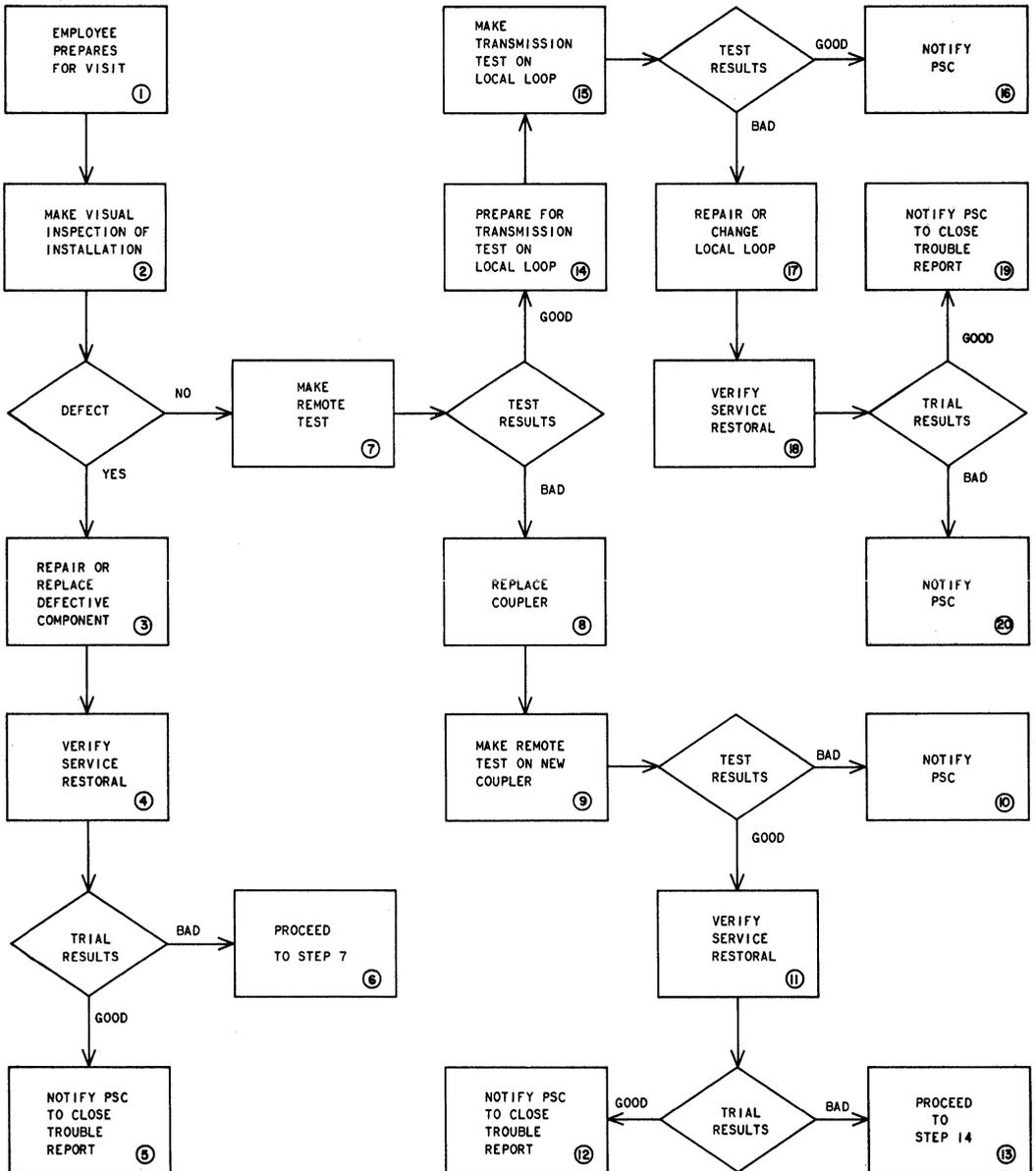


Fig. 9—Activities for Clearing or Troubleshooting Trouble at a Coupler Station

telephone line through the data key. Proceed with the test as follows:

- (1) Set the oscillator for a 1000-Hz frequency and a 600-ohm output impedance.
- (2) Select the proper scale on the VOM to measure -5 dBm.
- (3) Connect the oscillator output to the VOM input with the 600-ohm resistor bridged across the VOM input.
- (4) Adjust the oscillator output level to obtain a -5 dBm indication on the VOM. Remove the 600-ohm resistor and connect the VOM and oscillator as shown in Fig. 10.

Note: After the indication is obtained, do not change the frequency or level setting on the oscillator.

- (5) Use the associated network control signaling apparatus (tel set, key telephone equipment, etc) and dial a quiet battery termination at the serving central office.
- (6) After the connection is completed, operate the data key associated with the coupler.

Note: When exclusion key on a tel set functions as the data key, the telephone handset must remain off-hook during the test.

- (7) Use the VOM to again measure the signal level (in dBm). This value is used in 3.12 to derive the level option strapping from Table B.
- (8) Disconnect the test equipment and restore the connection to normal.

4.12 Remote Test: The remote test is required to measure the test signal of the coupler at the local serving office. The test signal provides a check of the local loop and the limiting function of the coupler. The initial reading can then be compared with subsequent readings for indications of service degradation.

4.13 The data coupler must be connected to the telephone line through the data key for this test. Proceed with the test as follows.

- (1) Use the associated network control signaling apparatus (tel set, key telephone equipment, etc) and contact a test employee at the local test desk. If the local test desk is not equipped for ac testing, contact a remote test location that is equipped or a data test center (see Step 5).
- (2) Request the employee to call the coupler and to measure the level of the coupler test tone (2800 Hz) at the test desk.
- (3) Agree upon length of time required to perform the test, and when instructed by test employee, operate the data and TST keys.

Note: When an exclusion key on an associated tel set functions as the data key, the telephone handset must remain off-hook during the test.

- (4) After the agreed interval, restore the TST and data keys and request the level reading from the test employee. This level indicates the loss of the loop plus the coupler at 2800 Hz. When the test is made at time of installation, the actual value of the loss **must** be recorded on the line history card for comparison against measurements made in subsequent tests. If the level of the 2800-Hz signal on subsequent tests varies by more than 2 dB from the original

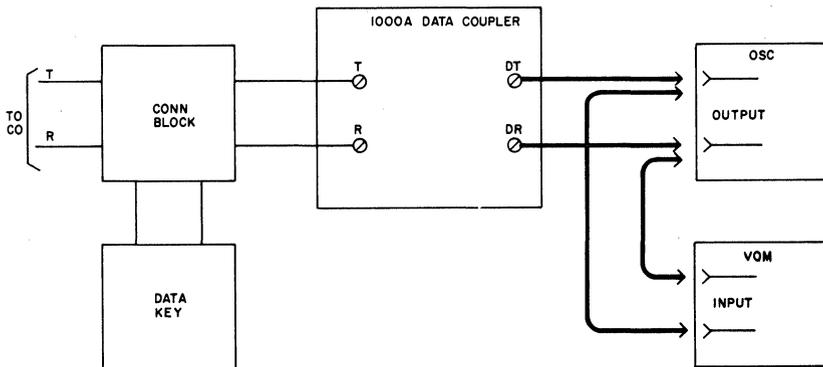


Fig. 10—Test Equipment for Impedance-Matching Test

value, it is an indication of possible trouble in either the loop or coupler.

(5) If the test tone must be measured at a remote test desk or data test center over facilities of unknown or varying loss, a successful receipt of the tone indicates there is ac continuity in the loop and coupler. This is estimated to provide an 80 percent confidence level that the coupler and loop facilities are operating satisfactorily.

(6) Restore the telephone connection to normal.

4.14 503C or 2503C Tel Set Test: This test verifies that the tel set mode indication and audible monitor features are operating properly. The requirements of this test are based on the logic sense which gives a contact closure when the tel set is connected to the line. In all other cases, the mode indication will be open.



This test can be performed without disconnecting the customer interface, in which case the necessary precautions should be taken to ensure that the

customer does not receive inadvertent signals.

(1) Use the VOM to measure the resistance between the two terminals on the connecting block (described in 3.09.) The VOM should indicate continuity.

(2) Lift the telephone handset and measure the resistance between the two terminals on the connecting block. The VOM should indicate continuity.

(3) Operate the exclusion key to place the tel set in the data mode, then measure the resistance between the two terminals. The VOM should indicate an open circuit.

(4) Operate the exclusion key to place the tel set in the voice mode and dial the local milliwatt supply.

(5) When the 1000-Hz tone is heard in the handset, operate the exclusion key to data. The tone should still be heard in the handset.

(6) Return the equipment to normal.