1001D DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

CONTENTS PAGE

1. GENERAL

1.01 This section provides information required for installing and maintaining the 1001D data coupler (Fig. 1).

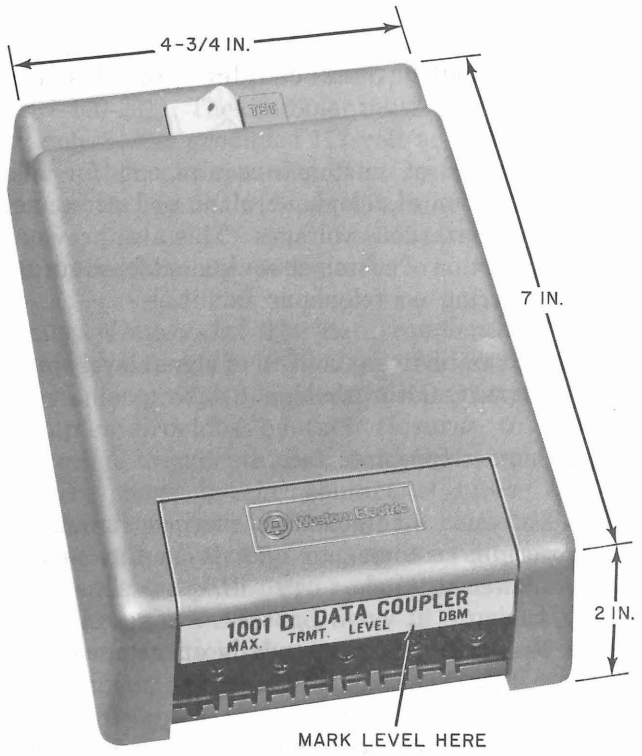


Fig. 1—1001D Data Coupler

1.02 This section is reissued to:

- Change Fig. 8 and 9
- Replace Table C
- Add additional references.

1.03 The data access arrangement (DAA) includes both the data coupler and telephone set as described in appropriate tariffs. The 1001D is an automatic data coupler which provides the means for connecting customer-provided automatic data equipment to the switched network for data and voice communications. The uniform service order code (USOC) for this DAA is CBT.

1.04 The 1001D data coupler is smaller than the 1001B coupler [rated Manufacture Discontinued (MD)], which has the same USOC. The 1001B and 1001D are otherwise interchangeable. The 1001D has no ANS switch, automatically answers in the test mode, and requires less current in the test mode.

1.05 The 1001D data coupler provides the following:

- Isolation of customer equipment for the protection of telephone plant and personnel from hazardous voltages. This also provides protection of customer equipment from surges occurring on telephone facilities.
- Automatic linear control of signal level above a specified threshold.
- Contact-type interface.
- Detection of incoming ringing signals to permit customer to operate in unattended answering mode.
- Test circuitry for manually operated remote testing.
- Off-hook control which allows customer equipment to dial-pulse for call origination.
- Timed delay on all calls to permit proper automatic message accounting.
- Indication of switchhook status on associated telephone set, if provided.
- 2-way transmission path.

1.06 Additional telephone functions, such as alternate voice service, may be provided with an associated telephone set as a standard option. Audible monitoring of the data transmission and mode indication through switch contacts are provided by 503C and 2503C telephone sets.

1.07 Customer equipment may be connected through the data coupler to local loop facilities or to Bell System private branch exchange (PBX) station lines.

1.08 At installations where TOUCH-TONE® calling service has been ordered, the customer may generate tone signals for originating calls through the transmission interface leads of the coupler.

1.09 A service offering in which the data coupler is used provides the customer with end-to-end transmission performance characteristics comparable to DATAPHONE® service on the switched telecommunications network. Because customer equipment, over which the Bell System has no design control, may contribute significantly to error performance, the Bell System cannot assume responsibility for the accuracy of transmitted data. End-to-end facilities, including the local loop, will be engineered and maintained to the equivalent DATAPHONE service requirements. These requirements are specified in Section 314-205-501 for local loops and in Section 314-205-500 for the switched network.

2. DESCRIPTION

A. Physical Description

2.01 The 1001D data coupler is a wall-mounted unit measuring 4-3/4 inches wide, 7 inches high, and 2 inches deep. The coupler weighs approximately 1-3/4 pounds and is enclosed in a gray plastic housing. The housing consists of a dark gray base and a light gray cover that snap together. One keyhole slot and one screw hole are provided in the base for mounting the unit on a wall or on other vertical surface. ***The coupler must be vertically mounted to ensure proper operation of the mercury relay.***

> ***Note:*** Two No. 6 by 1/2-inch pan-head self-tapping screws are shipped with the data coupler. The use of larger screws will short

circuit printed wiring paths on the circuit pack.

2.02 Circuitry for the coupler is mounted on two printed CPs (Fig. 2). Ten screw terminals at the lower end of the bottom CP provide the interface for connection to customer equipment. Interface control leads use contact closures for signaling. See Table A for lead designations. The cord required for connecting the customer modem to the interface must be supplied by the customer.

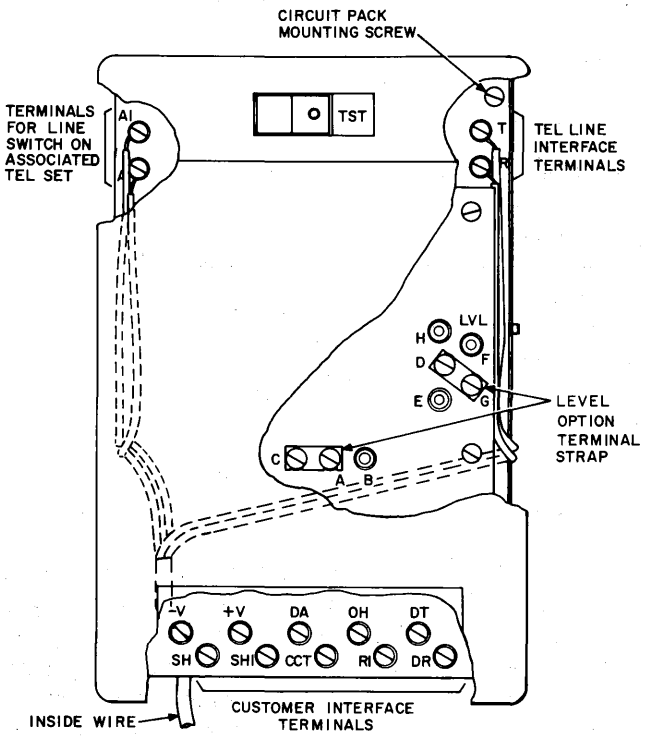


Fig. 2—Route of Station Wiring and Location of Terminals

2.03 Four additional screw terminals are provided on the larger printed CP for connecting the telephone line and associated apparatus to the coupler. The housing cover must be removed to make connections to the coupler. To remove, lift cover up from the bottom to relieve tension on mounting lips, then pull cover out at the top. Use D station wire to terminate connections. The following pairs of leads terminate on the four terminals:

- T and R—Telephone line transmission and signaling pair
- A and A1—Extension of associated telephone set switchhook to the customer equipment.

2.04 A locking switch (TST) is located at the top of the coupler to provide control of the test mode condition.

2.05 Level option terminals located on the smaller CP must be strapped by the installer to adjust the threshold of the automatic level control (ALC) (limiter) circuit of the coupler.

2.06 The data coupler is designed to operate over an ambient temperature range of 0 to 120°F with a maximum relative humidity of 95 percent.

2.07 The coupler ALC circuit is powered from dc telephone line current. An external power supply is required to provide a dc supply for the control circuit of the coupler. The external supply may be provided by the customer, or by the telephone company (telco) at customer request. When the telco is requested to provide the supply, a suitable power source is the 33A power unit (Section 167-452-101), the 28A1 power unit (Section 167-445-101), or the 19B2 power unit (Section 167-440-201). The customer must provide a standard 2-pole 3-wire grounded 117-volt ac power receptacle for either power unit. The receptacle must not be under control of a switch.

B. Functional Description

2.08 ***General:*** The data coupler is a network protective unit designed to interface a customer-provided automatic data terminal. The coupler provides contact closures to the data terminal to indicate the detection of ringing signals. In response to the contact closures, the data terminal provides signals which cause the coupler to seize the line, trip ringing, and cut through the transmission path. Prior to the transmission path cut-through, a 2-second delay is provided to allow proper operation of automatic message accounting equipment. A polarity guard, ALC, and a coupling transformer are provided to protect the telecommunications network, coupler, and customer equipment. In addition, the coupler circuitry permits the data terminal to originate and terminate data calls automatically.

2.09 ***Coupler Transmission Path:*** The coupler transmission path consists primarily of a coupling transformer, an ALC circuit, and a

TABLE A

INTERFACE LEAD DESIGNATIONS FOR 1001D DATA COUPLER

TERMINAL DESIGNATION	FUNCTION	
DT	Data Tip	600-Ohm Transmission Leads
DR	Data Ring	
OH	Off-On Hook Control	
DA	Request Data Transmission Path Cut-Through	
RI	Ring Indication	
CCT	Coupler Cut-Through	
SH (or MI)*	Switchhook Status of Associated Tel Set	
SH1	Return for SH Lead	
+V	Positive DC Power	
—V	Return for DC Power	

*SH is redesignated MI when used with MFT.

polarity guard (Fig. 3). The transformer terminates the telephone loop and provides a 2-way protective function (ie, hazardous voltages, surge protection, and longitudinal isolation). The ALC circuit prevents the customer signal level from exceeding the prescribed maximum limit. The polarity guard maintains the polarity of the line current and voltage required by the ALC circuit.

2.10 The ALC circuit continuously monitors the output of customer data signals. Option strapping on the level-adjusting network determines the customer signal power level (threshold) at which the circuit operates to control the output signal.

2.11 The signal power level is continuously averaged by the detector and integrator. When the averaged signal level exceeds the threshold during any 3-second interval, current is driven through a thermistor. The thermistor heats up, decreases in resistance, and since the thermistor shunts the transmission path, reduces the signal level to the threshold value.

Data Mode

2.12 ***Ring Detection:*** The ring detector (Fig. 3) is activated when the 20-Hz ringing signal is present on the line, indicating an incoming call. The R relay, part of the ring detector, operates and releases in response to each half cycle of ringing current. Contact closures of the R relay are used to close the RI interface lead to -V. ***The contact closures must be integrated by the customer data terminal to protect against false operation due to surges or to dial pulses. At least two cycles of 20-Hz ringing signal should be detected before reacting to the signal.***

Note: An interface control lead closed (connected) to -V indicates an ON condition. A control lead opened (not connected) to -V indicates an OFF condition.

2.13 ***Automatic Answer:*** When the data terminal is ready and satisfied that ringing has been received, the OH interface lead is closed to the -V lead. Closure of the OH lead operates

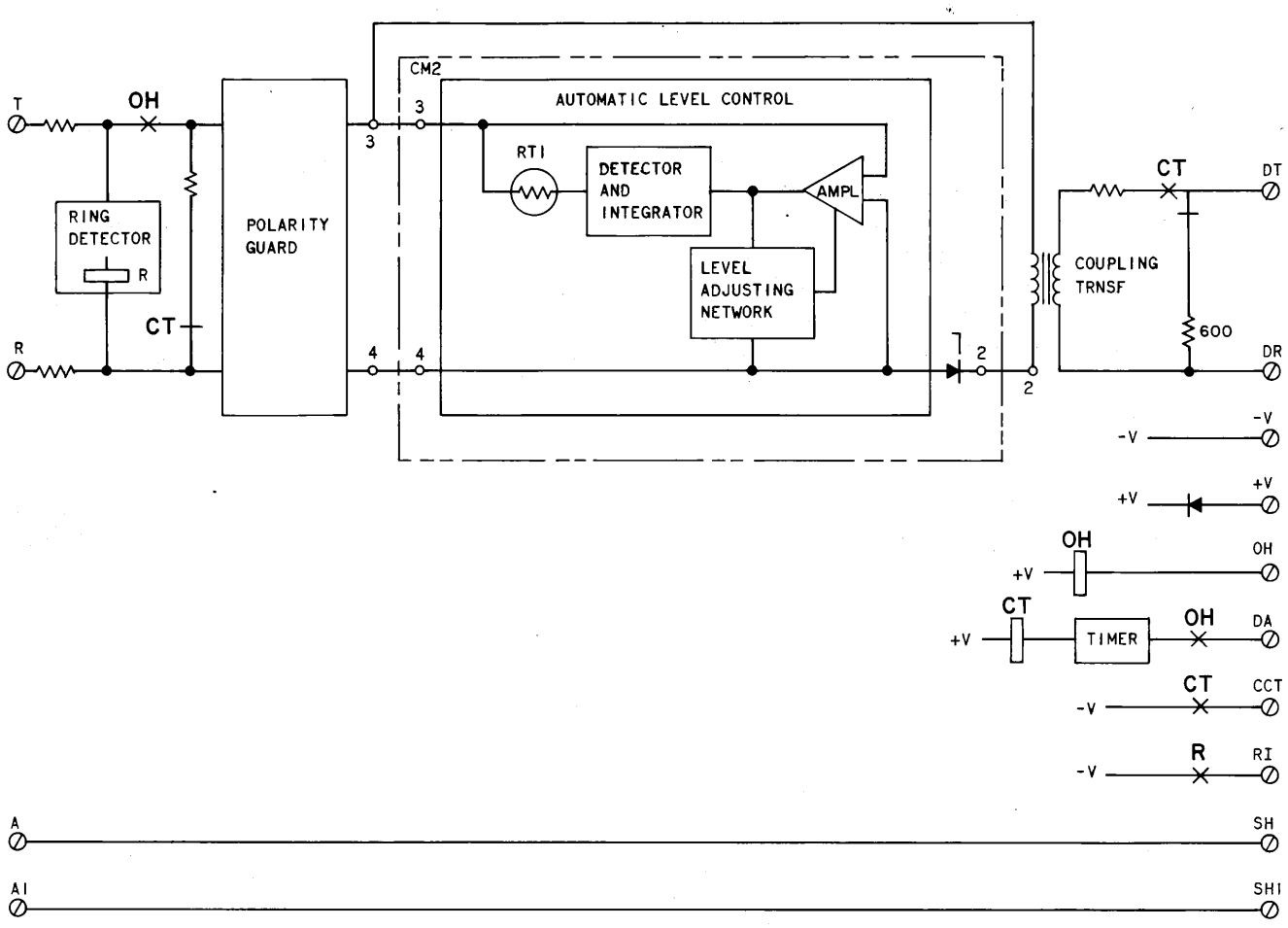


Fig. 3—1001D Data Coupler—Data Mode

the OH relay. In turn, the relay performs the off-hook function by closing the loop to trip ringing. The relay also closes the operate path from the DA interface lead to the delay timer. To complete the data transmission path, the data terminal closes the DA lead to -V. (The DA lead may be closed to -V at all times except when dial pulsing on the OH lead.) The DA lead closure, or the operation of the OH relay when DA is permanently ON except during dialing, starts the timer circuit. After a 2-second interval, the CT relay operates. The CT relay removes the terminating resistor from the loop, removes the terminating resistor from the data terminal, connects the data terminal to the telephone line through the ALC, and closes the CCT interface lead to -V. Closure of the CCT lead informs the data terminal that the transmission path is now completed through the coupler from the data terminal to the local loop.

Closure of the CCT interface lead does not imply that an end-to-end connection has been established.

2.14 The data coupler contains no circuitry to generate or detect answer-tone signals. The customer must provide or detect the answer tone when required.

2.15 ***Call Origination:*** Closing the OH interface lead to -V by the customer, either for call origination or for transfer from a manually originated call, causes the OH relay to provide the off-hook function as previously described. Opening the OH lead causes the OH relay to release and open the dc path through the coupler. This sequence of operations permits the data terminal to generate dial pulses for call origination when dial tone is

present. The pulsing sequence and timing requirements are as follows (Fig. 4):

(1) The OH lead is closed.

Note: The DA lead may be closed to -V to detect dial tone or, after an interval, the presence of tone may be assumed and blind dialing initiated. If the DA lead is closed, a 2-second interval will occur before dial tone can be detected. The DA lead must be opened for the remainder of the dialing sequence after dial tone is detected. The dial speed should be a nominal value of 10 pps.

(2) The OH lead is opened for a 61-percent break interval.

(3) The OH lead is closed for a 39-percent make interval.

(4) Steps (2) and (3) are repeated for the number of pulses required; eg, a total of five openings of the OH lead for the digit 5.

(5) After the last pulse of a given digit, a 600- to 1600-ms delay occurs and the first pulse of the next digit is started.

(6) After all digits have been generated, the DA lead is closed.

2.16 Closing the DA lead, either for detection of dial tone or after the dialing sequence is completed, causes the circuit to function the same as on incoming calls when combined with the closing

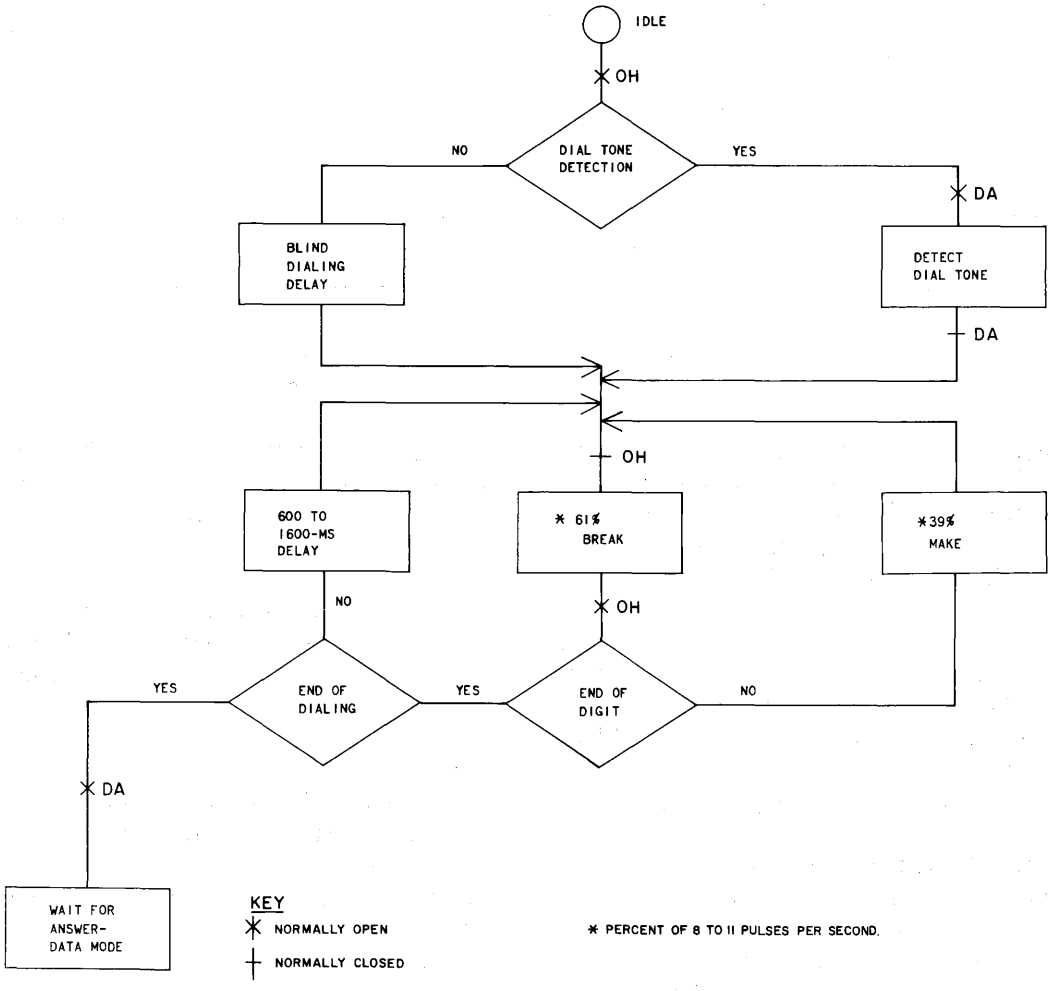


Fig. 4—Customer Automatic Calling Sequence Diagram—DC Dial Pulsing

of the OH lead. After a 2-second interval, the CT relay operates to connect the data terminal to the telephone line and closes the CCT lead to inform terminal equipment that the transmission path has been cut through to the local loop.

2.17 Automatic calling may also use TOUCH-TONE signaling for call origination (Fig. 5). As previously stated, closing the OH and DA leads to -V causes the coupler to go off-hook and provides a transmission path between the data terminal and the telephone line. When dial tone is present, multifrequency signals are generated to access the switched network. The customer may then wait for answer tone or for a verbal answer before transmitting data.

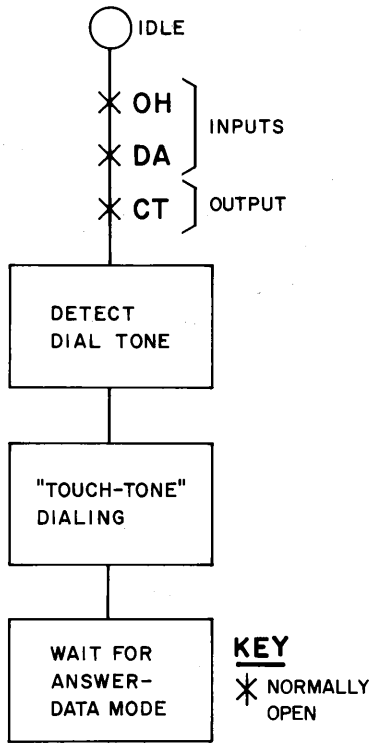


Fig. 5—Customer Automatic Calling Sequence Diagram—TOUCH-TONE Dialing

2.18 ***Call Termination:*** When data transmission is complete, the data coupler does ***not*** provide an automatic disconnect. ***The data terminal must recognize the end of the call and must open the OH interface lead.*** In turn, the OH and CT relays drop to open the telephone loop and disconnect terminal equipment from the coupler. The coupler returns to idle state.

Test Mode

Operation of the TST switch while transmitting data will interrupt the data signals.

2.19 The data coupler test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 6). This permits testing the level control, the local loop, and certain control functions of the coupler. The circuit is designed to be tested remotely from the local test desk (LTD), although a data test center (DTC) or other designated test location may perform the test.

2.20 The test circuit consists of a tone oscillator, test (TE) relay, and a switch (TST). The TST switch is used to condition the test circuit for operation. The switch closes a path to a relay driver for the TE relay and to the winding of the OH relay. The switch also removes two of the interface control leads (OH and RI) from the customer equipment to prevent false operation or indication.

2.21 The data coupler detects the incoming ringing signal of a test call in the same manner as previously described for data mode. The R relay operates and releases in response to ringing current. When the R relay operates, -V is closed to a relay driver which in turn operates the TE relay. A make contact on the TE relay provides a hold path for the TE relay and an operate path for the OH relay. In addition, the TE relay operates to (1) remove the transmission path from the customer equipment and to connect the path to the output of the test oscillator, (2) open the remaining interface control leads (DA, CCT, and RI) to the customer equipment, and (3), close -V to the call timer via a make contact on the OH relay.

2.22 The OH relay operates to close the loop and to trip ringing. The relay also completes the start path for the call timer. After a 2-second delay, the CT relay operates to connect the output of the test oscillator to the telephone line.

2.23 The test circuit generates a 2800-Hz signal at a level which exceeds the maximum power level allowed for any coupler installation. This level causes the ALC circuit to operate and

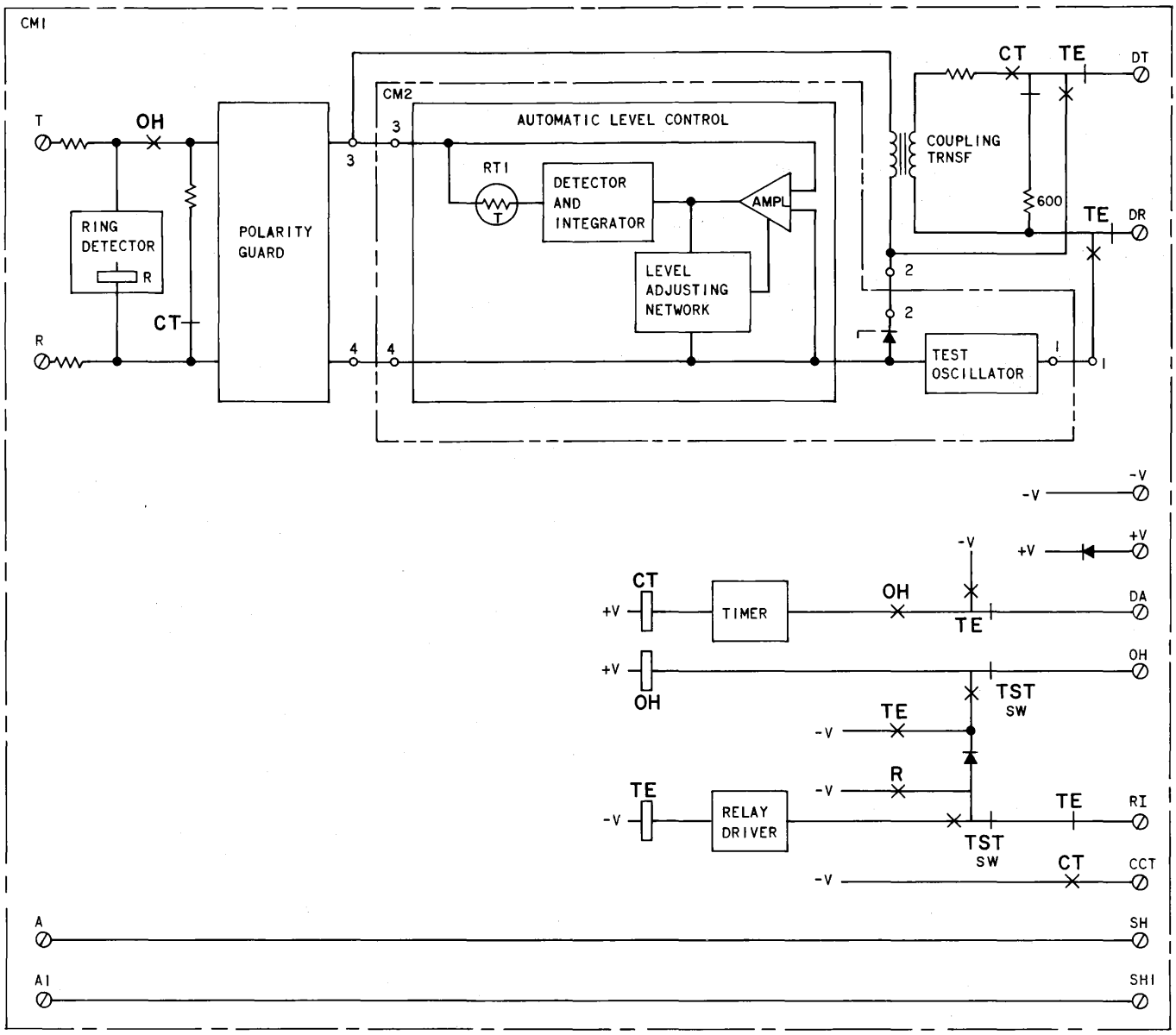


Fig. 6—1001D Data Coupler—Test Mode

reduce the signal level to the value specified at the time of installation.

2.24 Restoring the TST switch releases the coupler from test mode. The TST switch must be restored at the end of the test for proper operation of the coupler.

3. OPTIONS

A. Telephone Sets

3.01 An associated telephone set is a standard option with the data coupler. The coupler can be installed without a telephone set for fully automatic operation. The coupler SH and SH1

interface leads provide the customer with the status of the line switch on an associated telephone set when used with the data coupler. When a telephone set is provided, the exclusion key and telephone set ringer wiring options must be specified on the service order. The exclusion key options provide for either the coupler to control the line or the telephone set to control the line. Telephone set ringer options provide the desired ringing features for each of the two line control options. A description of these options is included in the following paragraphs.

(a) ***Option A—Coupler Controls Line (Automatic Operation)***

(b) ***Option B—Telephone Set Controls Line***

(c) ***Option C—With Ringer Connected on Telephone Set Side of Exclusion Key:***

(1) When coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the coupler RI interface lead can be activated but the telephone set cannot ring.

(d) ***Option D—With Ringer Connected on Telephone Line Side of Exclusion Key:***

(1) When the coupler controls line

When the exclusion key ***is not operated,*** the coupler RI interface lead can be activated and the telephone set can ring.

When the exclusion key ***is operated,*** the telephone set cannot ring and the coupler RI interface lead cannot be activated (since handset must be lifted to operate exclusion key and this causes dial tone).

(2) When telephone set controls line

When the exclusion key ***is not operated,*** the telephone set can ring but the coupler RI interface lead cannot be activated.

When the exclusion key ***is operated,*** the telephone set can ring and the coupler RI interface lead can be activated.

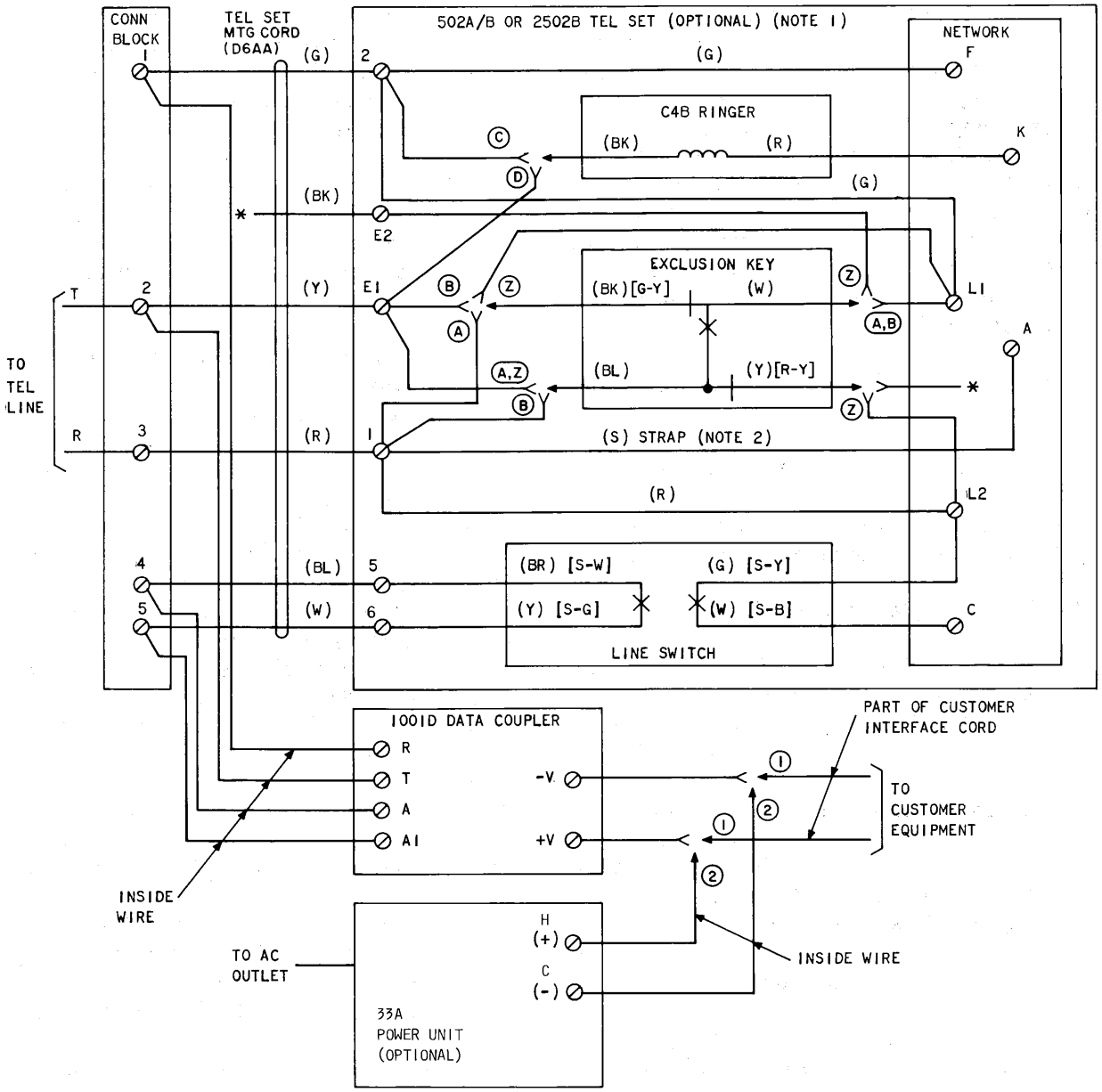
3.02 Options specified in 3.01 apply to the standard [502A/B or 2502B (Section 502-501-102 or 502-503-102)] as well as the multifunction telephone (MFT) [503C or 2503C (Section 502-501-120 or 502-503-120)] when used with the 1001D data coupler. Connections for these options using the 502- and 2502-types are shown in Fig. 7. Additional options are available using the MFT, and are discussed in 3.03, and shown in Fig. 8 and 9. Wall-mounted telephones are not recommended and should not be used.

3.03 The 503C (rotary dial) and the 2503C (TOUCH-TONE dial) telephone sets furnish the customer the following additional options.

- Allows monitoring of data transmission and voice answer-back signals through the telephone handset as used in digital inquiry voice answer-back (DIVA) applications.

- Provides an indication of whether telephone line is connected to telephone set or data coupler, or it may be used to provide an indication of SH (ie, on-hook or off-hook).

These additional features provided by the 503C (or 2503C) telephone set necessitate the use of a triple transfer exclusion key and a high-impedance bridging transformer in the telephone set. One set of the exclusion key contacts switches the line between the telephone and the coupler. The second set switches the monitoring circuit, and the third set provides the mode indication. The high-impedance transformer allows the attendant to monitor data transmission with the telephone handset. Both sets are in a light gray housing; however, they



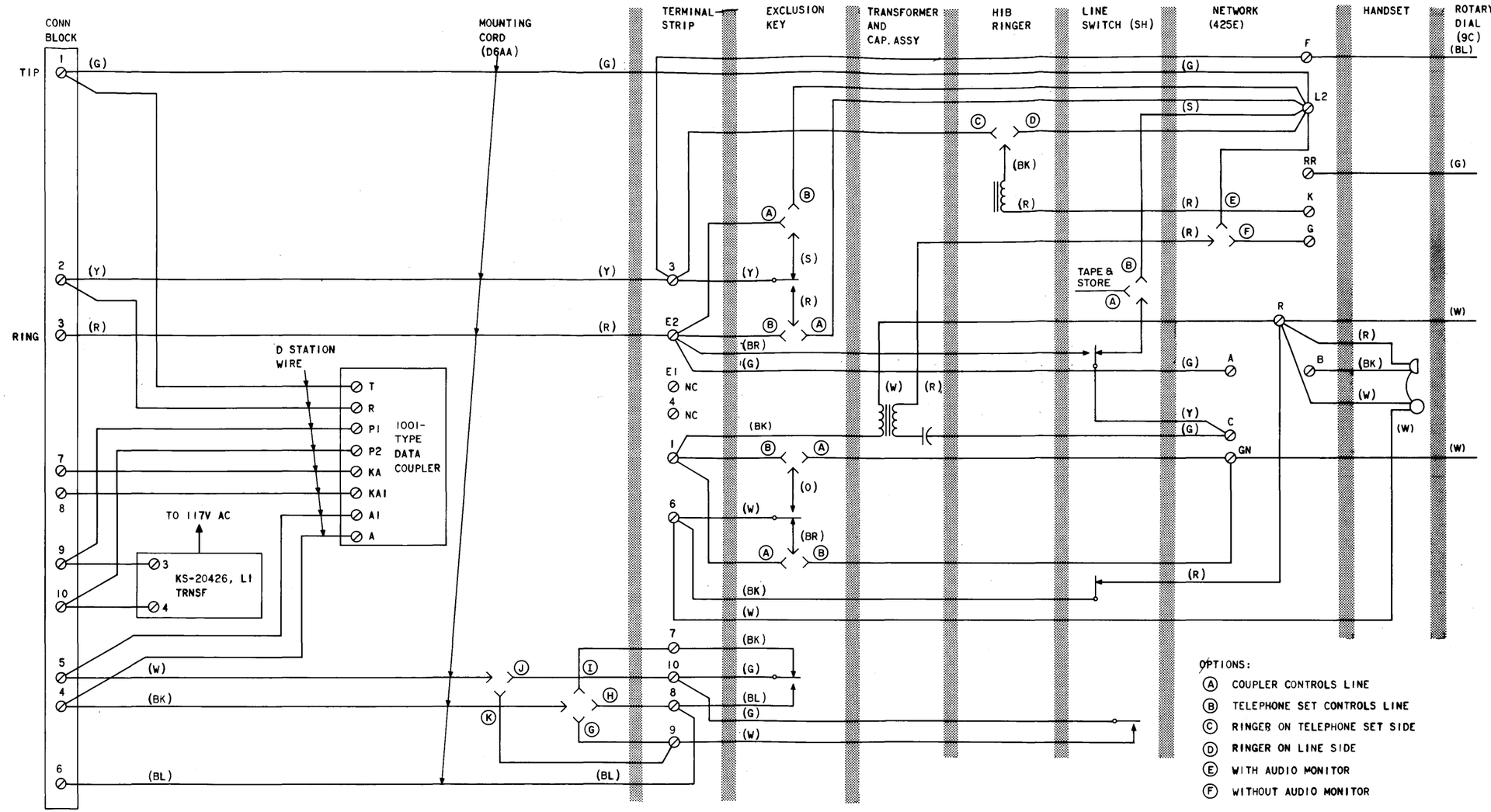
NOTES:
1. EXCLUSION KEY AND RINGER MUST BE REWIRED FOR DESIRED OPTION.
2. IF C4A RINGER IS USED, WIRE AS FOLLOWS:
   (BK) TO 2 OR E1, DEPENDING ON OPTION USED
   (S) TO K OF NETWORK
   (S-R) TO A OF NETWORK
   (R) TO 1 OF TERMINAL STRIP

Ⓩ ORIGINAL FACTORY WIRING OF TEL SET
① POWER FURNISHED BY CUSTOMER
② OPTIONAL TELCO FURNISHED UNIT
* INSULATE AND STORE
( ) CURRENT COLOR CODE
[ ] MD COLOR CODE

EXCLUSION KEY OPTION	WIRING OPTION
COUPLER CONTROLS LINE	A
TEL SET CONTROLS LINE	B

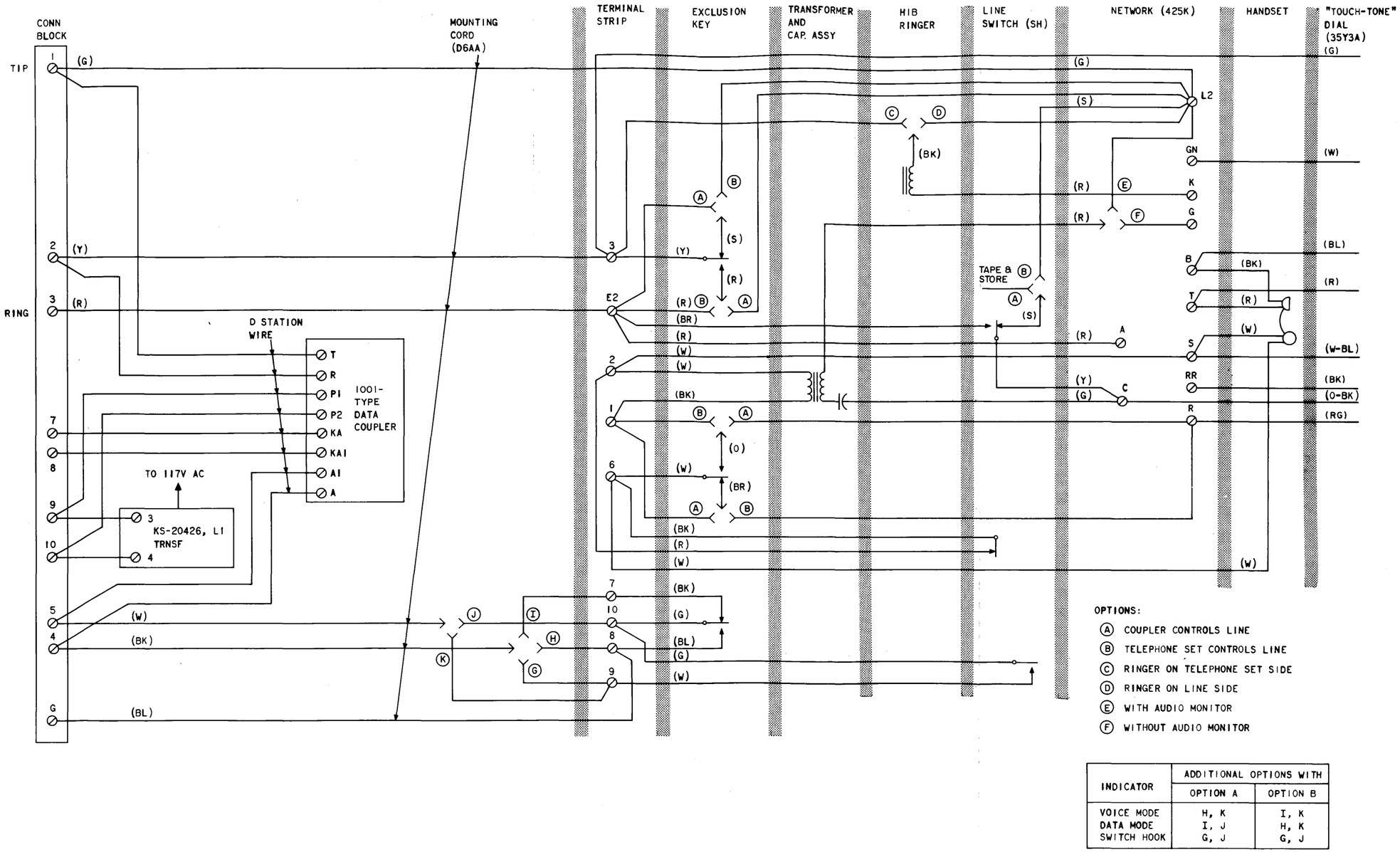
RINGER OPTIONS	WIRING OPTION
RINGER ON TEL SET SIDE OF EXCLUSION KEY	C
RINGER ON TEL LINE SIDE OF EXCLUSION KEY	D

Fig. 7—Typical Connections for 1001D Data Coupler With 502A/B or 2502B Telephone Set



INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCHHOOK	G, J	G, J

Fig. 8—Typical Connections for 1001D Data Coupler With 503C Telephone Set



INDICATOR	ADDITIONAL OPTIONS WITH	
	OPTION A	OPTION B
VOICE MODE	H, K	I, K
DATA MODE	I, J	H, K
SWITCH HOOK	G, J	G, J

Fig. 9—Typical Connections for 1001D Data Coupler With 2503C Telephone Set

may be enclosed in standard 500- or 2500-type housings of another color if desired.

3.04 In a multiple data coupler installation, it is often desirable to associate several data couplers with one telephone set. Key telephone sets are available in 6-, 10-, 18-, and 30-button sizes. Key telephone sets can connect to one of several lines. The auxiliary key contact for each line, designated the A lead, is used to operate associated circuitry. The A lead may also be used to operate a relay which transfers a line from the data coupler to the telephone set as shown in Fig. 10. The function of the exclusion key is replaced by the line pickup key on the key telephone set. Note, however, that the coupler is never disconnected from the line when wired as shown in Fig. 10. The switchhook indicator function (SH lead) is not available with key telephone set installations unless auxiliary key telephone units (KTUs) are used. The coupler is assumed to be the primary station. Data calls can be originated and answered without interference from the telephone set. To indicate activity of the data coupler, the OH contact is used to connect the winking lamp supply to the telephone set. The lamp under the key designated for the line assigned to this coupler winks when the data coupler is on-line and off-hook.

3.05 Apparatus necessary for providing telephone service for automatic data couplers consists of a key telephone set with enough capacity for the lines involved, a transfer relay for each line involved, a ringup relay for each line that requires manual answering as a service feature, and a line current detecting relay to supply visual indication of the coupler status. Figure 10 shows the connections for a representative KTU. Other types of KTUs that provide the required features may be used at the discretion of the telco. Additional features such as common pickup of a single group of lines from any of several telephone sets may be supplied by bridging key telephone sets and adding additional KTUs. Any service commonly offered in a local area should be provided according to local practices.

B. Line Current Status Indicator (LCSI)

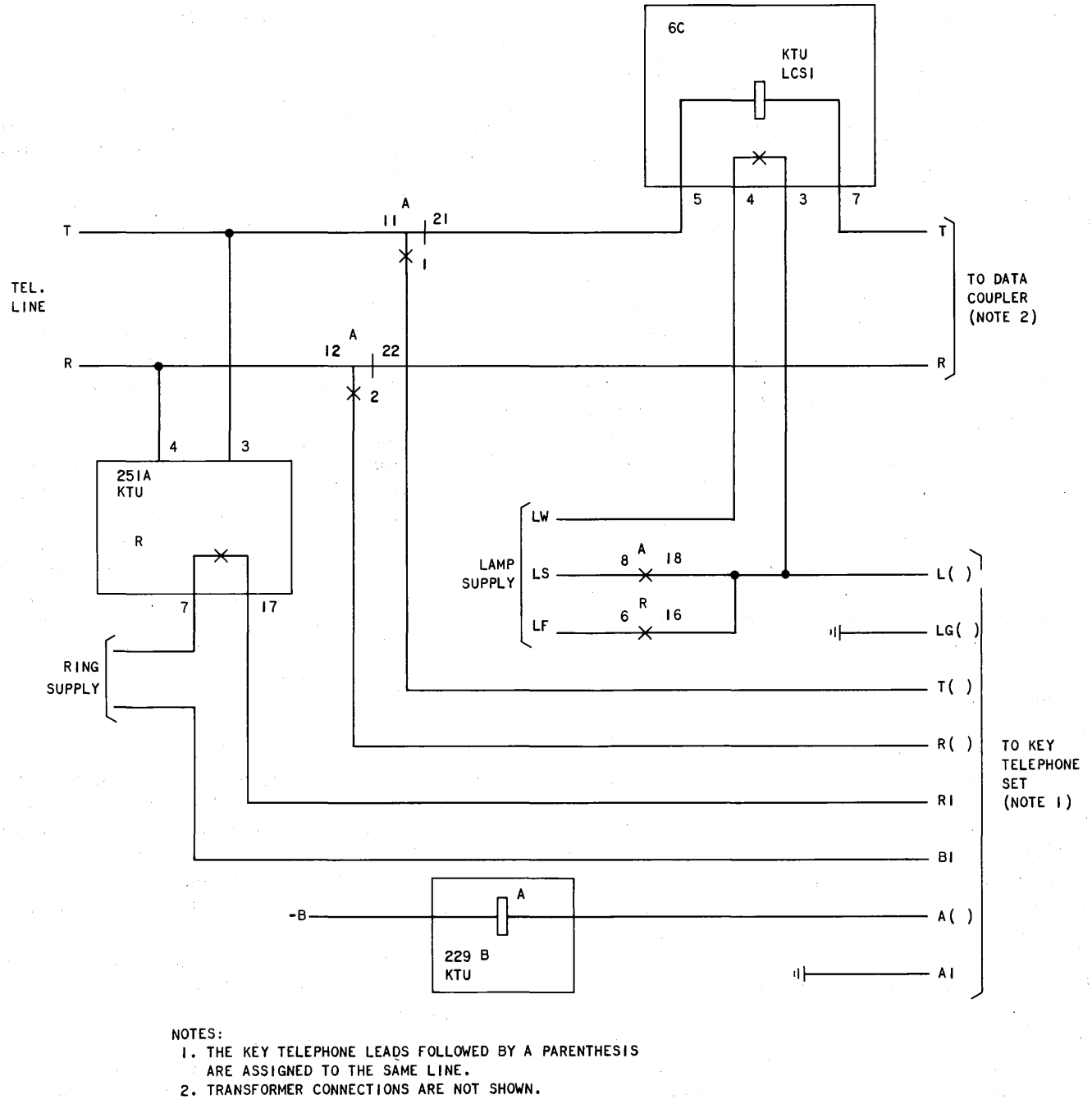
3.06 An LCSI may be installed with the coupler on an optional basis to aid the customer in recognizing the end of call. The LCSI will not work on facilities served by certain central offices and it performs differently with some of the central offices that it ***will*** work with. Refer to Table B to determine the applicability to a particular installation.

Caution should be exercised in using the LCSI to indicate a far-end disconnect. Momentary line current interrupts occur during call setup. They can be up to 400 ms long and can occur up to 10 seconds after dialing is completed and at the called end, 500 ms after answering a call. In response to far-end disconnect, some switching offices interrupt line current, but it is important to note that some do not. When such interrupts do occur, the LCSI contact will open momentarily. To avoid misinterpretation of momentary opens, it is recommended that an open should not be interpreted as an indication of far-end disconnect unless it is greater than 5 ms in duration. Customers should verify disconnect arrangements with the local telephone service organization before relying on the LCSI for that function.

3.07 The line current indication from the LCSI can be presented to the customer in one of two ways. Option Z designates a contact closure between terminals A and A1 on the coupler. If option Y is used, the LCSI contact is wired to a pair of terminals on a separate connecting block.

3.08 The LCSI (Fig. 11) must be made locally and consists of a 317A-type dry reed relay and two varistors in a 74B-49 connecting block measuring 2.75 inches wide, 4 inches long, and 1.6 inches high. The relay is in series with the coupler and gives a contact closure at the customer interface when at least 20 mA of line current is flowing through the relay and coupler. The two varistors are used to provide a low-impedance transmission path to the coupler.

If the customer uses the contact closures directly, current through the terminals should be limited to less than 10 mA. The customer circuit must also be noninductive with an open circuit voltage less than



NOTES:
1. THE KEY TELEPHONE LEADS FOLLOWED BY A PARENTHESIS ARE ASSIGNED TO THE SAME LINE.
2. TRANSFORMER CONNECTIONS ARE NOT SHOWN.

Fig. 10—1001D Data Coupler Connections With KTU

50 Vdc. The maximum length of the loop over which the coupler can operate is reduced by approximately 800 feet if an LCSI is used.

3.09 Assemble the unit in accordance with the following procedures.

(1) Remove cover from the 74B-49 connecting block.

(2) Remove the 426A electron tube assembly, including mounting screw, and discard.

Warning: The adhesive used in (3) sets quickly and should not be allowed

TABLE B

LINE CURRENT STATUS INDICATOR APPLICATION*

OFFICE SERVING OFF-HOOK END	END OFF-HOOK	END ON-HOOK	MIN CURRENT INTERRUPT	RELATED TO DIAL TONE	USE OF LCSI FOR DISCONNECT
ESS	Called	Calling	12 ms	Before	Okay
ESS	Calling	Called	37 ms	Before	Okay
No. 5 X-Bar	Called	Calling	10 ms	Before	Okay
No. 5 X-Bar	Calling	Called	32 ms	After	Discourage
No. 1 X-Bar	Called	Calling	0.4 sec	After	Discourage
No. 1 X-Bar	Calling	Called	0.4 sec	After	Discourage
SXS	Called	Calling			Discourage
SXS	Calling	Called			Discourage

* The use of dial long line circuits and carrier facilities on local loops will isolate station equipment from central office dc interrupts.

to come in contact with anything (especially the skin of the installer) except the relay, the applicator, and the connecting block base.

(3) Apply adhesive (Eastman 910 or equivalent) in the area to be occupied by the 327C relay.

(4) Place relay on base plate, topside down.

(5) Remove and discard the lower screws from terminal strip eyelets in positions 2, 3, 4, and 5.

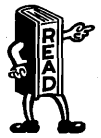
(6) Wire the unit in accordance with Fig. 11.

C. Telephone Company-Provided DC Power

3.10 An external power supply is required to provide a dc supply for the control circuit of the coupler. A 20- to 28-Vdc supply capable of supplying 100 mA will normally be provided by the customer. The telephone company will optionally furnish power (refer to 2.07 and 4.07).

4. INSTALLATION AND CONNECTIONS

4.01 The 1001D data coupler may be used with various types of central office lines or Bell System PBX station lines that provide access to the switched network.



All installation connections and tests must be performed prior to the customer making any connections to the interface.

4.02 Verify that the assigned loop facilities meet transmission requirements for the specific data service before proceeding with the installation. The requirements for the 1001D data coupler are as follows:

(a) ***Loop Loss:*** Maximum 1000-Hz insertion loss (including coupler loss of 2 dB) is 11 dB.

(b) ***Set Classification:*** Installation measurements are specified on the service order. When the modem type cannot be determined, Type II requirements should be specified. When the

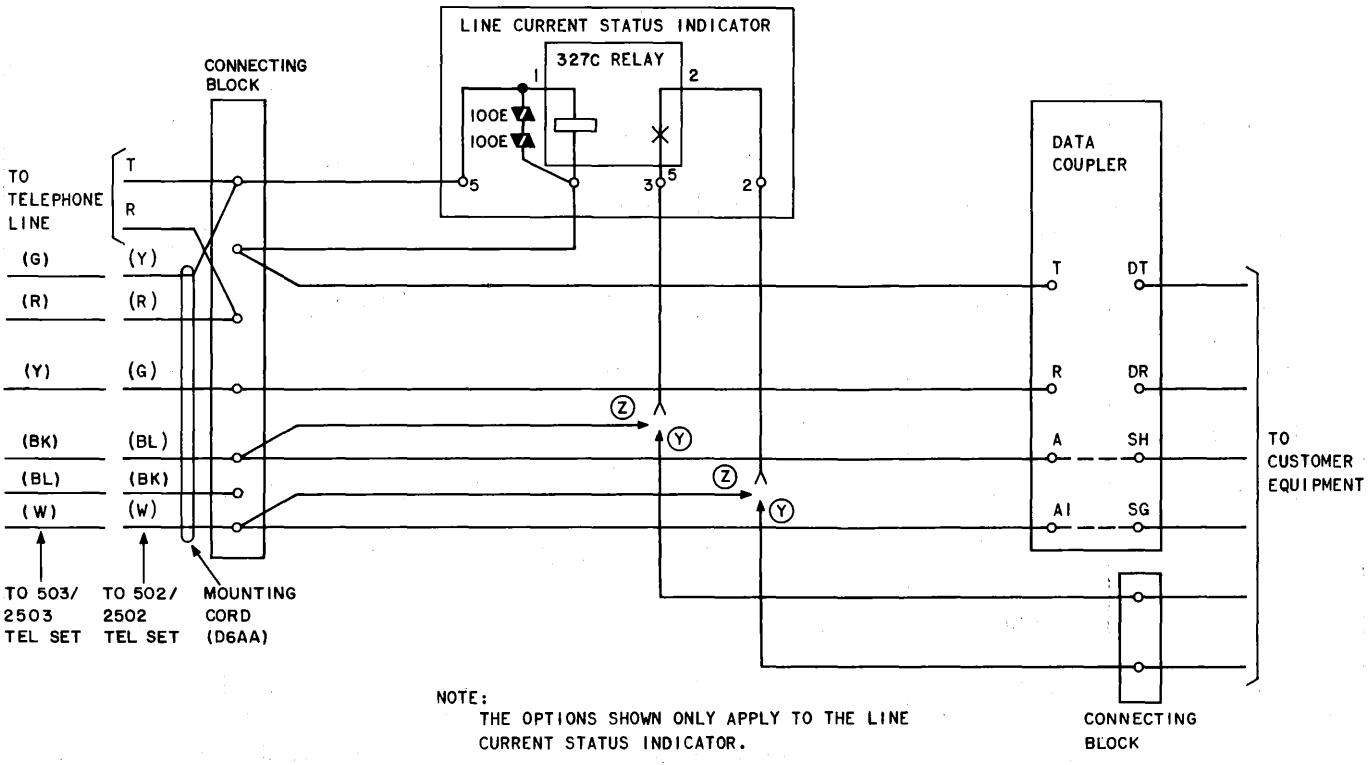


Fig. 11—Line Current Status Indicator Connection Diagram

type of modem can be obtained from the customer, the following guidelines should be used.

(1) For all analog modems, Type II requirements should be specified.

(2) For all other modems, requirements based on speed of modem (same as for switched 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.

4.03 Installation of the coupler should comply with general practices to ensure an orderly station arrangement. Information relating to a selection of type of connecting block and electrical code requirements is given in Section 590-010-200. See Fig. 12 for a typical interconnection block diagram.

4.04 When test or demonstration calls are made, refer to Section 010-250-001 for the proper procedure for crediting charges.

4.05 Location of the data coupler shall be determined by the following conditions.

- ***The coupler must be mounted vertically*** on a wall or other smooth vertical surface to ensure proper operation of the OH mercury relay.
- The coupler must be within range of the interface cord supplied by the customer. The maximum recommended length is 50 feet.
- Location of the coupler should provide easy access for operation of the TST switch by the customer attendant.

A. Installation of Data Coupler

4.06 Install the coupler on a wall or other vertical surface as follows:

(1) Remove the tape securing the cover to the base pan. Retain the screw envelope which is between the tape and cover. The envelope

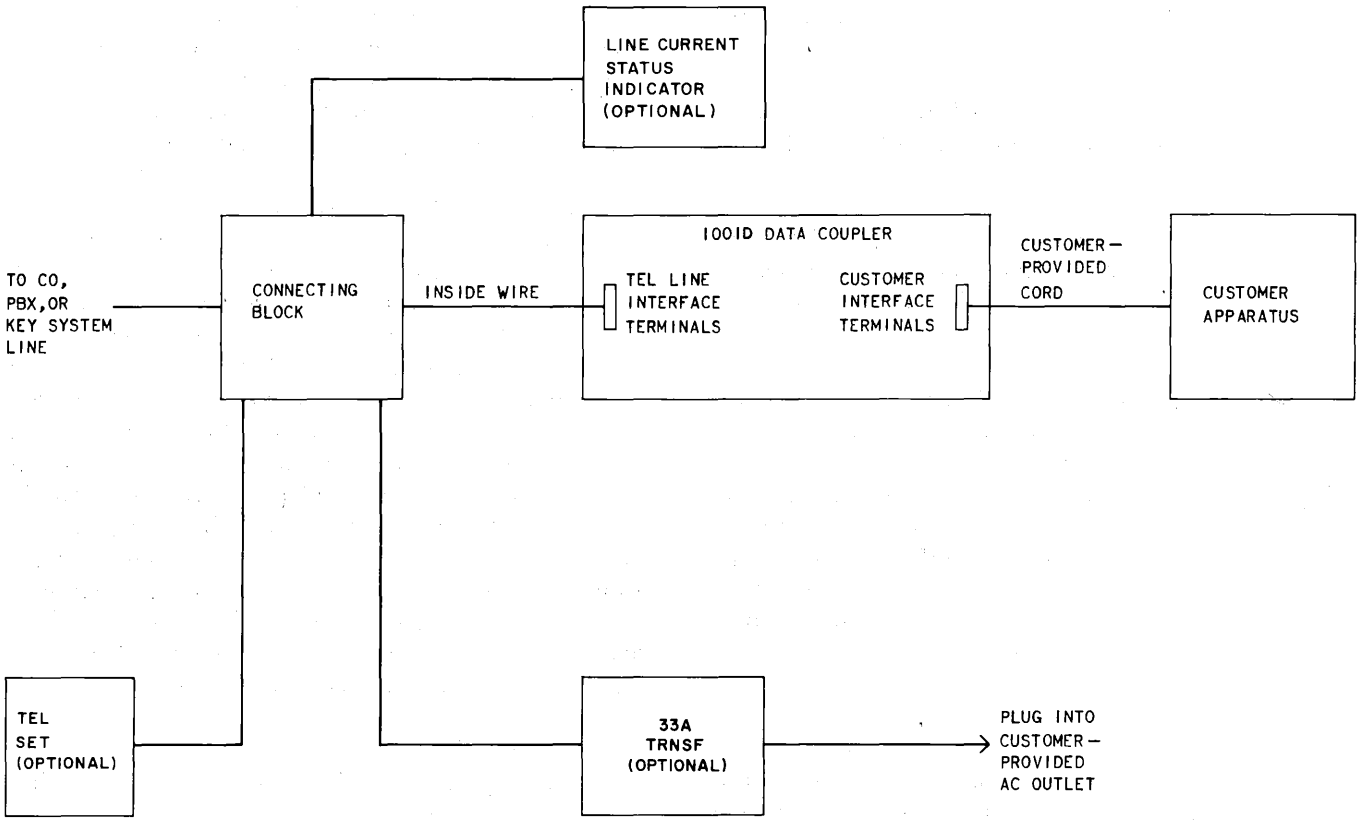


Fig. 12—Block Diagram of Typical 1001D Data Coupler Installation

contains two pan-head screws used to mount the coupler base pan to either a wood or metal surface. It also contains the four screws used to attach the CP to the base pan.

(2) Remove the snap-off cover assembly from the coupler. (See 2.03.)

(3) Position the coupler base pan vertically against the wall with the keyhole slot narrow end up and not less than 7 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base pan with two No. 6 by 1/2-inch pan-head self-tapping screws. The screws are supplied with the coupler.

(4) Route the D station wire through the slots on the base pan as shown in Fig. 2. Attach the CP to the base pan using the four self-tapping screws in the envelope. ***Care should be taken not to overtighten screw terminals or stripping will result.*** Connect the leads as required to the screw terminals on each side of the printed wiring board. Be sure to connect T, R, A, and A1 leads discussed in 2.03.

Trouble has been experienced in older 1001D couplers with cable stress studs in the base pans pressing against the printed circuit paths. The employee should examine the coupler during an installation or maintenance visit and remove these studs with diagonal cutters as applicable.

B. Installation of Power Unit

4.07 When an external dc supply is to be provided by the telco, install a 33A (Section 167-452-101), 19B2 (Section 167-440-201), 28A1 (Section 167-445-101), or equivalent power unit. Connect the power supply as follows:

(1) Connect the power supply ***only*** to the data couplers.

(2) Connect the C terminal (33A) or B SIG terminal (19B2 or 28A1) (negative) to -V on the couplers.

(3) Connect the H terminal (33A) or G SIG terminal (19B2 or 28A1) positive to +V on the couplers.

(4) If directed by the customer, either the negative or positive terminal may be connected to LOC GRD or the chassis ground strap as appropriate.

Note: AC lamp and AC ringing supplies are referenced to G SIG terminal (positive).

Do not connect the power unit to local ground when the coupler -V terminal is internally grounded within the customer equipment. The customer must not make any connections to the +V interface terminal.

C. Completion of Installation

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

4.09 Instruct the customer to raise only the hinged portion of the cover to gain access to the interface terminals. Also caution the customer that overtightening the interface screws may cause stripping.

4.10 Install telephone set if specified on the service order. If a 503- or 2503-type telephone is used, redesignate the SH terminal as "MI" (mode indicator) on the coupler.

Do not connect the customer interface leads to the coupler unless requested by, and under the direction of, the customer.

4.11 After the coupler and associated units have been mounted and connected to the telephone line, perform the tests outlined in Part 5.

4.12 Inform the customer, at the time the coupler is installed, of the maximum permissible signal power output from the data equipment. The output level of the customer-provided equipment is the power measured at the customer interface into a 600-ohm resistive load. It may vary between -1 and -10 dBm depending upon the 1000-Hz loss of the local loop including the nominal insertion loss of the coupler (approximately 2 dB).

5. MAINTENANCE AND TESTS

5.01 Maintenance and test procedures are provided to assist the telco employee during installation and troubleshooting visits to a data coupler station. All level measurements and test results made during installation and maintenance must be recorded on a circuit layout record card (CLRC) 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. Some tests will require disconnection of customer equipment from the interface in order to make tests and/or to replace a defective coupler. The following precautions ***must*** be taken.

- ***Obtain permission from the customer to disconnect and reconnect the interface leads from the coupler.***
- ***Turn the power to both the customer equipment and to the coupler OFF before the customer leads are disconnected.***
- ***After all tests are completed and the interface is reconnected, ask the customer to verify that the interface has been reconnected properly.***

A. Maintenance

5.02 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 DAA installation. When the customer requests such a repair visit and it is subsequently determined that the trouble is ***not*** in the telco equipment, the employee must inform the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

5.03 Maintenance of a coupler installation on customer premises is limited to local tests,

testing by serving or test office, or replacing a defective unit.

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

5.04 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 that the trouble is in Bell System equipment, the condition should be reported to the designated PSC or equivalent test center. All available information concerning the failure mode should be provided to the PSC.

5.05 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 telco employee must be dispatched to customer premises. The conditions which could warrant a maintenance visit and efforts which lead to each are shown in Fig. 13.

5.06 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. 12 when 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, follow the suggested sequence of activities as illustrated in Fig. 14 and described in the following:

(1) The telco employee must be properly equipped with information (BSP documentation, line card details, etc), spare coupler, and test equipment, etc, for locating trouble and effecting repairs at the customer premises.

(2) Upon arrival at the coupler station, question the customer to obtain any information relating to the reported trouble, then perform a visual and mechanical inspection of the installation. Check that the TST switch on the coupler is not partially operated. Check for disconnected or broken cords, inside wiring, drop wire, broken components, or any other possible trouble causes. Repair or replace any defective or marginal components (ie, ringer, dial, handset, etc).

(3) Perform a remote test to the LTD or equivalent test location.

(4) If any components were replaced or repaired ***and*** the results of the remote test are satisfactory, close trouble report.

(5) If all components are satisfactory ***and*** the results of the remote test are satisfactory, perform an interface voltage test.

(6) If the results of the interface voltage test ***or*** remote test are not satisfactory, replace the coupler and perform installation tests. Ensure that all level measurements made during the required installation tests are properly recorded on the CLRC.

(7) Perform a remote test on the new coupler.

(8) If the results of the new coupler remote test are ***not*** satisfactory, notify the PSC.

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

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

(11) If the customer cannot exchange data or is ***not*** satisfied with the service, disconnect the coupler and perform a complete transmission test of the local loop as described in Section 314-205-501.

(12) If the results of the loop test are satisfactory, notify the PSC.

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.

(13) 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 must meet requirements outlined in Section 314-205-501.

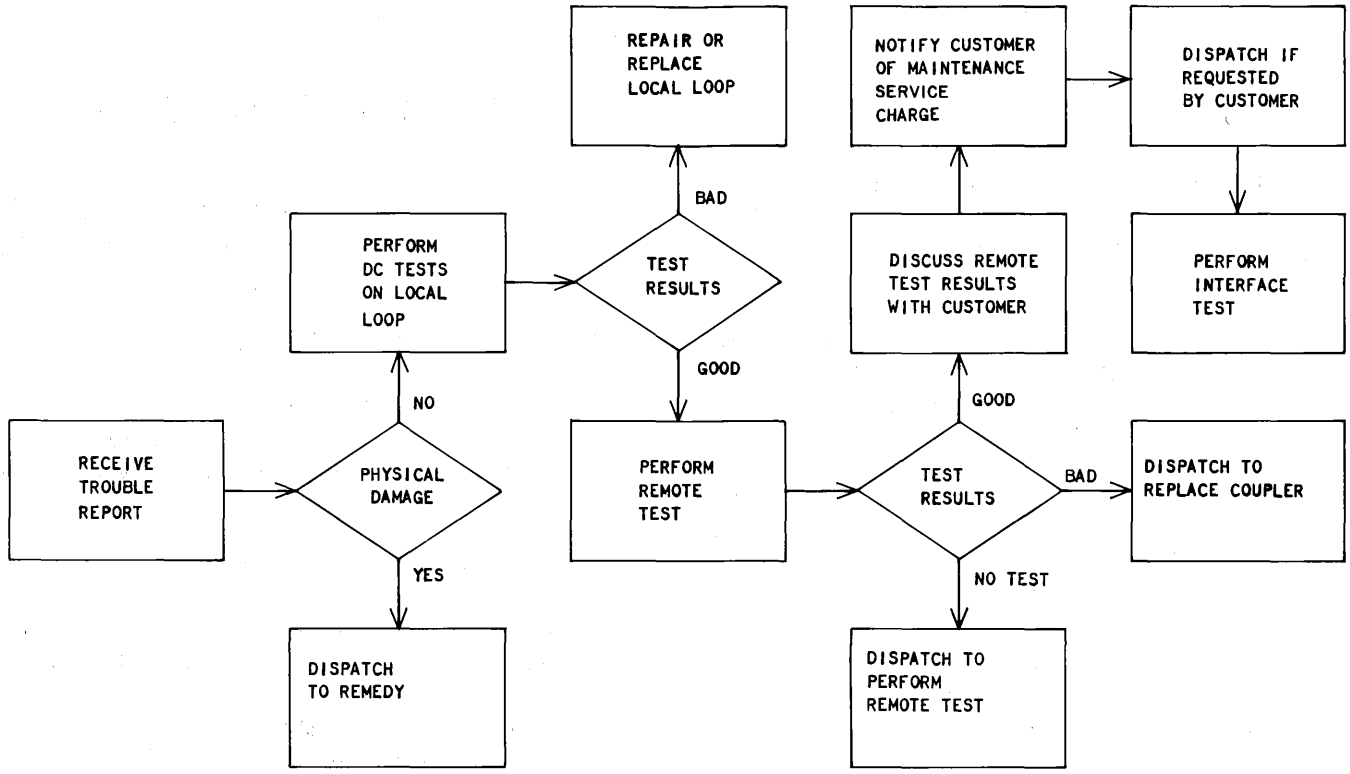


Fig. 13—Basic Activities Prior to Dispatching Employee

(14) After changing the defective loop, reconnect the coupler to the telephone line. Perform the insertion loss and impedance matching tests to determine if the maximum allowable customer level and the required limiter option strapping have changed. Notify the customer of the level change and then request the customer to verify service restoral.

(15) 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 and record the new level on the CLRC.

(16) 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 supervision, who can escalate according to normal procedures of data technical (DATEC) support. Refer to Sections 010-521-100 and -101. Notify the PSC of the repair work that has been completed and wait for further instructions.

B. Tests

5.07 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
- Interface Voltage Test
- LCSI Test
- 503C or 2503C Telephone Set Test.

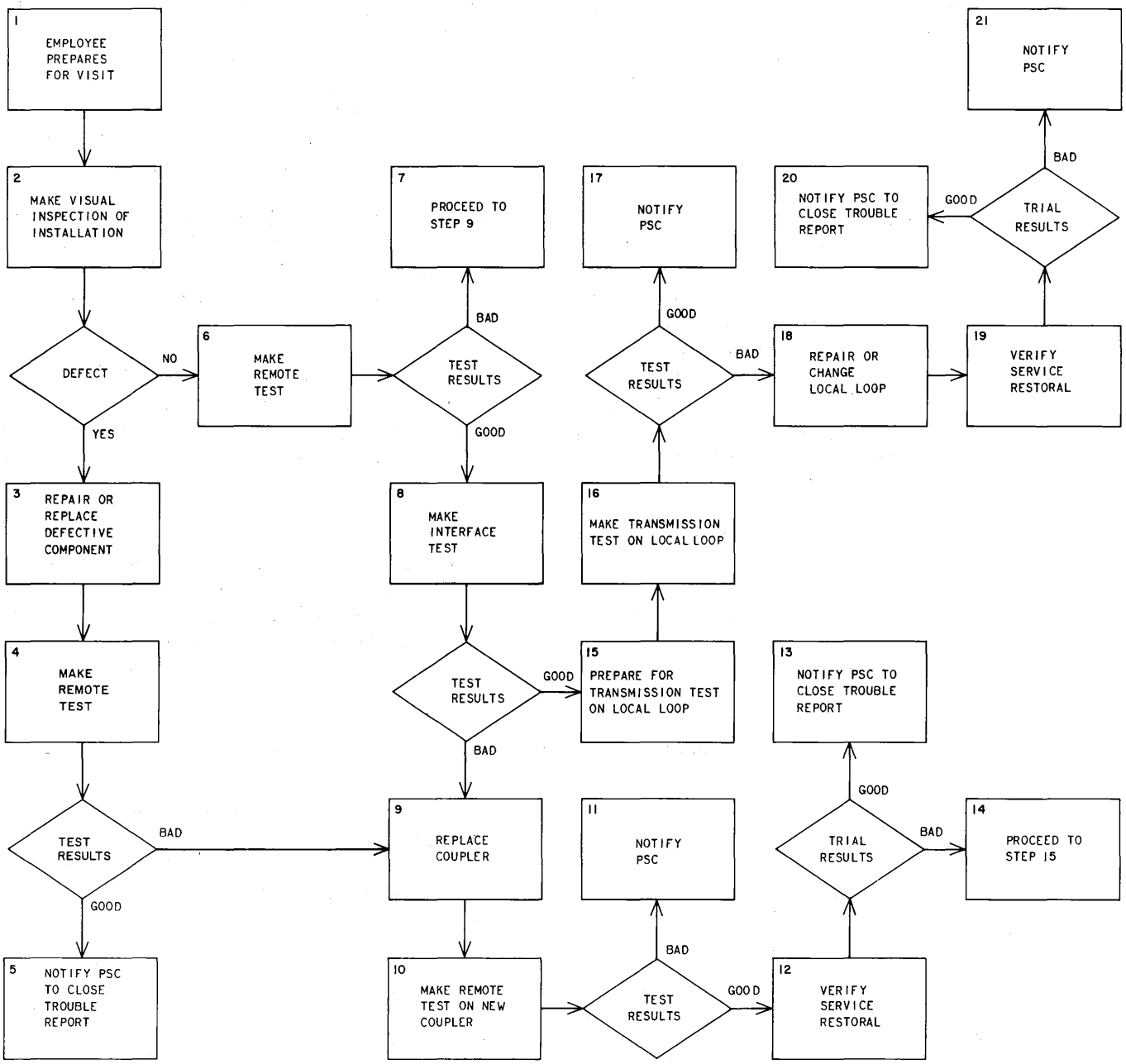


Fig. 14—Activities for Troubleshooting at a Coupler Station

5.08 The following test equipment is required for the tests:

- 600-ohm ±1% resistor
- KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent with a high-impedance, bridging-type ac voltmeter with a dB scale such that 0.776 Vac corresponds to 0 dB.
- 1013-type hand test set, or equivalent
- KS-19353-L4 oscillator or equivalent with a 600-ohm output impedance and a capability of a -5 dBm reading when connected across 600 ohms.
- 33A power unit or equivalent power source providing between 20 and 26 Vdc.

Note: The insertion loss test ***and*** the impedance matching test are required to determine proper level option strapping, using Table C.

Insertion Loss Test

5.09 The insertion loss test measures the combined loss of the loop and coupler. The results of the test are used to determine the maximum allowable customer signal power level which will result in a level no greater than -12 dBm at the serving central office (SCO). This test requires that the customer interface leads be disconnected from the coupler in accordance with precautions outlined in 5.01. The coupler must be connected to the telephone line. Proceed with the test as follows:

(1) Locate and remove any existing straps on level option terminals A through H (Fig. 2).

Note: Cover must be removed to gain access to level option terminals.

(2) Connect strap between terminals OH, DA, and -V.

(3) Connect 600-ohm resistor across terminals DT and DR. If a transmission measuring test set is used instead of the VOM, the test set provides the 600-ohm termination.

(4) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. ***Do not*** connect the power unit to the ac outlet at this time.

(5) Use the telephone set associated with the coupler, if provided, or connect the hand test set across tip and ring of telephone line, and dial the milliwatt supply (1000 Hz) of the SCO.

Note: If a telephone set is associated with the coupler, remove the handset and ensure that the exclusion (data) key is in the talk position before dialing the milliwatt supply.

→TABLE C←

LEVEL OPTION STRAPPING FOR 1001D DATA COUPLER

INSERTION LOSS (INSERTION LOSS TEST) dB	MAXIMUM ALLOWABLE CUSTOMER LEVEL dBm	LIMITER OPTION TERMINALS			
		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
2 — 2.9	−10	AB, DE	AC, DE	AC, DE	AC, DE
3 — 3.9	−9	AC, DF	AB, DE	AC, DE	AC, DE
4 — 4.9	−8	AB, DF	AC, DF	AB, DE	AC, DE
5 — 5.9	−7	AC, DG	AB, DF	AC, DF	AB, DE
6 — 6.9	−6	AB, DG	AC, DG	AB, DF	AC, DF
7 — 7.9	−5	AC, DH	AB, DG	AC, DG	AB, DF
8 — 8.9	−4	AB, DH	AC, DH	AB, DG	AC, DG
9 — 9.9	−3	AC	AB, DH	AC, DH	AB, DG
10 — 10.9	−2	AB	AC	AB, DH	AC, DH

Example: Value obtained in insertion loss test = 6.4 dB.
Value obtained in impedance matching test = —4.2 dBm.
Place straps between A and C, and D and G.

(6) When the tone is heard, connect the power unit to a 117-Vac power outlet and remove the hand test set from the line (or operate the exclusion key to data mode on the associated telephone).

(7) Condition the VOM to measure approximately -5 dBm. Measure the level (in dBm) of the signal between the coupler DT and DR terminals with the VOM.

(8) Remove power unit from outlet. (The CO connection will terminate.)

Impedance Matching Test

5.10 This test follows the insertion loss test on either an installation or maintenance visit; therefore, the level option terminals should not be strapped for this test. 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 test equipment and straps as shown in Fig. 15.

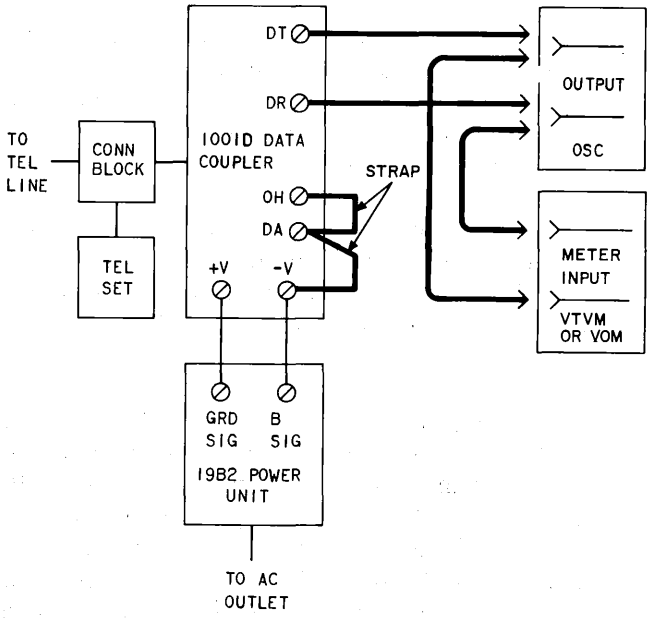


Fig. 15—Test Equipment Connections for Impedance Matching Test

(4) Adjust the oscillator output level to obtain a -5 dBm indication on the VOM.

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

(5) Connect the hand test set across tip and ring of the telephone line, and dial a quiet battery termination at the SCO.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion key is in talk position, and dial the quiet termination.

(6) After the connection is completed, plug power unit into socket and remove the hand test set from the line (or operate the data key to data mode on the associated apparatus).

(7) Measure the signal level with the VOM. This value is used to derive the level option strapping from Table C.

(8) Remove the straps, disconnect test equipment, and restore the connection to normal. (The CO connection will terminate.)

5.11 Using the values obtained in 5.09 (7) and 5.10 (7), refer to Table C and apply straps as indicated. Mark the maximum input limit on the data coupler as determined in 5.09 (7) (Fig. 1).

Remote Test

5.12 The remote test measures the test signal of the coupler at the SCO at time of installation. The test signal provides a check of the local loop and the limiting function of the coupler. Subsequent readings can then be compared with the original reading for indications of service degradation.

5.13 The data coupler must be connected to the telephone line for this test. Proceed with the test as follows:

(1) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. Connect the power unit to a 117-Vac power outlet.

(2) Use the telephone set associated with the coupler, if provided, or connect the hand

test set across tip and ring of the telephone line, and contact the LTD. If the LTD is not equipped for ac testing, contact a remote test location that is equipped, or a DTC.

Note: If a telephone set is associated with the coupler, remove the handset and ensure that the exclusion (data) key is in talk position before initiating the call to the test desk.

(3) Request the LTD employee to call the coupler and to measure the level of the test tone (2800 Hz) received at the LTD.

(4) Agree upon length of time required to perform the test, and restore the connection to idle state (hang up).

(5) Operate TST switch to ON position (depress the red dot half of switch).

(6) After the agreed test interval (Step 4 above), operate TST switch to OFF position.

(7) Call the LTD and request the level reading from the employee. This level indicates the loss of the loop and coupler at 2800 Hz. When the test is made at time of installation, the actual value of the loss ***must*** be recorded on the CLRC 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.

(8) If the test tone must be measured at a remote test desk or DTC over facilities of unknown or varying loss, a successful receipt of the tone indicates that there is ac continuity in the loop and coupler and that the coupler operates satisfactorily.

(9) Disconnect the power unit and restore telephone connection to normal.

Interface Voltage Test

5.14 The interface test reasonably assures that the interface terminals of the coupler will respond to proper signals from the customer terminal, or will indicate to the terminal when the coupler is conditioned for various operational modes.

5.15 This test requires that the customer interface leads be disconnected from the coupler in accordance with precautions outlined in 5.01. (For this test, disconnect LCSI option Z, if provided.) The coupler must be connected to the telephone line. Use the VOM to make the measurements during the test. Proceed as follows:

Note: When making measurements in the following steps, be careful to observe proper polarity with the meter.

(1) Connect the positive lead (H) of the power unit to the +V terminal, and the negative lead (C) to the -V terminal. Connect the power unit to a 117-Vac power outlet.

(2) Originate a call to the coupler from another line or arrange to be called from the LTD. Observe that the voltage between terminals (-) RI and +V follows the ringing cycle and swings between -10 to -26 (ON) and 0 (OFF) Vdc; the ON interval being approximately 2 seconds and the OFF interval approximately 4 seconds on the switched network.

Note: The contact closure of the RI lead on an incoming ringing signal should track with the ***on*** and ***off*** interval of the ringing cycle. The exact period of the ***on*** and ***off*** interval is dependent upon the type of ringing machine used.

(3) Leaving the meter connected between (-) RI and +V, short terminal OH to -V with a clip lead. Observe that the voltage swings to 0 Vdc after ringing is tripped. This checks the operation of the OH relay.

(4) Leaving short between terminals OH and -V, measure the voltage between terminals (-) CCT and +V. The meter indicates 0 Vdc to show that the interface lead (CCT) is in OFF condition.

(5) Leaving the meter on terminals CCT and +V and the short between terminals OH and -V, connect a strap between terminals OH and DA. After 2 seconds, observe that the voltage swings to between -20 and -26 Vdc. This checks the delay timer and the operation of the CT relay. Remove short between terminals OH and -V. Observe that voltage between terminals CCT and +V swings back to 0 Vdc.

(6) Remove handset on telephone and connect meter between terminals SH (or MI) and SH1. The meter indicates continuity between the terminals to check the switch contact status circuit.

(7) Replace handset on telephone. An open is indicated on the meter between terminals SH (or MI) and SH1.

(8) Remove the power unit, meter, and straps from the coupler.

(9) Reconnect customer interface leads to the coupler. Request customer to verify connections.

LCSI Test

5.16 This test should be used to verify proper operation of the LCSI. This test is performed by disconnecting the customer LCSI interface only.

LCSI With Option Z

(1) Measure the resistance between terminals SH (or MI) and SH1. The meter should indicate an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between terminals SH (or MI) and SH1. The meter indicates a short circuit.

(5) Restore TST key to normal.

LCSI With Option Y

(1) Measure the resistance between the two terminals on the separate connecting block at the customer interface. The meter indicates an open circuit.

(2) Operate TST key.

(3) Initiate a call to the coupler.

(4) Measure the resistance between the two terminals on the separate connecting block. The meter indicates a short circuit.

(5) Restore TST key to normal.

503C or 2503C Telephone Set Test

5.17 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 an open. The customer MI interface must be open for this test.

5.18 Lift telephone handset. Using the VOM, make resistance measurements between terminals MI and SH1 on the data coupler, in accordance with the options installed and Table D. Return handset to cradle.

> ***Note:*** It is only necessary to make the one pair of readings corresponding to the options installed.

5.19 Initiate a call to the coupler. Lift handset to answer call. After a 3-second delay, a 2800-Hz tone is heard in handset.

TABLE D

MFT SET TEST WITH 1001D DATA COUPLER

INDICATOR	OPTIONS INSTALLED	OHMMETER READING	
		EXCLUSION KEY	
		UP	DOWN
Voice Mode	A, H, K	0	∞
Data Mode	A, I, J	∞	0
Switchhook	A, G, J	0	0
Voice Mode	B, I, K	∞	0
Data Mode	B, H, K	0	∞
Switchhook	B, G, J	0	0

Note: Switchhook operated for all readings.

6. REFERENCES

6.01 The following BSPs 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
167-440-201	19- and 20-Type Power Units—Identification, Installation, Connections, and Maintenance
167-445-101	28A1-Type Power Units—Identification, Installation, and Connections
167-452-101	33A Power Unit—Identification, Installation, and Connections
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
502-501-102	▶Reference—502-, 510-, 511-, 515-, 555-, and 558-Type Telephone Sets
502-501-120	Reference—503B, 503BM, 503C, 503CM, 513B, and 513BM Telephone Sets
502-503-102	Reference—2502-, 2510-, 2511-, 2515-, 2555-, and 2558-Type Telephone Sets
502-503-120	Reference—2503-Type Telephone Sets◀
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)
SD-&CD-1D206-01	1001-Type Data Couplers