1000A DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section contains information required for installing and maintaining the 1000A data coupler (Fig. 1).

1.02 This section is reissued to:

- Change procedure for removing cover
- Correct Fig. 3 and 5
- Change insertion loss and impedance matching tests for short loops
- Add Part 5—References.

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.

1.04 The coupler has the following provisions:

- Restricts customer data signals automatically to a prescribed maximum signal power
- Permits alternate data and voice transmission
- Protects customer from metallic and longitudinal line surges in excess of 50 volts
- Protects telephone company (telco) personnel and equipment from hazardous voltages applied from customer-provided equipment
- Provides longitudinal isolation of the telephone plant from customer-provided equipment
- 2-wire bi-directional operation
- Test circuitry for manually operated remote testing.

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.

1.06 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 DATAPHONE® 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 DATAPHONE service requirements. These requirements are specified in

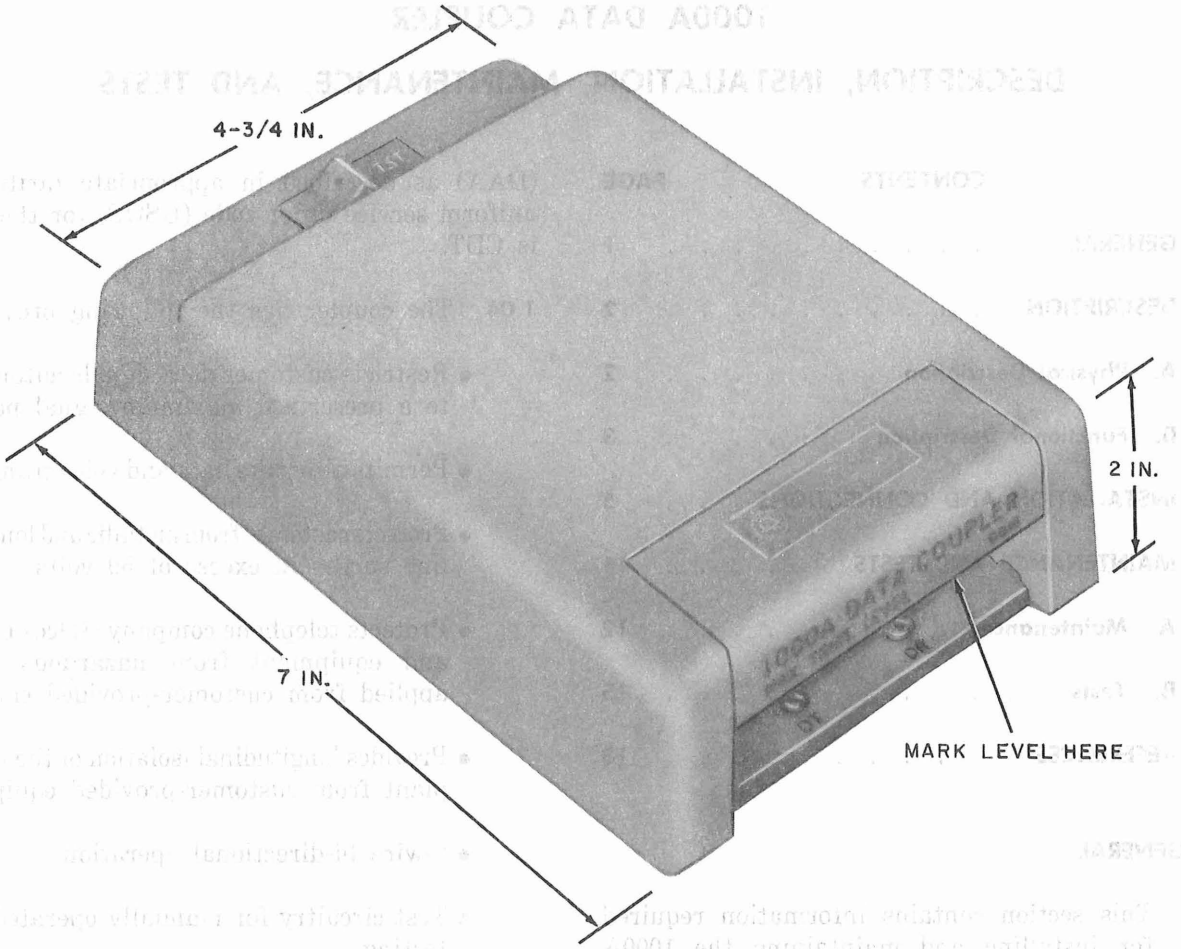


Fig. 1—1000A Data Coupler

Section 314-205-501 for local loops, and Section 314-205-500 for the DDD network.

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 board mounted on a dark gray plastic base, enclosed by a light gray plastic cover assembly. Two screw terminals are provided under the hinged flip portion of the cover for interface connection to customer apparatus or equipment. Two additional screw terminals are provided on the circuit board for connection to 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 dB over the temperature range of 20° to 120°F.

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

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

2.07 The 503C-61 telephone 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 telephone set is coded 2503C-61. Both sets are in a 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 telephone 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

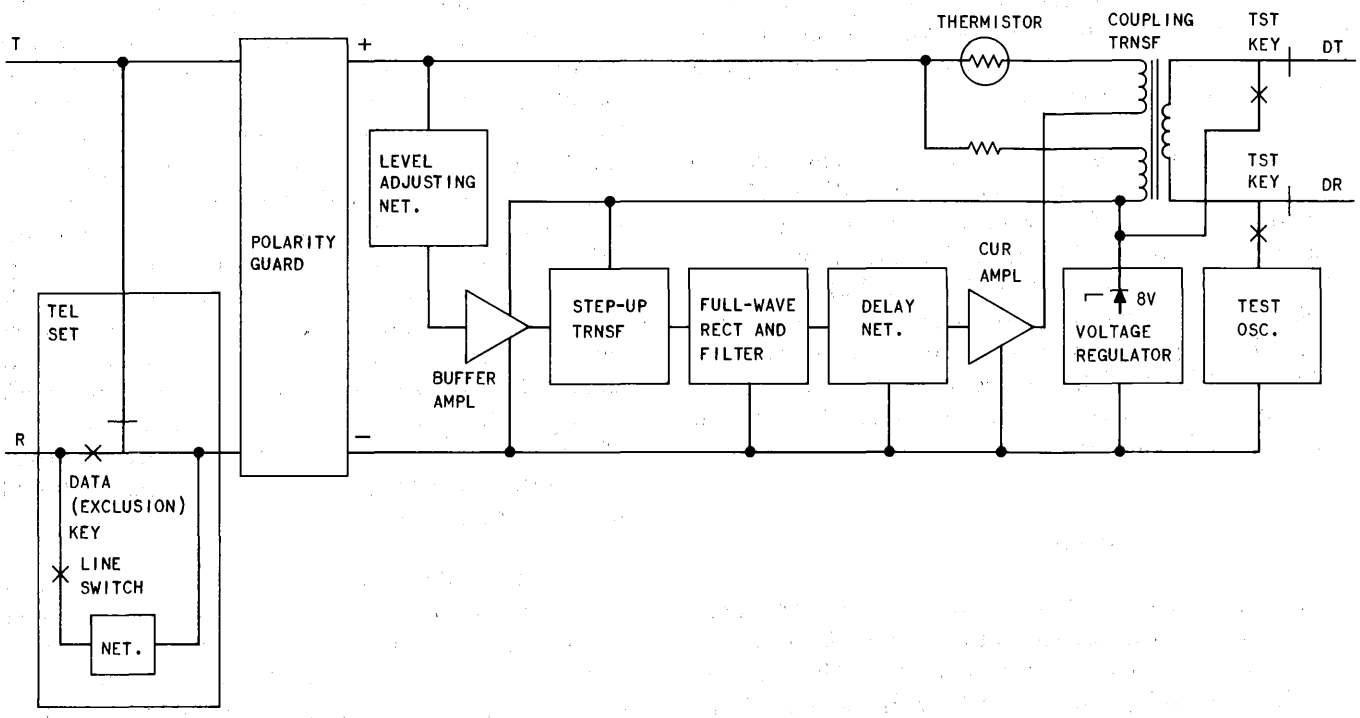


Fig. 2—1000A Data Coupler—Functional Schematic

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. When the limiting function is not activated, the thermistor permits very little signal to flow through the second winding. As the current amplifier conducts, the thermistor heats up and decreases in resistance. This permits the opposing signal current to flow through the winding. The overall line current begins to reduce and, in turn, the signal level decreases. The signal is thus reduced to a level which is just sufficient to maintain the limiting circuit at the threshold voltage.

2.17 At the completion of data transmission, restoring the data key returns the operation to the talk mode (the coupler returns to an idle state).

2.18 ***Test Mode:*** A test circuit provides the means for applying a tone to the line through the coupling transformer. This permits testing of the data coupler and/or the local loop. The coupler may be remotely tested from the serving central office or tested locally on customer premises. The test circuit consists of a tone oscillator and a TST key.

2.19 Tone is applied to the line when the TST key is operated and the coupler is connected to the telephone line. The tone is a 2800-Hz signal with a constant level that exceeds the maximum power level allowed. This causes the limiting circuit to activate whenever the coupler is in the test mode. Measuring the oscillator output provides a reasonable check of the operating condition of the data coupler and local loop.

Accidental or intentional operation of the TST key while transmitting data will interrupt the data signals.

2.20 Restoring the TST key removes the test oscillator from the circuit and returns the coupler to the data mode.

3. INSTALLATION AND CONNECTIONS

3.01 The data coupler may be used with various types of central office lines, key telephone systems, or PBX lines that provide access to the DDD network facilities.

3.02 Verify that the assigned loop facilities meet the transmission requirements for the specific data service before proceeding with the installation. 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 the type of modem can be obtained from the 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 DATAPHONE service) should be specified.

(3) If the type of modem is known to be similar to a Bell System DATAPHONE 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 a 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. 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 tape securing cover to base pan. Retain screw envelope that is secured under tape.

(2) Remove snap-off cover assembly from the coupler by lifting cover up from bottom to relieve tension on mounting lips, then pull cover out at top. Lift up circuit board from base pan.

(3) Position base pan vertically against wall with keyhole slot end up and at least 3 inches above top of baseboard or other obstruction which will be below the unit. Secure base with two screws.

(4) Route inside wiring through slots on base as shown in Fig. 3. Attach circuit board to base using four screws provided. Connect the two leads to terminals T and R on printed wiring board.

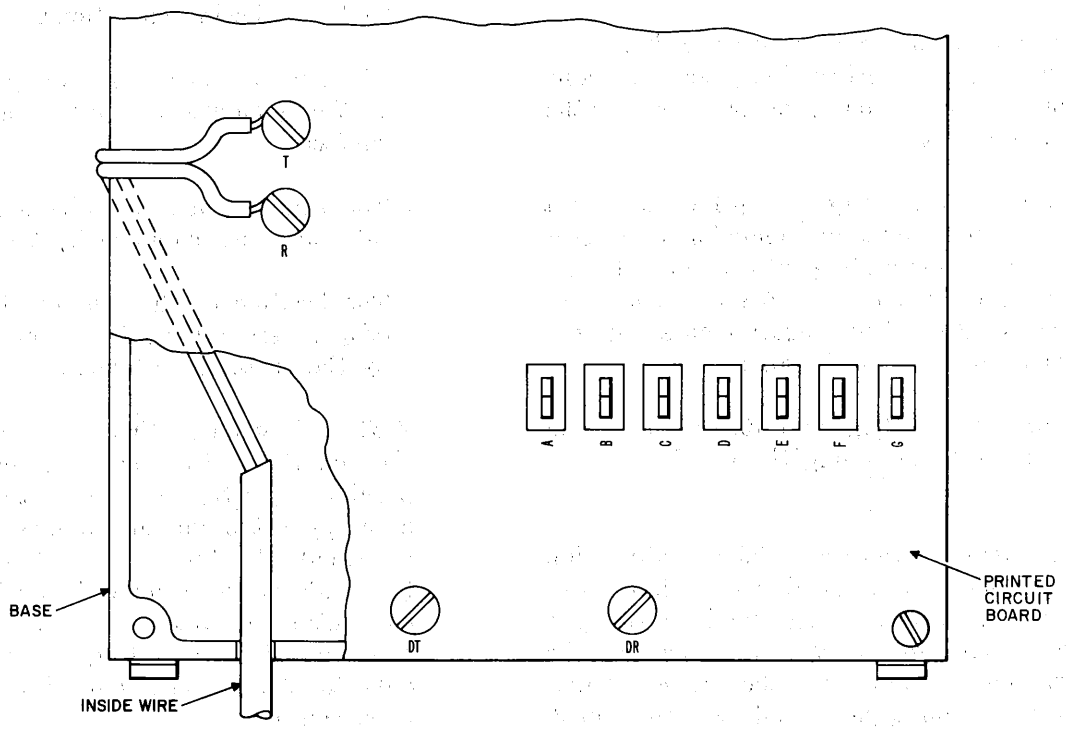


Fig. 3—Route of Station Wiring and Location of Terminals

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

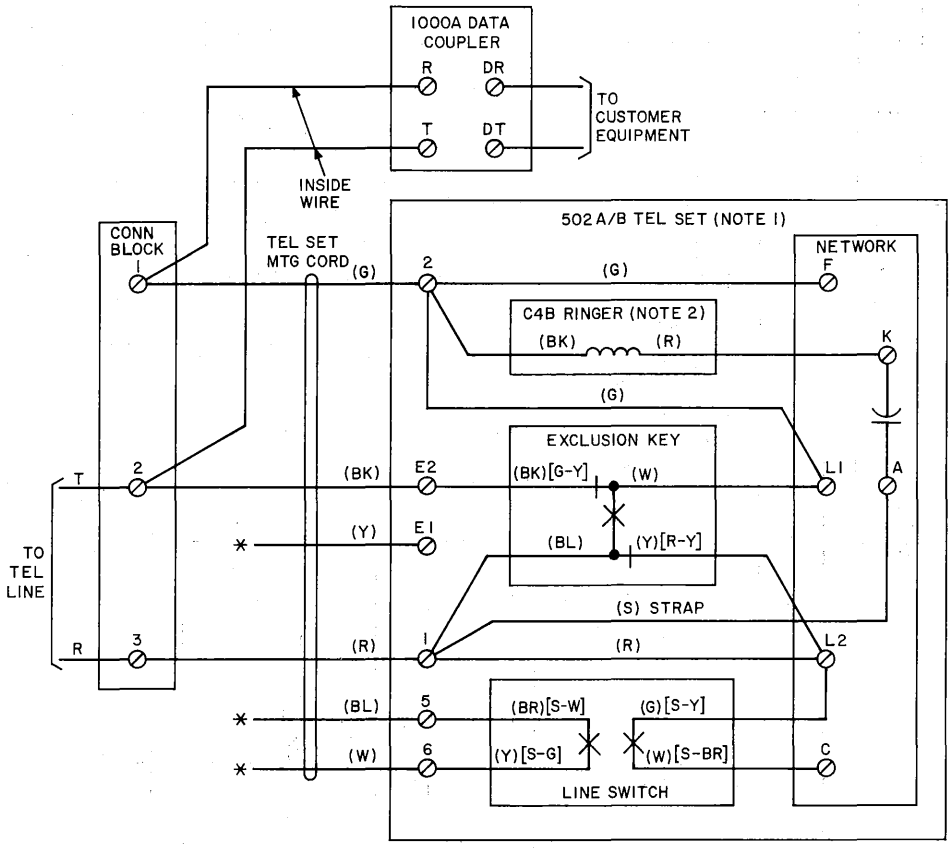
Note: Do not replace cover at this time.

3.08 When a telephone 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 telephone set. The rewiring permits the telephone set to control the line. Location of the terminals on the coupler is shown in Fig. 3.

3.09 A separate connecting block must be installed with the coupler when the 503C-type telephone set is used to furnish a telephone mode indication. A connection is made between a set of the exclusion key contacts in the telephone set and two terminals on the connecting block. The exclusion key contacts are closed when the line is connected to the telephone set. The customer may monitor the terminals on the connecting block and obtain an indication of the mode in which the telephone 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 the appropriate section for the telephone set being used. A 15D key telephone unit (KTU) may be used with a 1A system for incoming call detection.



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

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

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

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 insertion loss and impedance-matching tests 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*** determines the proper strapping for the option terminals.

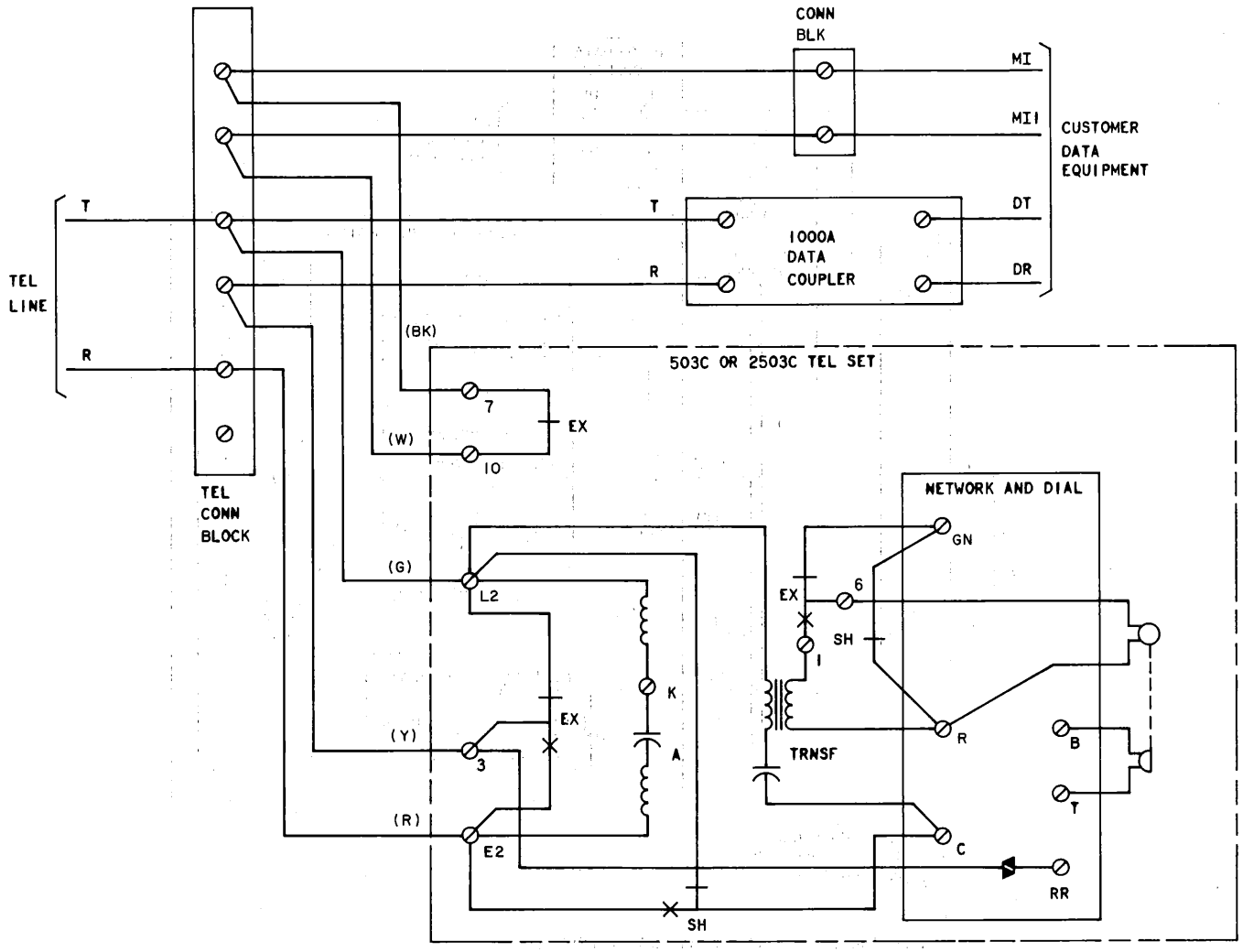


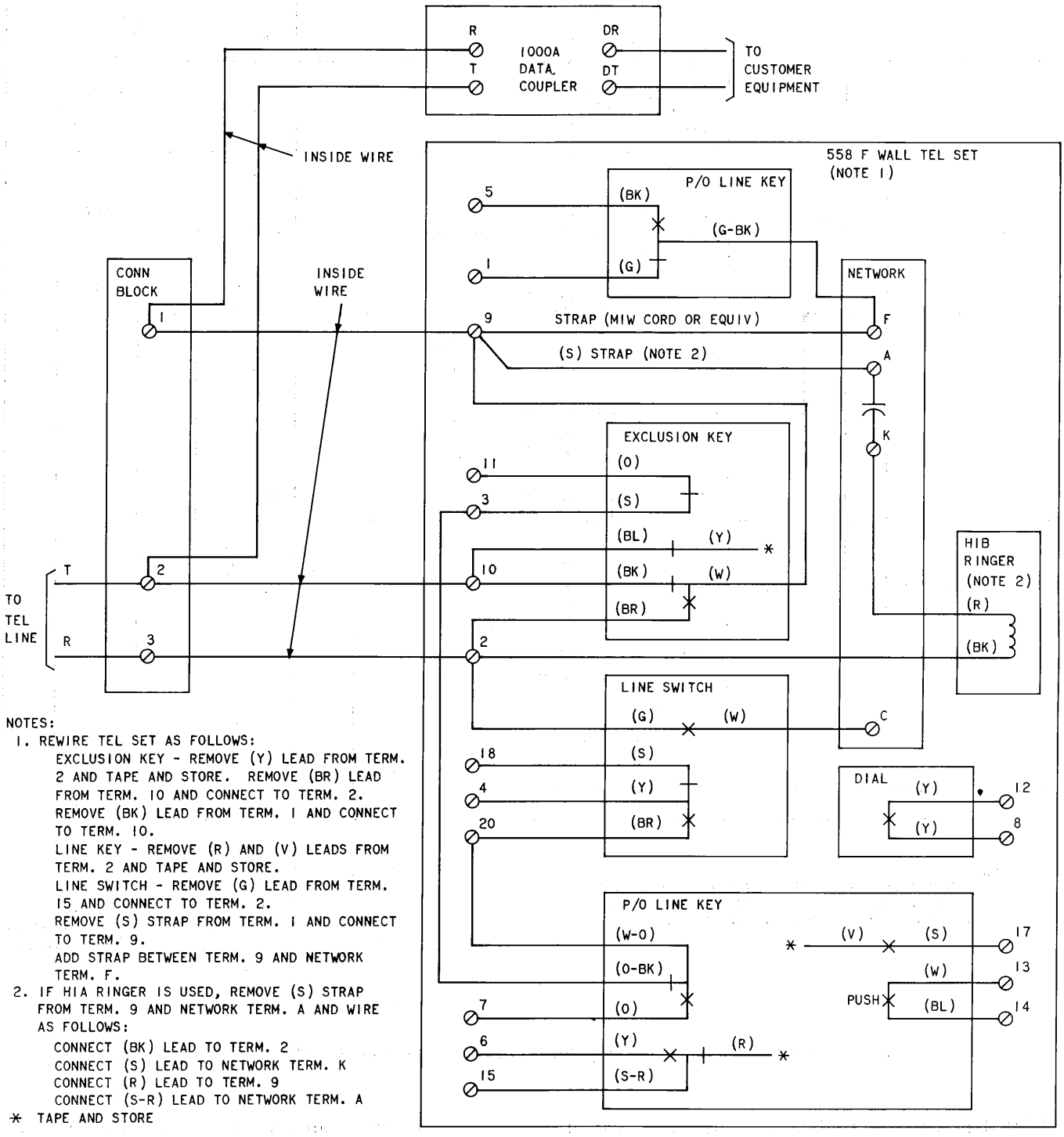
Fig. 5—Typical Connections for 1000A Data Coupler With 503C or 2503C Telephone Set

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 -4.2 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.

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 3.13, "-5" would be marked on the label.

3.15 In the event appropriate ac power 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 loss of the coupler to the estimated measured loss



NOTES:

1. REWIRE TEL SET AS FOLLOWS:
   EXCLUSION KEY - REMOVE (Y) LEAD FROM TERM. 2 AND TAPE AND STORE. REMOVE (BR) LEAD FROM TERM. 10 AND CONNECT TO TERM. 2. REMOVE (BK) LEAD FROM TERM. 1 AND CONNECT TO TERM. 10.
   LINE KEY - REMOVE (R) AND (V) LEADS FROM TERM. 2 AND TAPE AND STORE.
   LINE SWITCH - REMOVE (G) LEAD FROM TERM. 15 AND CONNECT TO TERM. 2. REMOVE (S) STRAP FROM TERM. 1 AND CONNECT TO TERM. 9.
   ADD STRAP BETWEEN TERM. 9 AND NETWORK TERM. F.
2. IF HIA RINGER IS USED, REMOVE (S) STRAP FROM TERM. 9 AND NETWORK TERM. A AND WIRE AS FOLLOWS:
   CONNECT (BK) LEAD TO TERM. 2
   CONNECT (S) LEAD TO NETWORK TERM. K
   CONNECT (R) LEAD TO TERM. 9
   CONNECT (S-R) LEAD TO NETWORK TERM. A

* TAPE AND STORE

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

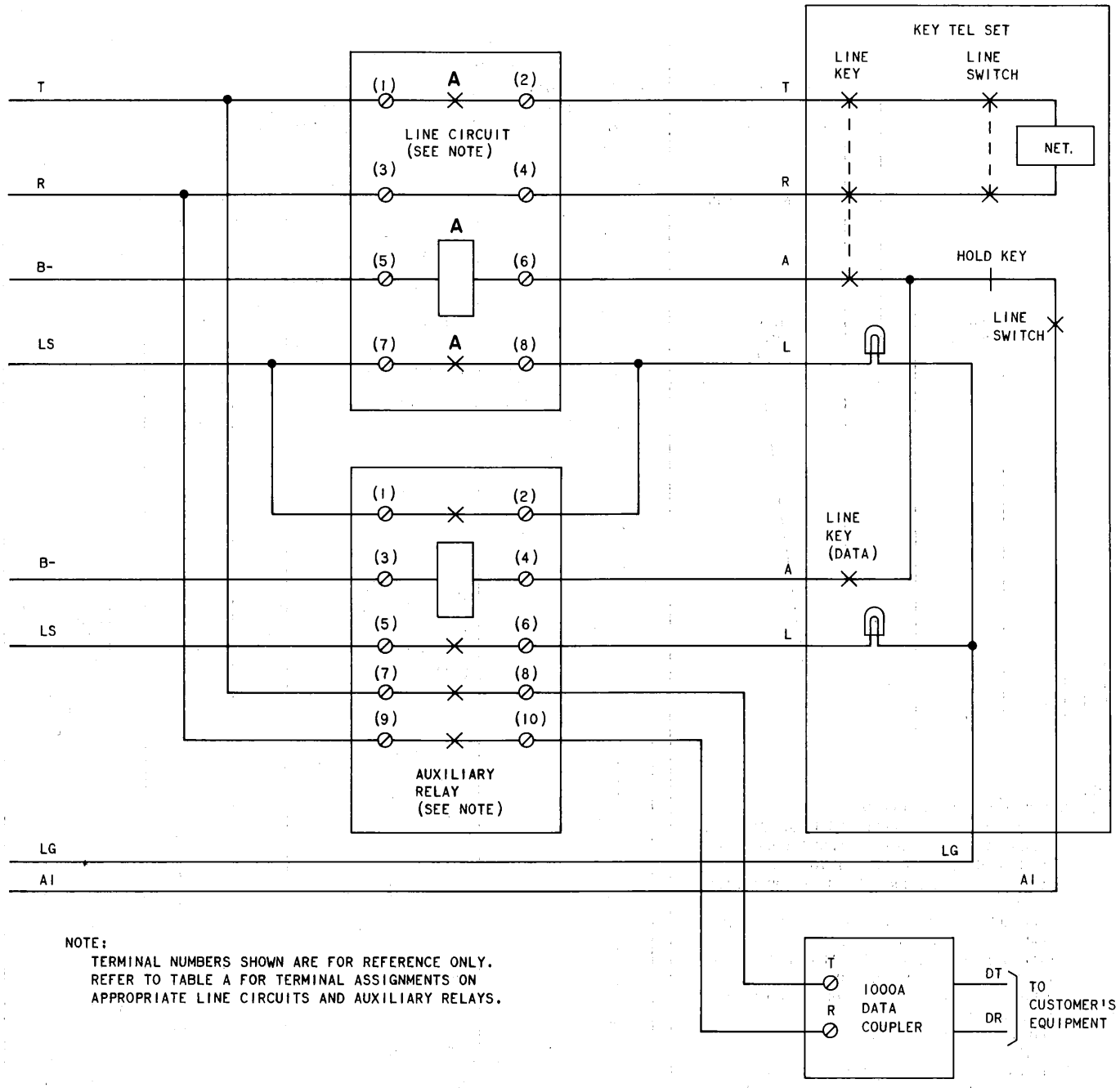


Fig. 7—Connections for Key Telephone System Arrangements—Partial Schematic

(EML) of the assigned loop. This combined loss of the loop and coupler is used 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 Instruct the customer to raise only the hinged portion of cover to gain access to interface terminals DT and DR. Also caution customer that overtightening screw terminals may cause stripping. ***Do not connect the interface leads to the***

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	7	1	8	2	26	3	29	5	—	—
	or 239A Line Circuit	A	E	B	F	Y	H	T	G	—	—
	229B Auxiliary Relay	14	4	20	10	13	3	12	2	11	1
1A	29A Line Circuit	1	4	12	15	7	9	2	5	—	—
	29A Auxiliary Relay	1	4	7	9	2	5	3	6	14	11

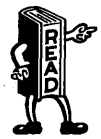
coupler unless requested by, and under the direction of, the customer.

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 Record all level measurements and test results made during installation on a line history card, or equivalent, to assist in analyzing future trouble and to detect gradual degradation of service. ***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 informed when the actual measured loss (AML) of the loop deviates from the estimated measured loss (EML) by more than ±1 dB.

4. MAINTENANCE AND TESTS

4.01 Maintenance and test 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 precaution must be taken.



Obtain permission from the customer to disconnect the customer interface leads.

TABLE B

LEVEL OPTION STRAPPING FOR 1000A DATA COUPLER

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

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 telco equipment, inform 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 customer premises should be limited to local tests, testing with a serving or test office, or replacing a defective unit.

> ***Note:*** Do not attempt individual component repair or replacement on the printed circuit board.

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 test 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, perform the most likely necessary tests or evaluations to isolate and clear the trouble within the station as directed by the PSC. 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

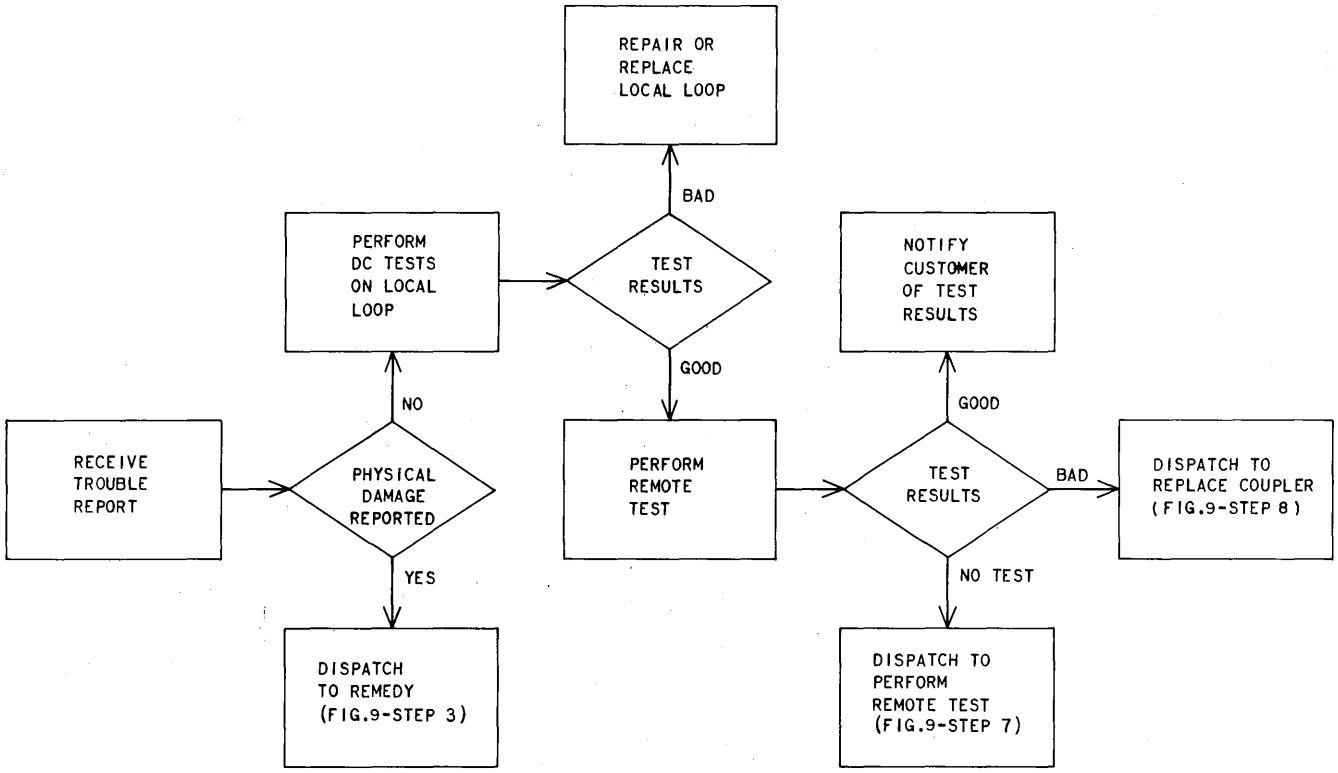


Fig. 8—Basic Activities Prior to Dispatching Employee

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, test equipment, etc, for locating trouble and effecting repairs at customer premises.

(2) Upon arrival at the coupler station, question the customer to obtain any information relating to the trouble. 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, repair or replace the component (ie, replace ringer, dial, handset, etc, on associated telephone set when provided).

(4) After making the necessary repairs, request the customer to verify service restoral (ie, try to exchange data with station that caused the customer to report the trouble).

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

(6) If the customer cannot exchange data or is not satisfied with the service, proceed with the investigation (Step 7).

(7) If the installation appears to be in order after the visual inspection, have the local test desk or equivalent test location equipped for ac testing, such as a data test center, make the remote test of the coupler as outlined in 4.12.

(8) If the results of the coupler remote test are ***not*** satisfactory, replace the coupler with one known to be operating properly. Refer to Part 3 for installation and connection procedures for the replacing coupler. Ensure that all level

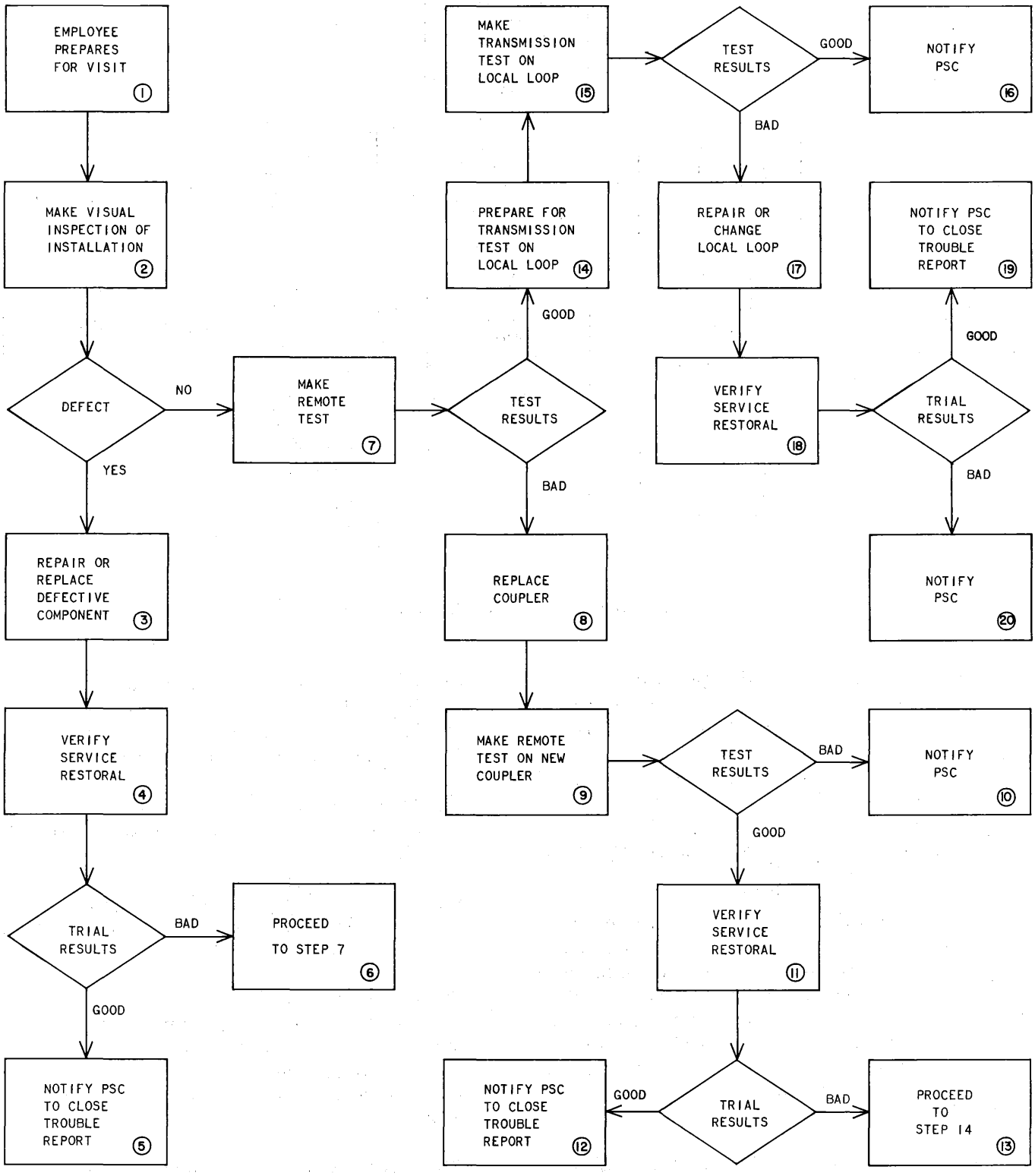


Fig. 9—Activities for Clearing Trouble at a Coupler Station

measurements made during installation tests are properly recorded on the line history card.

(9) After the coupler has been replaced, have the remote test outlined in Part 4 made on the replacing coupler.

(10) If the results of the replacing coupler remote test are ***not*** satisfactory, notify the PSC of the repair work that has been completed and request instructions before continuing investigative efforts.

(11) If the results of the replacing coupler remote test are satisfactory, request the customer to verify service restored (ie, try to exchange data with the station that caused the customer to report the trouble).

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

(13) If the customer cannot exchange data or is not satisfied with the service, 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, 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 a transmission test on the local loop.

(16) If the results of the loop test are satisfactory, notify the PSC that the results of the coupler and local loop tests are satisfactory and 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, 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 the defective loop, the repaired or changed loop has been tested, 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 the maximum allowable customer level has been changed. Notify customer of level change and then request customer to verify service restoral (ie, try to exchange data with the station that caused the customer to report the trouble).

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

Note: Prior to leaving customer premises, perform the remote test outlined in 4.12 and record the new level 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. 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 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 Telephone 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. Results of the test are used to determine the level option terminals which must be strapped in the coupler. 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.

Note: ▶If the local loop is estimated to have less than 3 dB of loss or has been measured with the result of the measurement indicating a loop loss of 3 dB or less, proceed as follows. Locate resistor R10 by holding the coupler with the switch up. Resistor R10 is the one on Malco terminals just to the right of the thermistor, diagonally to the lower right of the transformer. Strap out resistor R10 with a clip lead. Leave the clip lead in place for both the insertion loss and impedance matching tests. Remove the clip lead before strapping the level option.◀

(3) Use the associated network control signaling apparatus (telephone 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 telephone 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. ▶See note following 4.09 (2).◀

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

(1) Set oscillator for a 1000-Hz frequency and a 600-ohm output impedance.

(2) Select proper scale on VOM to measure -5 dBm.

(3) Connect oscillator output to VOM input with 600-ohm resistor bridged across VOM input.

(4) Adjust oscillator output level to obtain a -5 dBm indication on VOM. Remove 600-ohm resistor and connect VOM and oscillator as shown in Fig. 10.

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

(5) Use associated network control signaling apparatus (telephone set, key telephone equipment, etc) and dial a quiet battery termination at the serving central office.

(6) After connection is completed, operate data key associated with coupler.

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

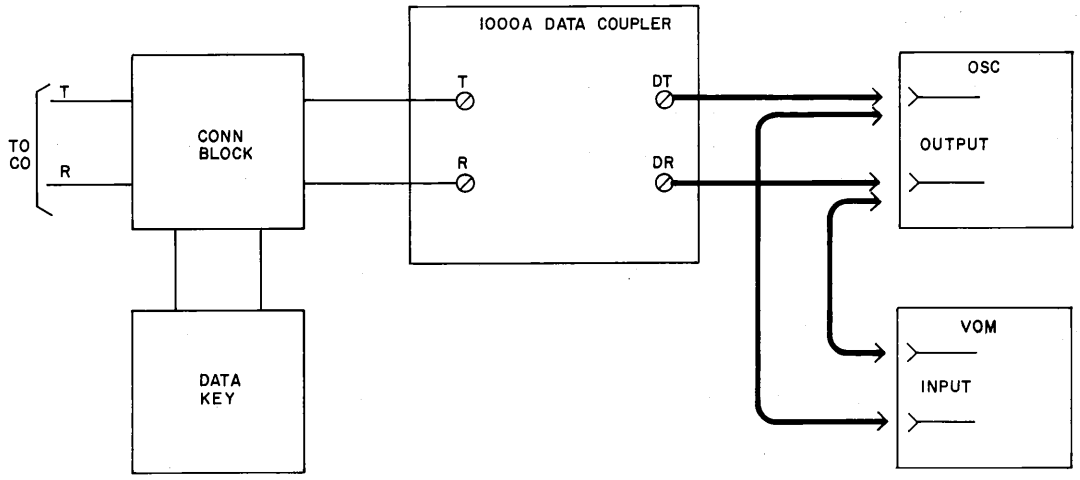


Fig. 10—Test Equipment Connections for Impedance-Matching Test

(7) Use VOM to again measure signal level (in dBm). This value is used in 3.12 to derive the level option strapping from Table B.

(8) Disconnect test equipment and restore 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 associated network control signaling apparatus (telephone, key telephone equipment, etc) and contact a test employee at the local test desk (LTD). If the LTD is not equipped for ac testing, contact a remote test location that is so equipped, or a data test center (DTC) (see Step 5).

(2) Request LTD or DTC employee to call the coupler and to measure level of coupler test tone (2800 Hz) at the test desk.

(3) Agree upon length of time required to perform test, and when instructed by LTD or DTC employee, operate data and TST keys.

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

(4) After the agreed interval, restore TST and data keys and request level reading from the LTD or DTC employee. This level indicates the loop plus coupler loss at 2800 Hz. When test is made at time of installation, record the actual value of loss 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 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 tone indicates there is ac continuity through 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 telephone connection to normal.

4.14 ***503C or 2503C Telephone Set Test:*** This test verifies that the telephone 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 telephone 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. Precautions should be taken to ensure that the customer does not receive inadvertent signals.

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

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

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

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

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

(6) Return equipment to normal.

5. ▶REFERENCES

5.01 The following Bell System Practices provide additional information that may be helpful in installing the data coupler:

SECTION	TITLE
010-250-001	Crediting Charges on Test Calls
010-521-100	Data Technical (DATEC) Support
010-521-101	Data Technical (DATEC) Support — Designee Directory
314-205-500	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network — Overall Data Transmission Test Requirements
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network — Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-200	Data Sets and Data Access Arrangements — General Installation and Connection Information
660-101-312	Maintenance Service Charge on Services With Customer-Provided Equipment (CPE)

5.02 Detailed information on the 1000A data coupler is contained in the following schematic drawing (SD) and circuit description (CD):

SD- & CD-1D205-01 1000A Data Coupler◀