

1001F DATA COUPLER

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

1. GENERAL

1.001 This addendum supplements Section 590-103-111, Issue 3. The attached pages must be inserted in accordance with the following filing instructions:

- (1) Remove from the section the pages numbered the same as those attached to this pink sheet.
- (2) Insert the attached pages with the same page number in their place. Insert point-numbered pages (eg, 16.1/16.2) following the page with the same basic number.
- (3) Place this pink sheet ahead of Page 1 of the section.

1.002 This addendum is issued to add coverage on the 502BM, 2502BM, 503CM, and 2503CM modular telephone sets.

Attached:

Pages 11 and 34 dated July 1978, reissued
Pages 12 and 33 dated July 1978, revised
Pages 12.1, 16.1/16.2, and 18.1/18.2 dated July 1978, added

3. OPTIONS

The following changes apply to Part 3 of this section:

- (a) 3.02—revised
- (b) 3.02.1—added
- (c) 3.02.2—added
- (d) Fig. 8.1 and 9.1—added

5. MAINTENANCE AND TESTS

The following change applies to Part 5 of this section:

- (a) Minor heading for 5.18—revised

NOTICE

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DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

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1. GENERAL

1.01 This section contains information required for installing and maintaining 1001F data couplers (Fig. 1).

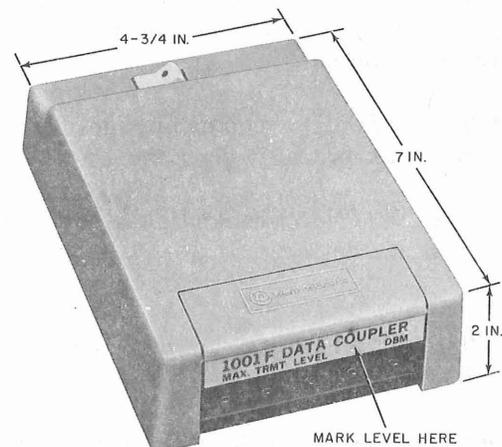


Fig. 1—1001F Data Coupler

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SECTION 590-103-111

1.02 This section is reissued to:

- Correct Fig. 8, 9, and 15
- Replace Table D
- Add additional references.

1.03 The data access arrangement (DAA) includes both the data coupler and telephone set as described in appropriate tariffs. The 1001F 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 the unit is CBS.

1.04 The 1001F data coupler is smaller than the 1001A data coupler [rated Manufacture Discontinued (MD)], which has the same USOC. The 1001F can replace the 1001A; however, due to different Electronic Industries Association (EIA) standards, the 1001A cannot always replace the 1001F. Other significant differences are as follows:

- (a) The 1001F data coupler has no ANS switch.
- (b) The 1001F data coupler remote test is performed differently due to the absence of lamps and the ANS switch.
- (c) The 1001F data coupler option designations for strapping of the output levels are between terminals.
- (d) The 1001F data coupler provides for optional customer-provided dc power.
- (e) The 1001F level control does not require dc loop current.

1.05 The 1001F data coupler provides the following:

- Interface control lead voltages as specified in EIA Standard RS-232-C
- Automatic linear control of signal level above a specified threshold
- Isolation of customer equipment for protection of telephone plant and personnel from hazardous voltages. This also provides

protection of customer equipment from surges occurring on telephone facilities.

- Detection of incoming ringing signals to permit customer to operate in unattended answering mode
- Test circuitry for manual remote test capabilities
- Off-hook control which allows customer equipment to dial-pulse for call origination
- A 2 ± 1 second delay in giving access to telephone line on incoming calls to permit proper operation of automatic message accounting equipment
- Switchhook indicator to provide customer status of switchhook (line switch) on associated telephone set when provided
- 2-way transmission path
- Internal dc power supply
- KA and KA1 lead controls for operation with key telephone equipment
- Capability of operation with data auxiliary set (DAS) 801-type automatic calling unit (ACU).

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 data transmission and mode indication through switch contacts are provided by 503C and 2503C telephone sets.

1.07 The data coupler may interface customer equipment directly to local loop facilities, key telephone system station lines, or to private branch exchange (PBX) station lines.

1.08 At installation 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 The 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 Section 314-205-500 for the direct distance dialing (DDD) network.

2. DESCRIPTION

A. Physical Description

2.01 The 1001F data coupler (Fig. 1) 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 which snap together. One keyhole slot and one screw hole are provided on the base for mounting the unit on a wall or other vertical surface. ***The coupler must be vertically mounted to allow proper operation of the mercury relay.***

Note: Two No. 6 by 3/8-inch pan-head metal screws and two No. 6 by 1/2-inch wood 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 EIA RS-232-C voltage levels. See Table A for lead designations. The cord required for connecting the customer modem to the interface must be supplied by the customer.

2.03 Eight screw terminals on the printed CP provide the interface for connecting the telephone line and associated apparatus to the coupler. The housing cover must be removed to make connections within 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 the connections. The following pairs of leads terminate on this interface:

- T and R—Telephone line transmission pair

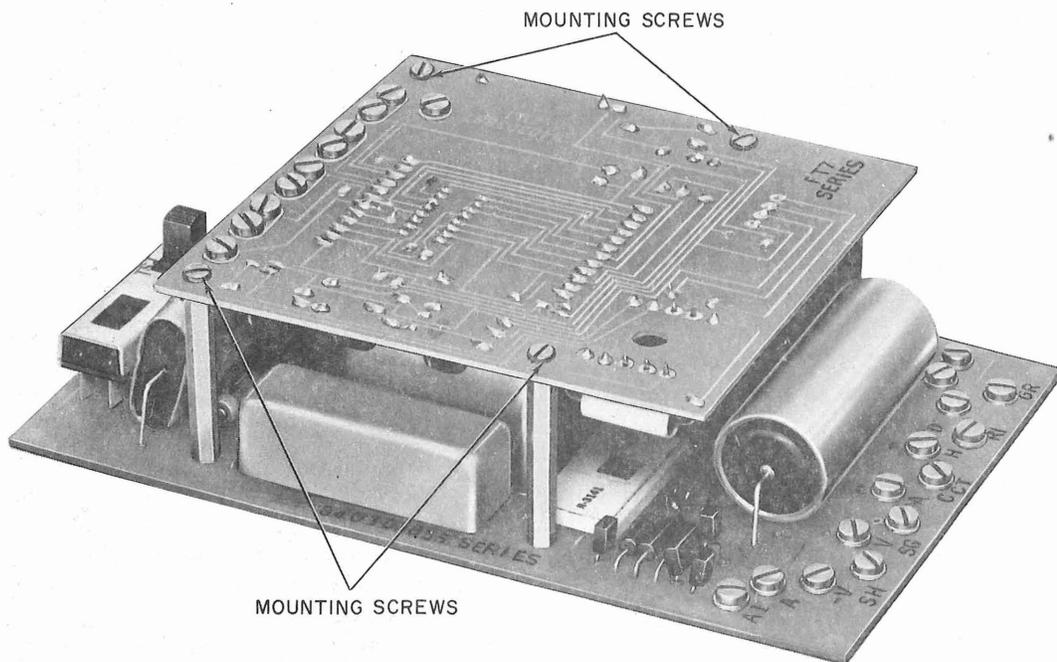


Fig. 2—1001F Data Coupler With Cover Removed

TABLE A

INTERFACE LEAD DESIGNATIONS FOR 1001F 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	Switchhook Status of Associated Tel Set	
-V	Negative DC Power	
+V	Positive DC Power	
SG	Return for DC Power and Common for OH, DA, RI, and CCT, and is Signal Ground.	

- KA and KA1—Key system **A** lead control contacts to indicate the off-hook condition to associated key telephone equipment
- A and A1—Extension of associated telephone set switchhook (line switch) to terminal equipment
- P1 and P2—Low-voltage ac leads from external transformer to internal power supply. Terminals 3 and 4 of transformer KS-20426-L1 are wired to P1 and P2 screw terminals.

2.04 One 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 a range of 0 to 120°F with a relative humidity of up to 95 percent.

2.07 An external transformer (KS-20426-L1) is required with each coupler to step down the standard 117-Vac power to 23.6 Vac. When telco furnishes the power, the internal rectifier provides the dc supply to all the coupler circuitry. This uses the two factory-provided straps which are left connected (option X not applied). The coupler may also be powered by the customer through the +V, -V, and SG customer interface leads. In this case the two factory-provided straps must be removed (Fig. 3 and 4) (option X is applied). Customer power requirements are indicated in 3.15.

B. Functional Description

2.08 General: The data coupler is a network protective unit designed to interface with a customer-provided automatic data terminal. The coupler provides signals to the data terminal to indicate the detection of ringing signals. In response to the signals, 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

The lamp causes the resistance of the photo-conductive cell to decrease, which allows signal current to flow through the control winding. The signal current in the control winding causes a transformer core flux, which is 180 degrees out of phase with the flux due to signal current in the customer winding, and thus reduces signal power level to the threshold value.

Note: When certain 1001F couplers are subjected to high frequency longitudinal voltages, customer data set tones are attenuated to unusable levels. This is caused by the coupler limiter responding to these unwanted voltages. This condition can be corrected by adding a KS-19774-L1, 2, 7, or 8, 1000-pF capacitor between the E terminal printed path and the signal ground printed path. This capacitor may be installed by the employee in the field as required. All 1001F couplers returned to the repair facility will be updated to include this capacitor, and will be marked series 3 or higher.

Data Mode

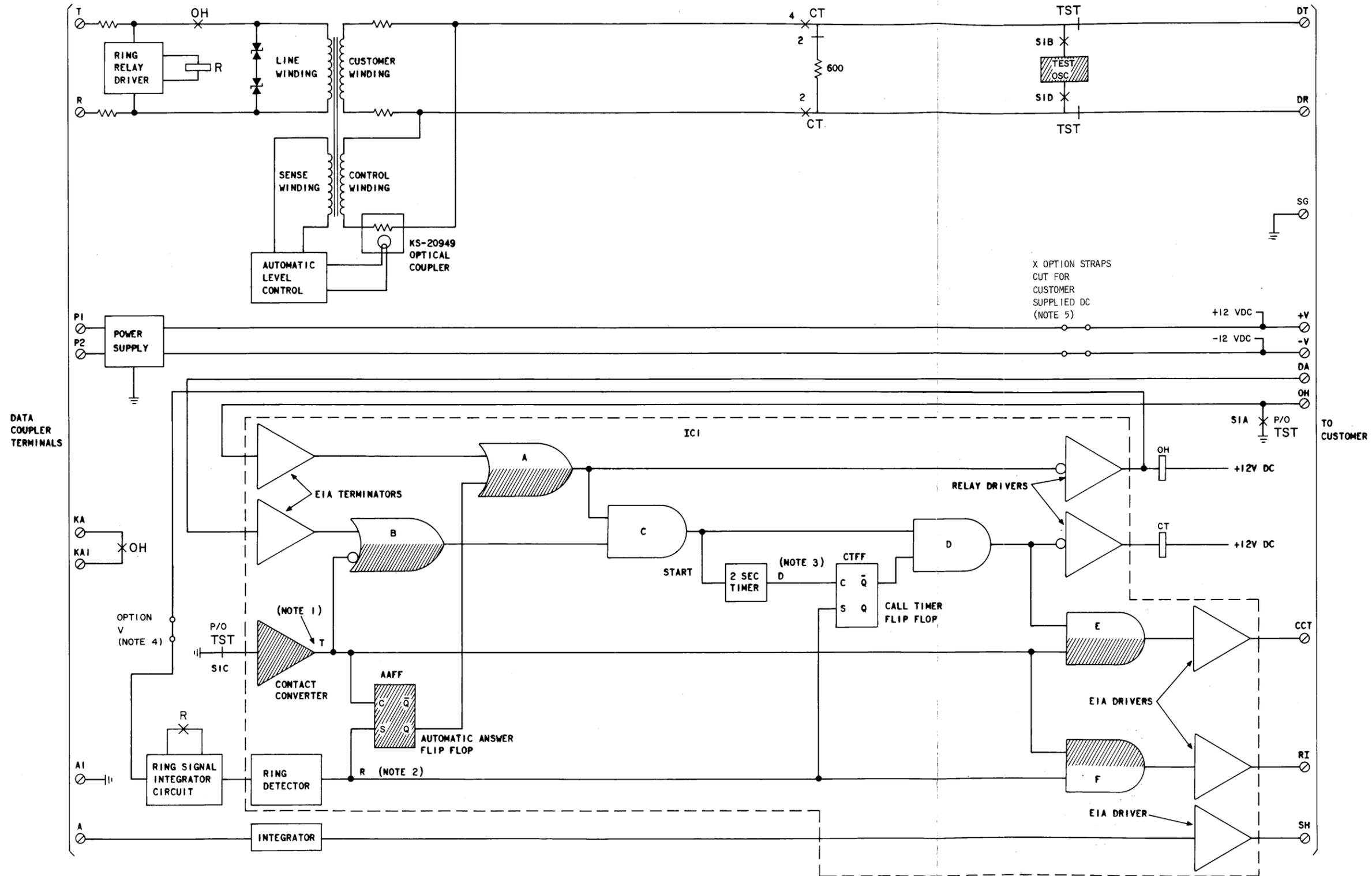
2.12 Ring Detection: The ring detector (Fig. 4) is activated when the 20-Hz ringing signal is present on the line, indicating an incoming call. The R relay, part of the ring detector, operates and releases in response to each half cycle of ringing current. Closures of the R relay contact are used to drive the ring signal integrator circuit. After approximately 2 cycles (100 ms) of 20-Hz ringing signal, the ring detector (part of IC1) output (R) goes high. In a similar manner, R goes low approximately 100 ms after the last contact closure. The ring detector output R is connected to the set leads of the call timer flip-flop (CTFF) and the automatic answer flip-flop (AAFF), and is ANDed with the test mode signal (T). Since the T signal is 1 when the TST switch is *not* operated, a received ring signal causes the ring indicator EIA output RI to switch from a normal output of -5 volts to +5 volts when not in test mode. RI then switches back to -5 volts during the period between rings. RI delay is equal to the ring relay driver delay plus the ring integrator delay. In test mode, the T signal is 0, which allows the AAFF to be set and inhibits the RI output from responding to ring.

Note 1: When dial pulsing through certain 1001F couplers into a No. 5 crossbar or a

step-by-step central office, sharp pulses are generated which cause capacitor C1 to discharge into the R relay. This causes the R relay to operate momentarily and may result in the RI circuit being activated during dialing. This condition can be corrected by the addition of a 458A, 458C, KS-21222, or equivalent diode (50-volt 1-amp silicon junction, such as a 1N4001) in series with a KS-20616-L1 220-ohm (or equivalent) resistor. Connect the anode of the diode to the junction of R10, R9, and C4. Connect the resistor between the cathode of the diode and pin 8 of IC1. If the diode is installed incorrectly (reversed), the RI circuit will be activated permanently and the OH relay will operate erratically. This diode may be installed by the employee during a maintenance visit. When a coupler is returned to the repair facility, the diode is installed by the repair facility. Series 2 couplers have this diode (CR8) added. This reduces the RI positive-to-negative transition to less than 10 μ s. Before the diode was added, the transition time was approximately 100 ms. If the RI positive time is too short for customer equipment, a series 1 coupler should be used, or the diode should be cut out of the circuit. Wiring which must be cut to remove the diode is designated option V in series 4 and higher couplers. In some installations, a long ring trip interval results in saturation of the ALC to maximum attenuation. This is evidenced by the customer being unable to transmit for 5 seconds or more after CCT turns *on*. To prevent this, wire the CT (1) make contact between terminal 4 to the upper board and the 8 (U) or 9 (T) terminal of the 2578BP (U) or 2578CB (D) transformer. Series 5A couplers have this wiring installed.

Note 2: Some quantity of FT7 Circuit Pack, Suffix G, manufactured during the last half of 1975 may not contain a red wire strap for the V option. In this case, wire leads to resistor R28 or diode CR8 may be cut to obtain the desired result. Both of these components are under large capacitor C12 (400 mf) at the screw interface end of the lower board.

2.13 Answering Incoming Calls: Ringing causes CTFF to be set and its Q output to go low. When the exclusion key of an associated telephone is wired so that the data coupler is in



- NOTES:
1. T= 1 WHEN TEST SWITCH IS NOT OPERATED.
T= 0 WHEN TEST SWITCH IS OPERATED.
 2. R= 1 WHEN RINGING IS RECEIVED.
R= 0 OTHERWISE.
 3. D= 0 WHEN START=0.
D= 1 TWO SECONDS AFTER START SIGNAL CHANGES FROM 0 TO 1.
 4. SERIES 5 AND LATER, CUT FOR EXTENDED RI (+) ON TIME.
 5. WITH OPTION X IN, THE STRAPS ARE REMOVED (CUSTOMER PROVIDED DC POWER); WITH OPTION X OUT, STRAPS ARE PROVIDED (TELCO PROVIDED DC POWER).

Fig. 4—Functional Schematic of 1001F Data Coupler

control of the line, a call is answered by a positive OH EIA input. The OH relay in the coupler operates to close the loop and stop ringing.

Note: If an ACU is used with the DAA, the ACU is informed that the data line is occupied.

Data access is generally requested at the same time (by a positive DA EIA input). Both inputs are ANDed which cause the C gate output to go high and start the call timer. Two seconds after the C gate output goes high, the call timer delay circuit output clears CTFF, making Q go high. This then causes the D gate output to go high, allowing the CT relay to operate and the CCT output voltage to become positive. After the initial 2-second delay, CTFF remains in the reset state and the customer has full control over the CT relay via the DA input.

Note: The 2-second delay in granting the customer access to the telephone line is required by serving central office (SCO) billing equipment.

2.14 When the CT relay is *not* operated, the customer DT and DR leads are terminated in 600 ohms. After the CT relay is operated and the CCT output voltage has become positive, CT contacts connect the customer data signal inputs (DT and DR) to the telephone line via the transmission circuit.

Note: The presence of the *on* voltage on the CCT lead does not imply that an end-to-end connection has been established.



An EIA ON voltage is a voltage more positive than +5 volts. An EIA OFF voltage is a voltage more negative than -5 volts.

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

2.16 Automatic Answer: The customer can provide answer of incoming calls by automatically providing a positive *on* voltage to the OH interface lead in response to a positive RI interface lead output. The customer must hold OH input positive to remain in data mode. Also, the exclusion key

option must provide for the coupler to control the line (option A).

2.17 Call Origination (Dial-Pulsing): The customer can originate a call by dial pulsing (rotary dial) or tone-address signaling (eg, TOUCH-TONE). A positive (*on*) voltage applied to the OH interface lead, either as a call origination or as a transfer from a manually originated call, will cause the OH relay to provide the off-hook function. A negative (*off*) voltage applied to the lead causes the OH relay to drop and open the telephone loop. Also, the circuit between the KA lead and the KA1 lead is opened. This sequence of operation 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. 5):

(1) The ON lead is closed.

Note: The DA lead can be closed (*on*) to detect dial tone or, after an interval, the presence of tone may be assumed and blind dialing initiated. The DA lead must be released for the remainder of the dialing sequence after tone is detected. The dialing rate is 8 to 11 pulses per second.

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

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

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

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

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

2.18 Operation of the DA lead, either for the 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 operation of the OH lead. The CT relay operates to connect the data terminal to the telephone line, and CCT EIA driver turns *on* the CCT lead to inform the terminal equipment that

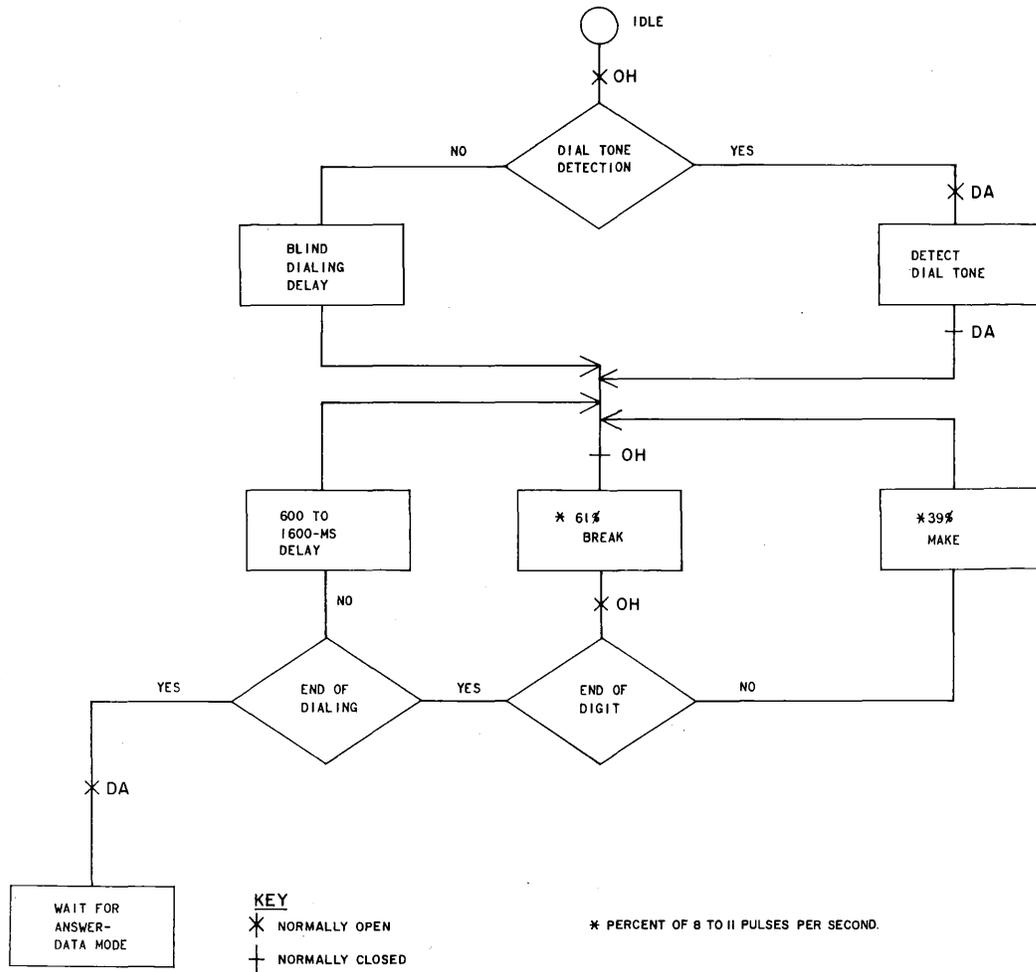


Fig. 5—Call Origination Sequence Diagram—DC Dial Pulsing

the coupler has closed the transmission path to the local loop.

Note: Since there is no ringing signal present on an outgoing call, the 2-second timer is not reset and CCT turns *on* immediately after OH and DA are turned *on*.

2.19 Call Origination (Tone-Address Signaling): Figure 6 shows the call origination sequence for tone-address signaling. As previously stated, turning *on* the OH and DA leads causes the coupler to go off-hook and provide 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 terminal must then wait for answer tone before transmitting data.

2.20 Call Termination: When data transmission is complete, the data coupler does *not* provide automatic disconnect. **The data terminal must recognize the end of the call and must turn OFF the OH interface lead.** In turn, the OH and CT relays drop to open the telephone loop and to disconnect terminal equipment from the coupler. The coupler returns to idle state. A line current status indicator (LCSI) may be installed with the coupler on an optional basis to aid the customer in recognizing end of call. The LCSI is further described in 3.11 through 3.14.

Test Mode



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

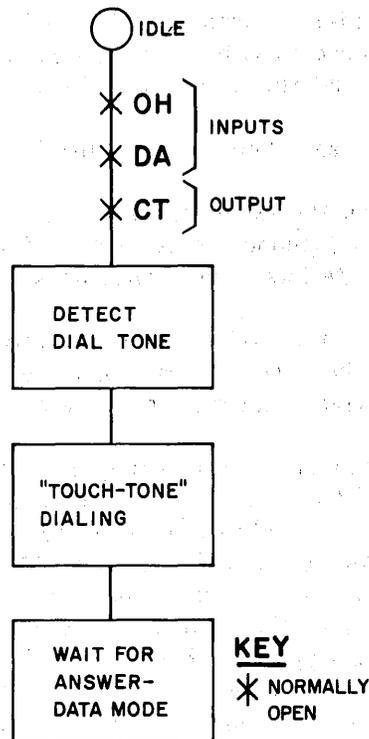


Fig. 6—Call Origination Sequence Diagram—Tone-Address Signaling

2.21 A test circuit provides the means for applying a test tone to the line through the ALC circuit (Fig. 4). This permits testing the level control, the local loop, and certain logic control functions of the coupler. The circuit is designed to be remotely tested from the local test desk (LTD), although a data test center (DTC), or other designated test location may perform the test.

2.22 The test circuit consists of a test oscillator, the test switch (TST), and the AAFF. When the TST switch is operated, the following occurs.

(a) TST switch contacts S1B and S1D disconnect DT and DR interface signals and connect the test oscillator signal of 2800 Hz to the transmission circuit via make contacts CT4 and CT2.

(b) Contact S1A grounds the OH input lead, removing customer control of the OH and CT relays.

(c) Contact S1C disconnects ground from the IC1 contact converter, causing the output T to switch from high to low.

2.23 The low state of T in test mode:

- Causes the output of gates E and F to go low, which results in CCT and RI interface leads remaining negative in test mode
- Removes the clear signal from AAFF so that it may respond to ringing
- After being inverted, provides a cut-through signal from gate B to gate C.

2.24 To test the coupler, the customer operates the TST switch, after which the serving test center (STC) calls the data coupler. Detected ringing causes AAFF and CTFF to be set. The Q output of AAFF then goes high which:

- (a) Causes the OH relay (via gate A and the OH relay driver) to operate and trip ringing, thus automatically answering the call
- (b) Provides a start signal (via gates A and C) to the call timer delay circuit and a high input to gate D.

The Q output of CTFF is low and prevents the CT relay from operating. Two seconds after ringing is detected, the 2-second delay circuit clears CTFF, causing its Q output to go high. This in turn allows the high output of gate C to operate the CT relay. CT contacts CT2 and CT4 then connect the test oscillator, whose output is approximately +6 dBm, to the telephone line via the transmission circuit. The variollosser operates and reduces the transmitted level to the value chosen at the time of installation. Should the level received by the test center disagree with previous records of the installation, the trouble should be analyzed and cleared.

2.25 Resetting the TST switch terminates the call by resetting the OH relay and conditions the coupler control circuit for normal customer control. 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 SH and SG interface leads provide the customer

with the status of the line switch on an associated telephone set when used with the data coupler. The coupler can be installed without a telephone set for fully automatic operation. 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 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 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 1001F 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. ♦A 558FM or 2558DM wall telephone set with exclusion feature may be used; this will require local engineering.♦

3.02.1 ♦The 502B and 2502B telephone sets shown in this section have been superseded by the 502BM and 2502BM, which are modular versions of these sets. The modular sets are available with an eight conductor cord which allows the sets to be plugged into the same series jack as shown in this addendum for 503CM and 2503CM telephone sets. When using the 502BM and 2502BM sets with data access arrangements in this way, it is necessary to order separately a D-180810 kit of parts and a D8AA-87 cord. Connection details are shown in supplements for Sections 502-501-102, Issue 3 (502BM) and 502-503-102, Issue 3 (2502BM).♦

3.02.2 ♦The 503CM and 2503CM telephone sets (Fig. 8.1 and 9.1) are the modular equivalent of the 503C and 2503C, respectively. MI and MIC connect to A and A1, respectively, of the data coupler arrangement.♦

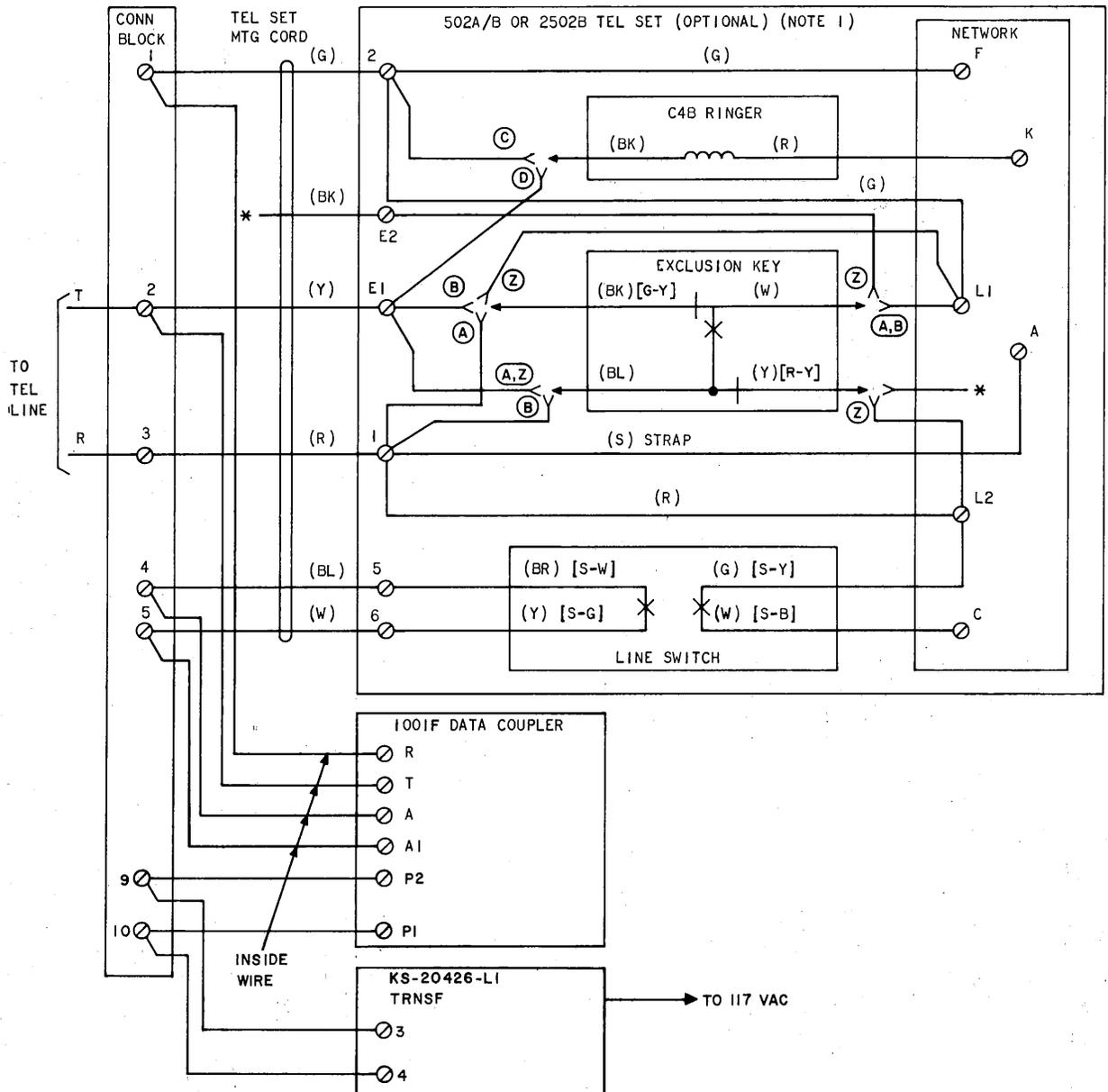
3.03 The 503C (rotary dial) and the 2503C (TOUCH-TONE dial) telephone sets furnish the customer the following additional options:

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



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
- Ⓣ 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—502A/B or 2502B Telephone Set Connection With 1001F Data Coupler

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 different 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, and a ringup relay for each line that requires manual answering as a service feature. Figure 10 shows the connections for a representative type of 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. ACU Application

3.06 The data coupler is designed to operate with automatic data terminals which can generate dial pulses for automatic calling. The coupler will also operate with a DAS 801-type ACU to provide the automatic calling function on either TOUCH-TONE or dc dial pulse lines. A partial schematic of a coupler/ACU connection is shown in Fig. 11 and a description of operational sequences is provided in the following text. A diagram for connecting the ACU to the coupler is shown in Fig. 12.

Note: When an optional 801-type ACU is provided for automatic call origination, install the unit in accordance with the section covering that unit.

3.07 Call Origination: Call origination with an ACU can be based on end-of-number (EON) operation or on answer-tone detection by the ACU.

3.08 To originate a call by using **EON operation**, the control leads to the coupler interface are in the **off** condition (the DA lead may be turned **on** permanently when all call originations are via the ACU). The ACU transfers the line from the coupler to the ACU in response to the call request (CRQ) signal from the data terminal. The normal dial sequence is presented to the ACU followed by the EON code. When the EON code is received, the ACU operates the ANS relay, causing the SH lead on the coupler to turn **on**. The previously operated LT relay drops in the ACU to return line control to the coupler. The data terminal responds to the **on** condition of the SH lead by turning **on** the OH lead on the coupler. Operation of the OH relay drops the ANS relay, turning the SH lead **off**. The OH relay operates to close and hold the loop and to supply the required supervisory contact closure to the ACU. The ACU turns **on** lead DSS and the customer terminal should respond by turning **off** circuit CRQ. The data terminal turns **on** the DA lead (if not permanently **on**) and looks for the CCT lead to indicate that the terminal has been cut through to the local telephone line. The data terminal should wait for answer tone or other signal from the called station before attempting to send data.

3.09 To originate a call by using the **answer-tone detection operation**, the control leads to the coupler interface are in the **off** condition (the DA lead may be turned **on** permanently when all call originations are via the ACU). The ACU transfers the line from the coupler to the ACU in response to the CRQ signal from the data terminal and accepts the normal dial sequence as presented. After dialing is completed, the ACU waits for detection of answer tone (2025 or 2225 Hz) from the called station. When answer tone is detected, the ACU operates the ANS relays, causing the SH lead on the coupler to turn **on**. The previously operated LT relay drops in the ACU to transfer line control back to the coupler. The sequence of operation now follows the same as for EON operation.

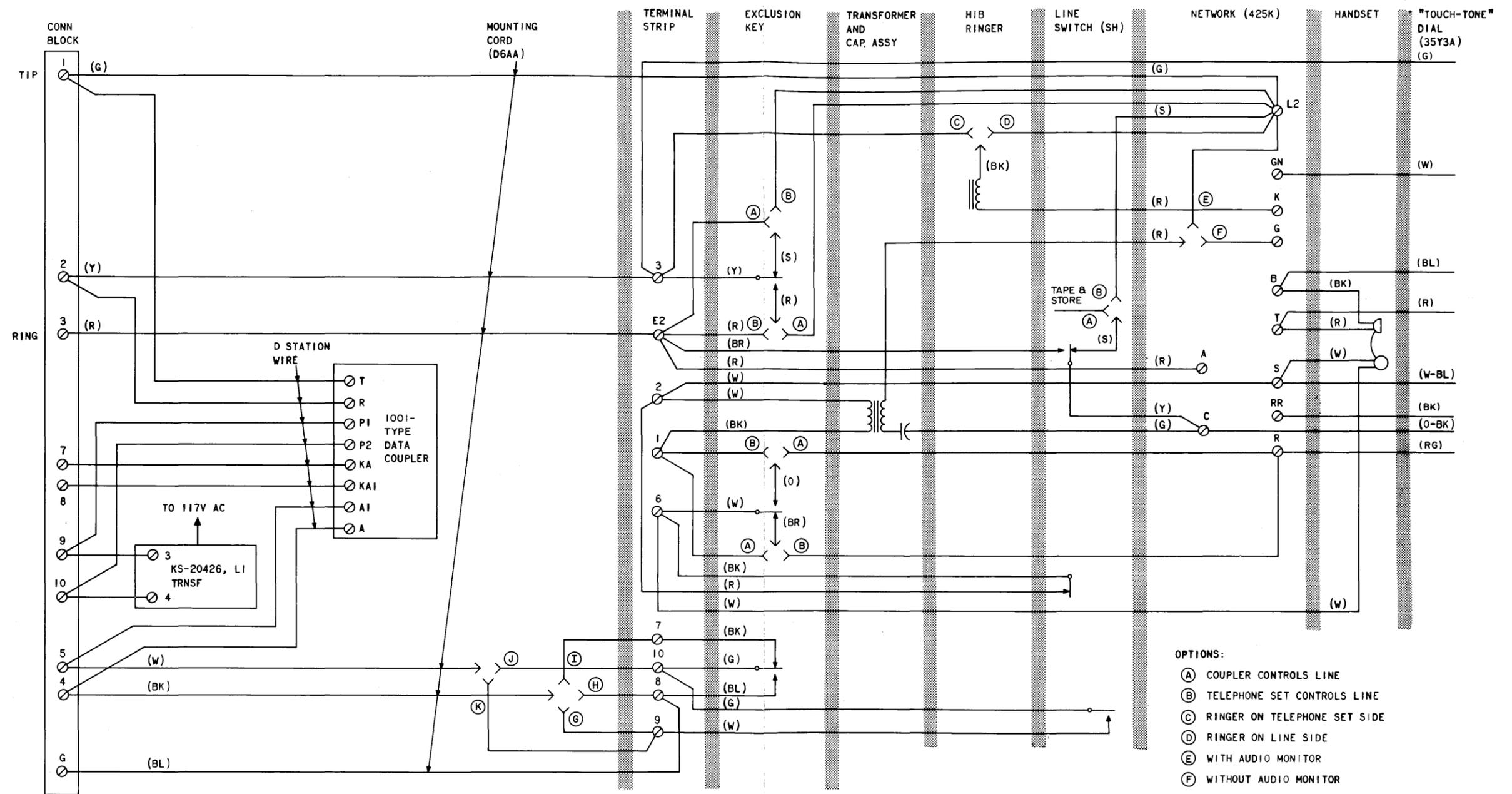


Fig. 9—2503C TOUCH-TONE Dial Telephone Set Connections With 1001F Data Coupler

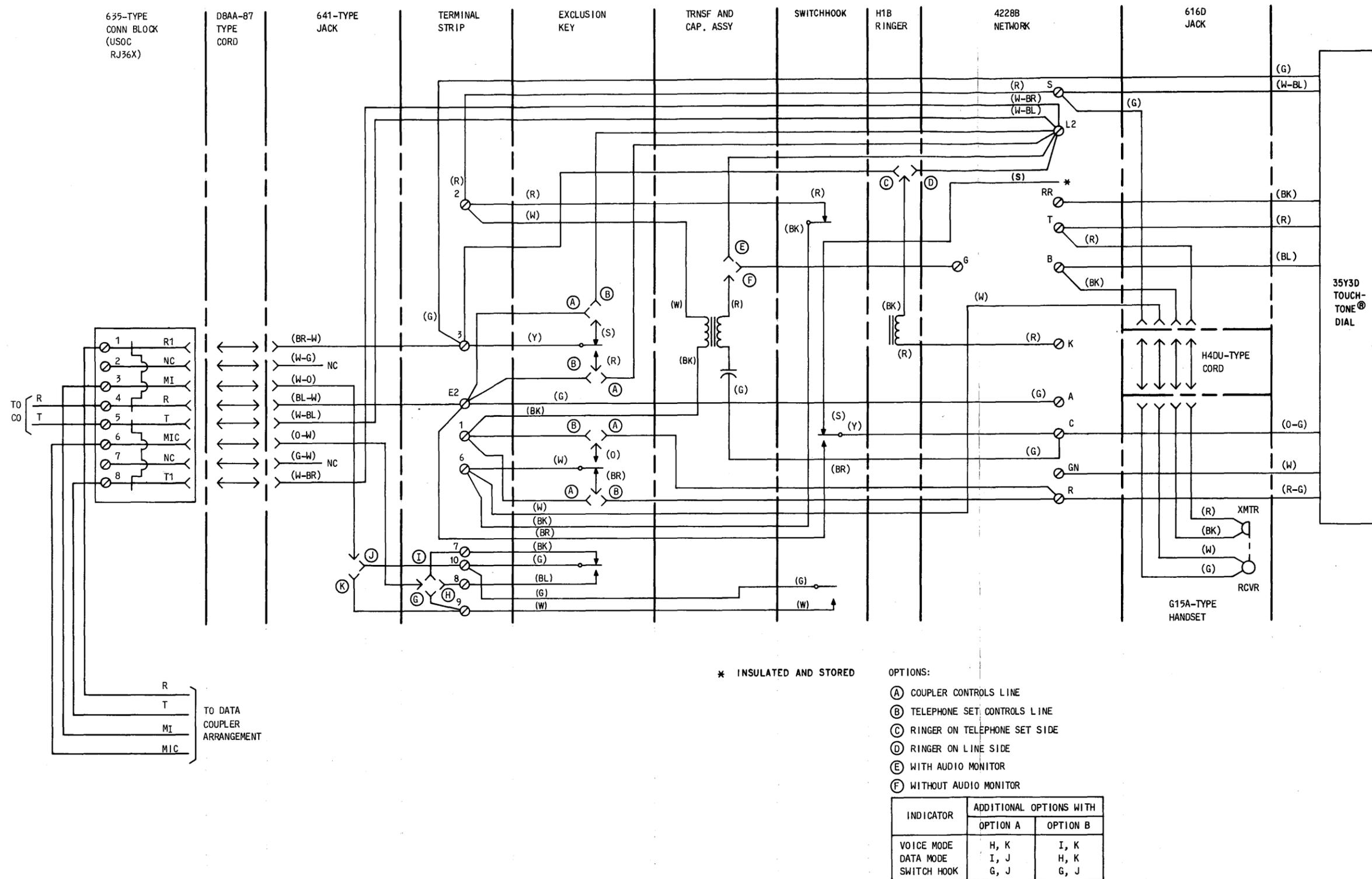
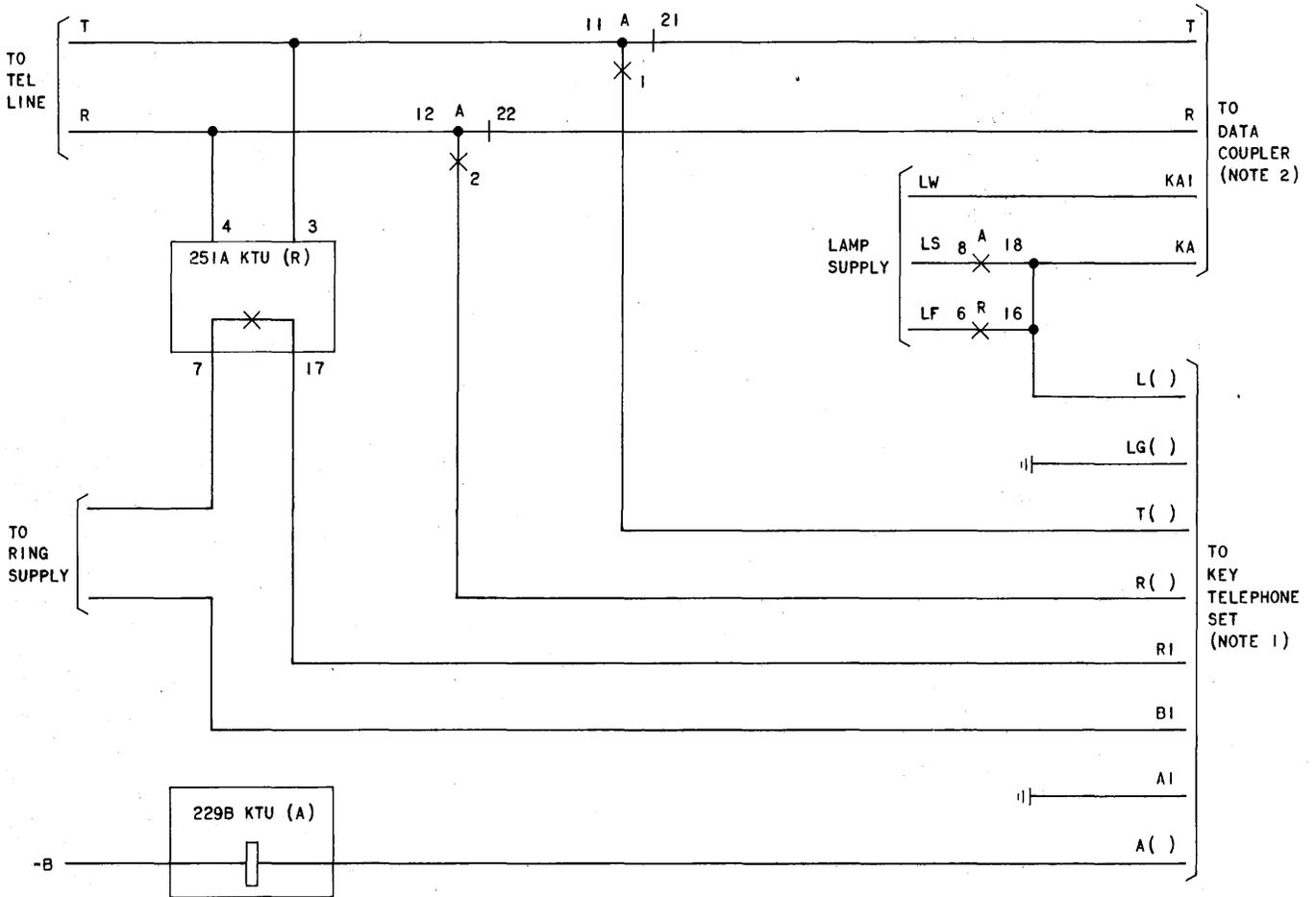


Fig. 9.1—Typical Connections for 1001F Data Coupler With 2503CM Telephone Set



NOTES:

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

Fig. 10—Key Telephone Unit Connections With 1001F Data Coupler

3.10 Call Termination: The data terminal terminates a call by turning *off* the OH lead to the coupler. The OH relay drops to open the loop-holding path and to inform the ACU that the data line is idle. The data terminal must monitor the DLO interface lead from the ACU to determine when the next call may be originated.

C. Line Current Status Indicator

3.11 A line current status indicator (LCSI) may be installed with the coupler on an optional basis to aid the customer in recognizing 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, up to 500 ms after answering a call. In response

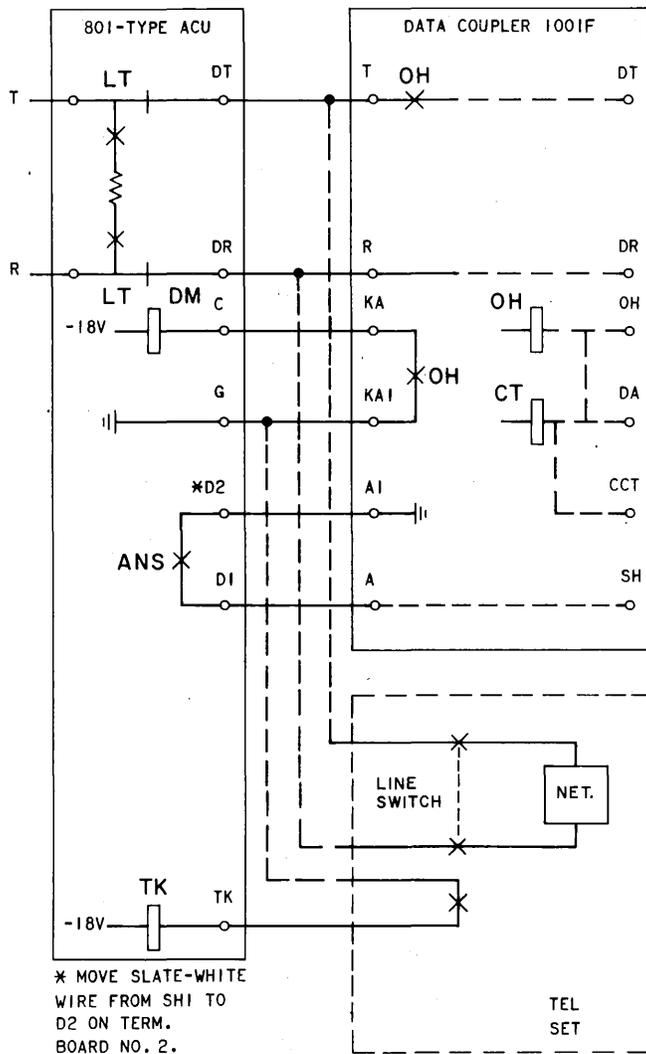


Fig. 11—801-Type ACU Partial Functional Schematic With 1001F Data Coupler

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 LCS I contact will open momentarily. To avoid misinterpretation of momentary opens, it is recommended that an open 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 LCS I for that function.

3.12 The LCS I can be arranged to present an EIA voltage with a parallel indication to SH contact closure spare leads (option Z) *or* a contact closure (option Y) to the customer as an indication of line current. The EIA voltage is derived from the SH driver circuit in the data coupler under control of the switchhook or the LCS I. If no associated telephone set is used, the indication is LCS I only. The LCS I indication will be a voltage on the SH lead at the customer interface. The contact closure option is a set of the LCS I relay contacts connected to two terminals on a separate connector block.

3.13 The LCS I (Fig. 13) must be made locally. It consists of a dry reed relay and two varistors on 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 or the input to the coupler SH driver circuit 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 50 Vdc. The maximum length of the loop over which the coupler can operate is reduced by approximately 800 feet if an LCS I is used.

3.14 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 Step (3) sets quickly and should not be allowed to come in contact with anything (especially the skin of the installer) except the relay, the applicator, and the connecting block base.*

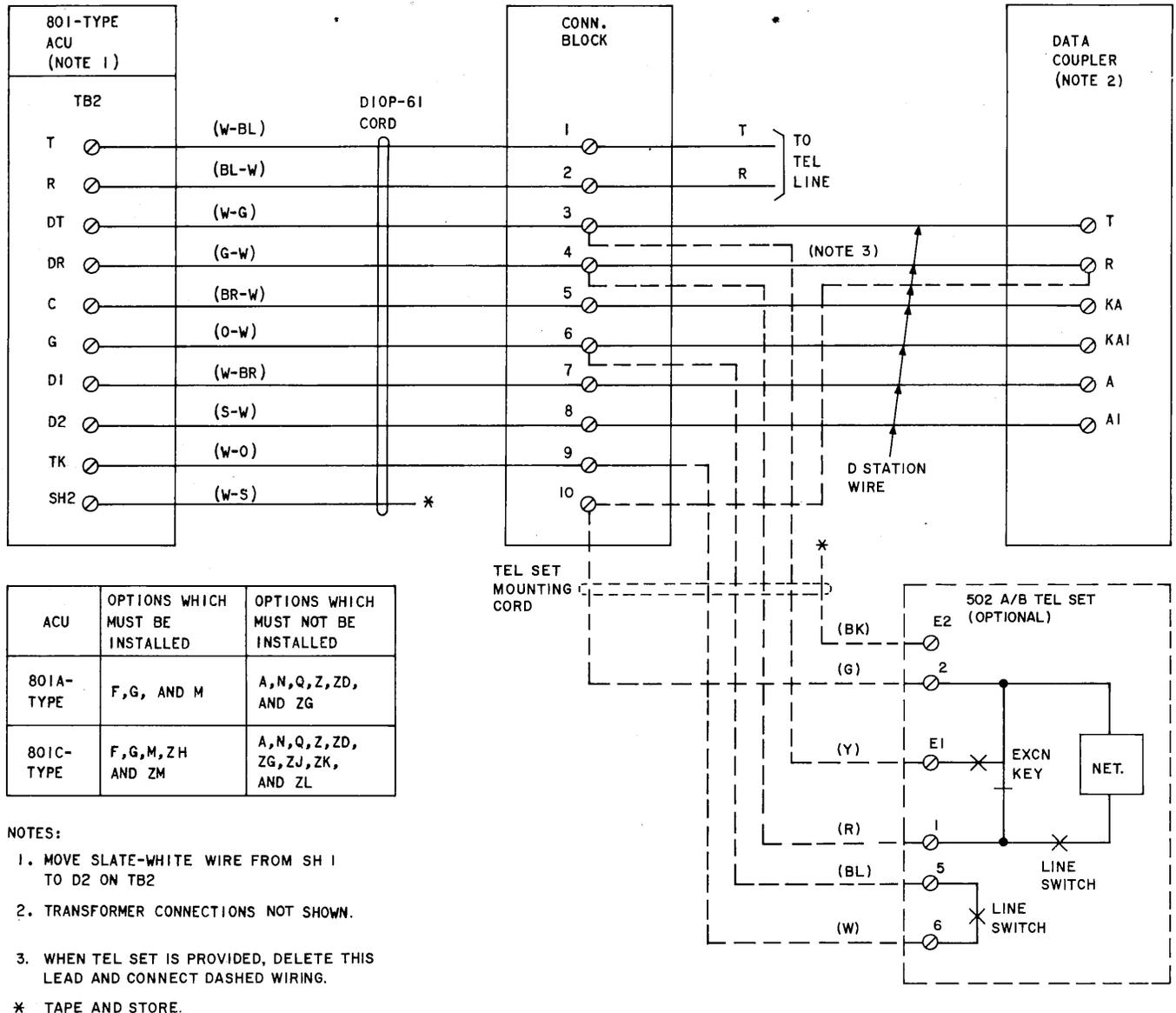


Fig. 12—801-Type ACU Connection With 1001F Data Coupler

- (3) Apply adhesive (Eastman 910 or equivalent) in the area to be occupied by the 327C relay.
- (4) Place relay on baseplate, 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. 13.

D. Customer-Provided Power

3.15 Customer-provided direct current may be used to power the 1001F data coupler. The factory-provided straps must be removed (Fig. 3 and 4). (Option X is applied.) These straps are accessed by removing the 1001F cover from the base and then removing the four screws that hold the top printed circuit board to the bottom printed circuit board (Fig. 2). To locate the two wire strap options, see Fig. 3. Each of these two wires should be cut at both ends near the printed circuit board and discarded. It is important that the

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 LCS I 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.

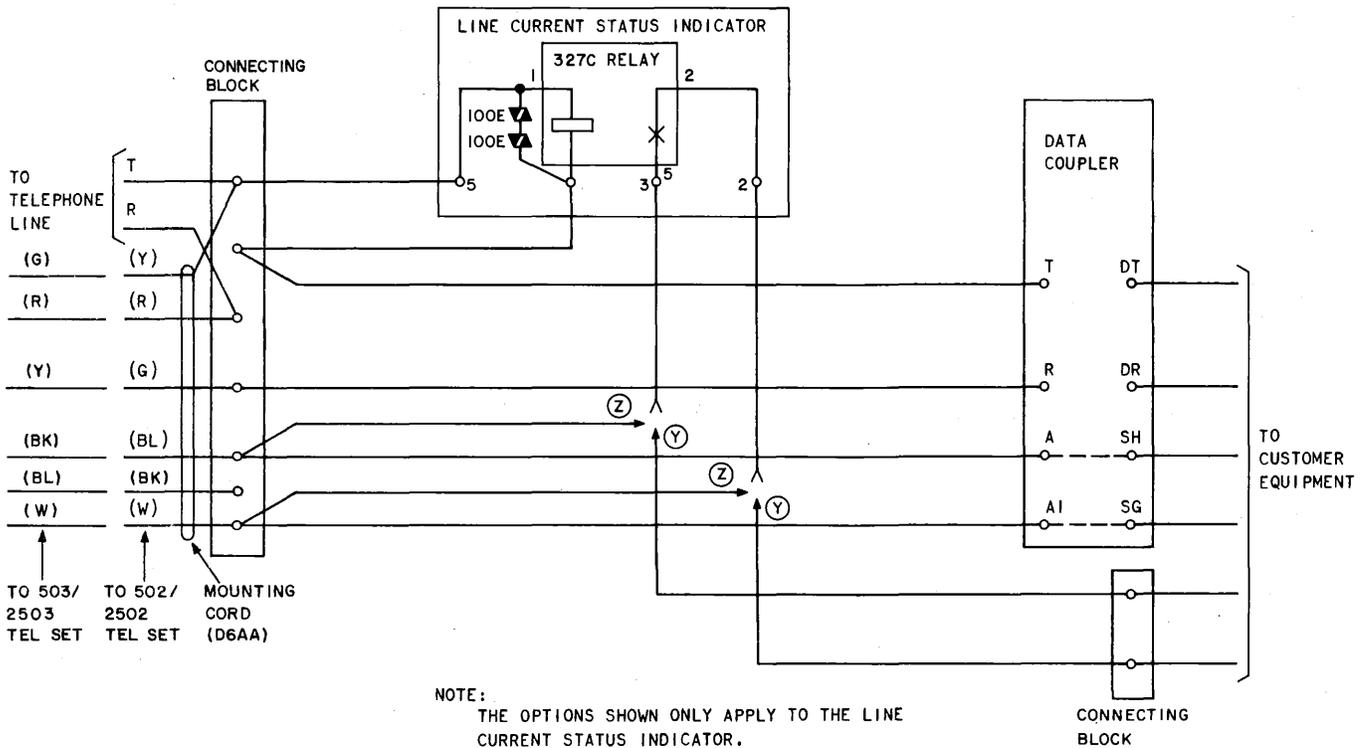


Fig. 13—Line Current Status Indicator Connection Diagram

remaining wire *not* touch any printed wiring paths or any components. Care should be exercised in replacing the top printed circuit board. The customer-provided dc power is connected to the +V, -V, and SG customer interface terminals and must conform to requirements shown in Table C. The ± 0.3 volt range stated in Table C allows for power supply tolerances, line regulation, and temperature variations. Supply voltage in excess of +12.7 volts (and less than -12.7 volts) could cause damage to the 1001F integrated circuits. A common dc supply may be used to power several couplers as long as the voltage requirements stated above are met. There should be no connections made to the P1 and P2 data coupler power terminals when the data coupler is customer powered.

E. Ring Indicator Lead Voltage Changes

3.16 The 1001F data couplers, series 2 and later, are equipped with diode CR8 and resistor R28. These were added to prevent false operation of the R relay when dial pulsing outward through the coupler. CR8 and R28 reduce the positive-to-negative transition time of the ring indicator (RI) lead to less than 10 μ s. Without CR8 and R28 the transition time of the RI lead is approximately 100 ms.

3.17 Option V (Fig. 3 and 4) connects CR8 and R28 into the circuitry. The coupler is shipped with option V connected. Option V should be removed (cut out) if the off-on control lead (OH) is not used for out dial pulsing.

4. INSTALLATION AND CONNECTIONS

4.01 The 1001F data coupler may be used with various types of SCO lines, key telephone systems, or PBX lines that provide access to the switched network facilities.



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 the transmission requirements for the specific data service before proceeding with the installation. General requirements for DAA are covered in Sections 314-205-500 and -501. Requirements for the 1001F 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 to be made should have been determined from the type of data modem information provided by the customer and specified on the service order. When the modem type cannot be determined, Type II 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, Type II requirements should be specified.

TABLE C

POWER SUPPLY PARAMETERS

PARAMETER	SUPPLY	
	+V	-V
Voltage	+12 \pm 0.3V	-12 \pm 0.3V
Load Current	0 to 50 mA	0 to 100 mA
Load Regulation	\pm 2%	\pm 2%
Output Ripple (peak-to-peak)	50 mV	50 mV
Operating Temperature Range	0 to 120° F	0 to 120° F

(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 selection of type of connecting block and electrical code requirements is given in Section 590-010-200. See Fig. 14 for typical interconnection block diagram.

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

4.05 Location of the coupler shall be determined by the following conditions:

- **The coupler must be mounted vertically** on a wall, or other vertical surface with the TST switch at the top, to ensure proper operation of OH mercury relay.
- The coupler must be within range of the interface cord supplied by the customer. This cord should not exceed 50 feet to meet EIA RS-232-C voltage specifications.
- Location of the coupler should provide easy access for viewing and operating the TST switch by the customer attendant.

A. Installation of Data Coupler

4.06 Install the coupler on a wall or 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.
- (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 the slot not less than 7 inches above the top of the baseboard or other obstruction which will be below the unit. Secure the base

with two No. 6 by 1/2-inch pan-head self-tapping screws supplied with the coupler.



Trouble has been experienced in older 1001F couplers having cable stress studs in the base pan. The employee should examine the base pan during an installation or maintenance visit and remove these studs with diagonal cutters as applicable.

(4) Route the D station wire through the slots on the base as shown in Fig. 15. Attach the CP to the base pan by using the four small self-tapping screws in the envelope. **Connect the A and A1 leads and, if necessary, the KA and KA1 leads to the terminals on each side of the printed wiring board. Care should be taken not to overtighten screws or stripping of the base pan screw holes will result.**

4.07 When the coupler installation does not include an associated telephone set, tip and ring of the telephone line may be connected directly to terminals T and R, respectively, on the coupler instead of to terminals on an associated connecting block shown in Fig. 7, 8, and 9. See 3.01 through 3.05 for information on installing an optional telephone set.

B. Installation of Power Transformer



Installation of the power transformer will not be necessary if the option for customer-provided power has been chosen. However, if the customer-provided power option has been chosen but the terminal (and the customer power) has not been installed, the power transformer must be installed in order to adjust and test the coupler. After completion of tests (when customer-provided power was chosen but not available), the power transformer is disconnected. The customer-provided power option must then be installed as described in 3.15.

4.08 The 1001F data coupler can be powered by the wall-mounted KS-20426-L1 low-voltage transformer supplied with each coupler. The

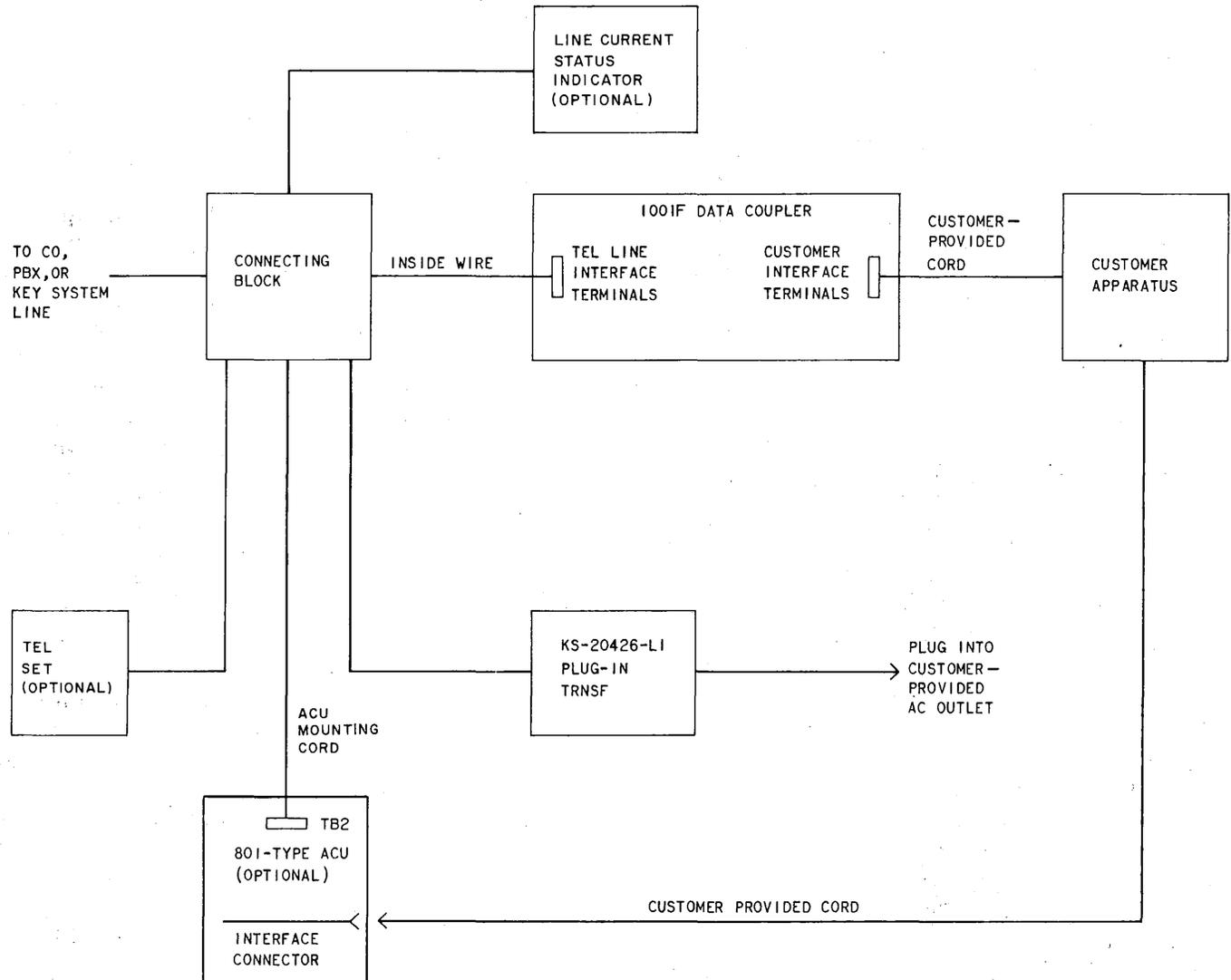


Fig. 14—Block Diagram of Typical 1001F Data Coupler Installation

KS-20426-L1 transformer provides two primary terminals in the form of parallel blades for use in a standard 2-pole, 3-wire grounded receptacle which serves as the mounting device. Two recessed screw terminals provide the means for connecting to the transformer secondary. Connections from the transformer are made **directly to the coupler** or to an associated connecting block. Terminals 3 and 4 of transformer KS-20426-L1 are wired to P1 and P2 screw terminals of the coupler. The furnished clamp must be used to hold the transformer securely in the receptacle. The receptacle provided by the customer must **not** be under control of a switch.



To prevent damage to the data coupler when using ac power, each data coupler must be powered by an individual transformer.

C. Completion of Installation

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

4.10 Install telephone set if specified on the service order. If a 503-, or 2503-type telephone is

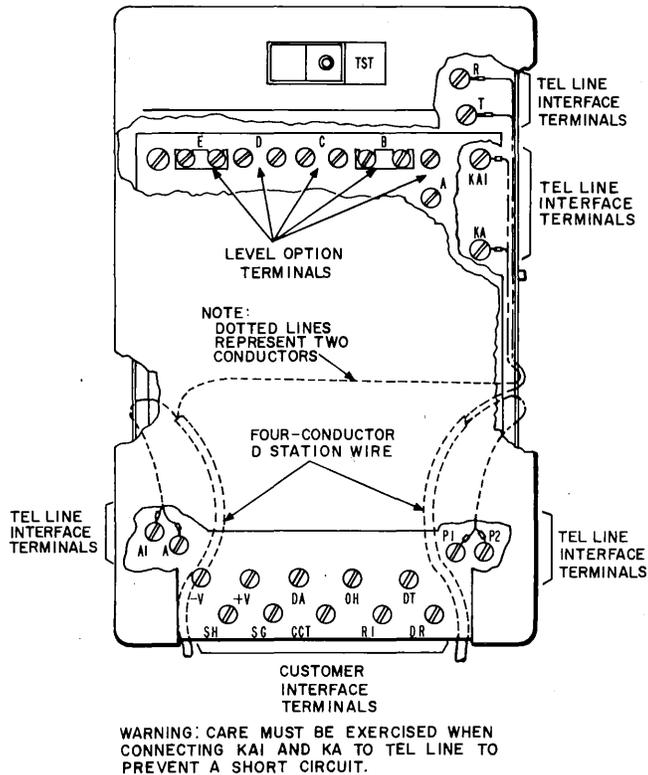


Fig. 15—Route of Station Wiring and Location of Terminals

used, redesignate the SH terminal on the coupler as "MI" (mode indicator).

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



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

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

4.13 Inform the customer, at the time the coupler is installed, of the maximum permissible signal power output from the customer provided 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 (approximately 2 dB) of the coupler.

5. MAINTENANCE AND TESTS

5.01 Maintenance and test procedures described in this part are provided to assist the employee during installation and troubleshooting visits to a data coupler station. All level measurements and test results made during installation 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 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. Power to the coupler can be removed by unplugging the KS-20426-L1 transformer.**
- **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 Bell System equipment, inform the customer and notify the PSC to fill out Form E-5855 in conformance with Section 660-101-312.

5.03 Maintenance of the coupler on customer premises is limited to local tests, testing by the serving or test office, or replacing a defective unit.

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



The 1001F data coupler can only be replaced by a 1001A if the customer terminal can work with EIA RS-232-B. Otherwise, a defective 1001F must be replaced by another 1001F.

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 forwarded 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 indicated in Fig. 16.

5.06 On a maintenance visit, tests or evaluations to isolate and clear trouble within the station should be performed as directed by the PSC. Begin with the steps shown in Fig. 16 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. 17 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 TST switch on 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 local test desk (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. 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 tests 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.

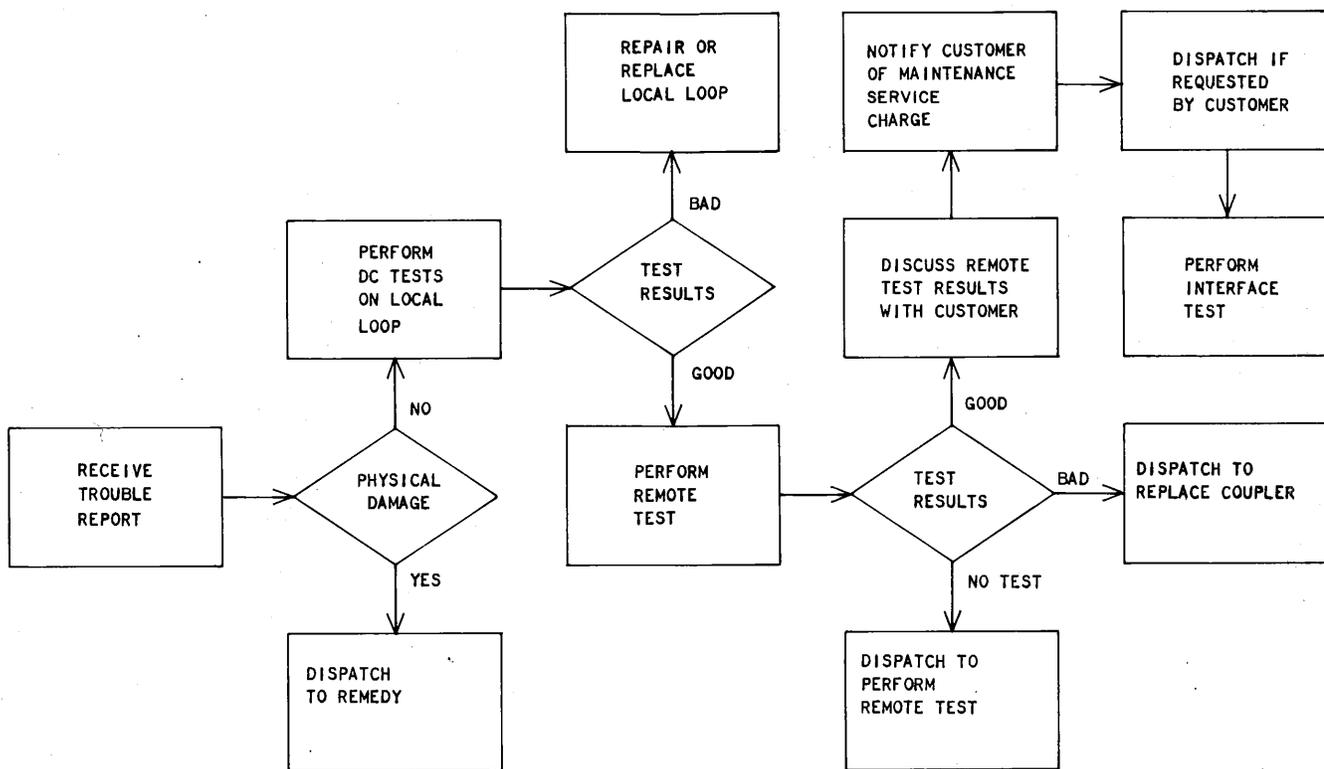


Fig. 16—Basic Activities Prior to Dispatching Employee

(14) After changing the defective loop, reconnect the coupler to the telephone line. Perform the insertion loss test and impedance matching test to determine if maximum allowable customer level has been changed. Notify customer of level change and then request customer to verify service restoration (ie, try to exchange data with the station that caused the trouble report).

Note: Prior to leaving customer premises, perform the remote test and record the new level on the CLRC.

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

(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 following 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
- ACU Test
- LCSi Test
- 503C or 2503C Telephone Set Test.

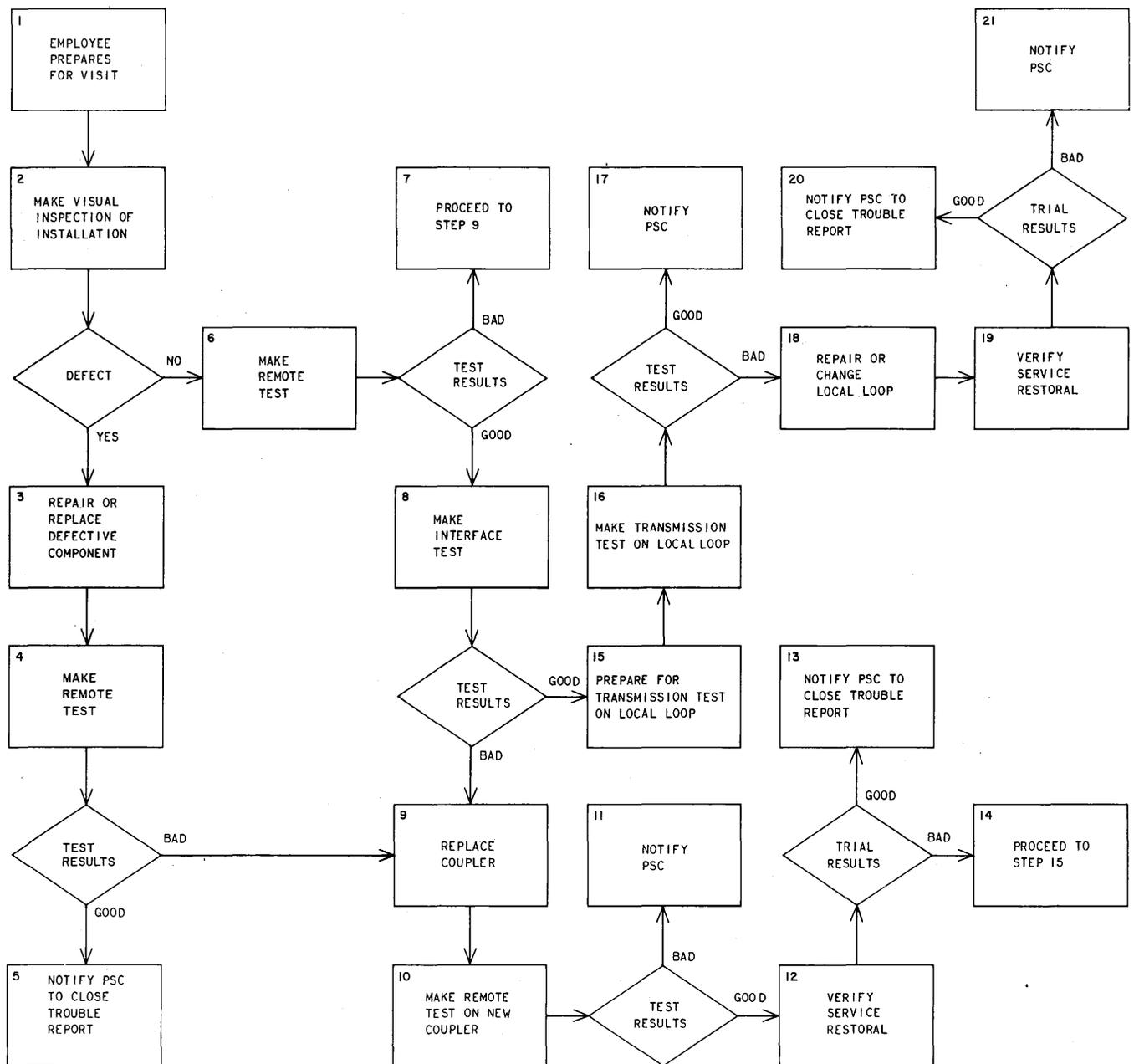


Fig. 17—Activities for Troubleshooting at a Coupler Station

5.08 The following test equipment is required for the tests:

- 600-ohm ± 1 percent 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.

Note: The insertion loss test *and* the impedance matching test are required to

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determine proper level option strapping, using Table D.

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 signal level no greater than -12 dBm at the SCO. This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line. Proceed with the test as follows:

- (1) Ensure that KS-20426-L1 transformer is connected to the coupler and plugged into power receptacle, or that customer-furnished power has been properly installed.
- (2) Locate and remove any existing straps on level option straps A through E (Fig. 15).

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

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

(4) Connect strap between terminals DA, OH, and SH.

(5) Connect the hand test set across tip and ring of the telephone line and dial the milliwatt supply (1000 Hz) 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 milliwatt supply.

(6) When the tone is heard, short terminal A to A1 with a clip lead and remove the hand test set from the line (or restore the talk key to data mode on the associated telephone).

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

◆ TABLE D ◆

LEVEL OPTION STRAPPING FOR 1001F DATA COUPLER

MEASURED LEVEL (INSERTION LOSS TEST) dBm	MAXIMUM ALLOWABLE CUSTOMER LEVEL dBm	MEASURED LEVEL (IMPEDANCE MATCHING TEST) dBm				
		-3.6 to 0	-4.6 to -3.7	-5.6 to -4.7	-6.6 to -5.7	-6.7 to -9
LIMITER OPTION STRAPS						
-2.5 to -3.4	-10	A, B, D, E	A, C, D, E	B, C, D, E	A, B, C, D, E	A, B, C, D, E
-3.5 to -4.4	-9	A, B, C, E	A, B, D, E	A, C, D, E	B, C, D, E	A, B, C, D, E
-4.5 to -5.4	-8	D, E	A, B, C, E	A, B, D, E	A, C, D, E	B, C, D, E
-5.5 to -6.4	-7	C, E	D, E	A, B, C, E	A, B, D, E	A, C, D, E
-6.5 to -7.4	-6	A, E	C, E	D, E	A, B, C, E	A, B, D, E
-7.5 to -8.4	-5	A, B, C, D	A, E	C, E	D, E	A, B, C, E
-8.5 to -9.4	-4	A, C, D	A, B, C, D	A, E	C, E	D, E
-9.5 to -10.4	-3	A, B, C	A, C, D	A, B, C, D	A, E	C, E
-10.5 to -11.4	-2	C	A, B, C	A, C, D	A, B, C, D	A, E

Example: Value obtained in insertion loss test = 6.4 dB.
 Value obtained in impedance-matching test = -4.2 dBm.
 Strap terminals D and E.

- (8) Remove the clip lead from A to A1. (The SCO 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. 18.
- (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, short terminal A to A1 with a clip lead and remove the hand test set from the line (or operate the data key to data mode on the associated telephone).

- (7) Measure the signal level with the VOM. Use this value to derive the level option strapping from Table D.

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

5.11 Using the values obtained in 5.09 and 5.10, apply straps in accordance with Table D. Mark the maximum input limit on the data coupler as determined in 5.09 (Fig. 1).

Remote Test

5.12 The remote test is required in measuring 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 and the KS-20426-L1 transformer connected to the coupler and plugged

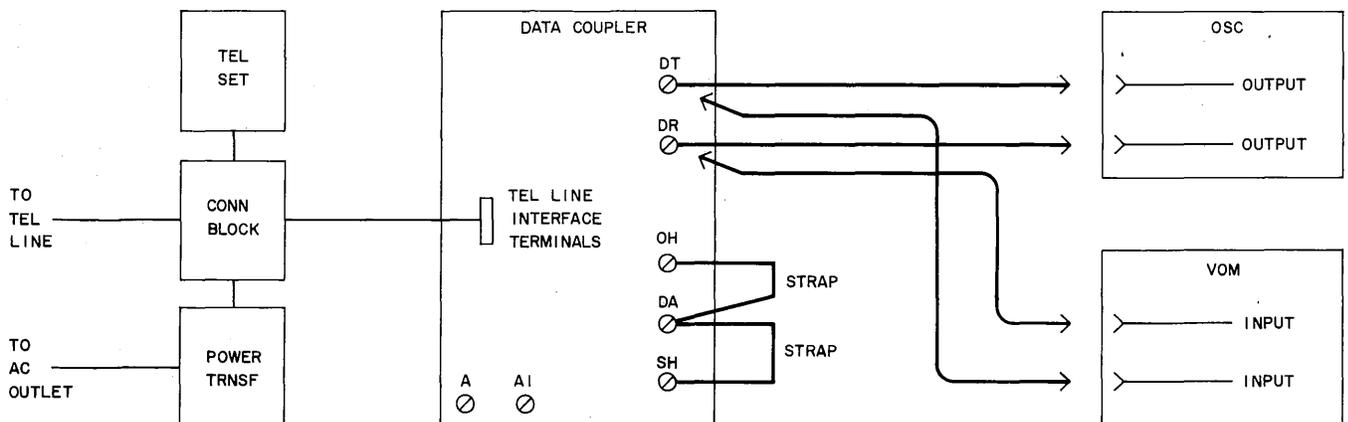


Fig. 18—Test Equipment Connections—Impedance Matching Test

into the ac receptacle. Proceed with the test as follows:

- (1) Connect the hand test set across tip and ring of the telephone line and contact the LTD.

Note: If a telephone set is associated with the coupler, remove the handset, ensure that the exclusion (data) key is in the talk position, and establish a connection to the LTD.

- (2) Request the LTD employee to call the coupler and measure the level of the test tone (2800 Hz) received at the LTD.
- (3) Agree upon length of time required to perform the test and restore the connection to idle state (hang up).
- (4) Operate TST switch to ON position (depress the red dot half of switch).
- (5) After the agreed testing interval, operate TST switch to OFF position.
- (6) Reestablish the connection to the LTD and request the level reading from the employee. This level indicates the loss of the loop and coupler at 2800 Hz. If 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.
- (7) 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 there is ac continuity in the loop and coupler and that the coupler operates satisfactorily.
- (8) Restore the telephone connection to normal.

Interface Voltage Test

5.14 The interface voltage test 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 the various operational modes.

5.15 This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. (For this test, disconnect LCSi Option Z, if provided.) The coupler must be connected to the telephone line and the KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Use the VOM meter 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 a strap between terminals A and A1.
- (2) Measure the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +5 and +12 Vdc.
- (3) Remove strap from terminals A and A1.
- (4) Measure the voltage between terminals (-) SH (or MI) and (+) SG. The meter should indicate between -5 and -12 Vdc.
- (5) 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 SG follows the ringing cycle and swings between +8 and +12 (ON) and -8 and -12 (OFF) Vdc. The ON interval is approximately 2 seconds and the OFF interval approximately 4 seconds.

◆**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.◆

- (6) Connect a strap between terminals OH and SH (or MI), and short terminal A to A1 with a strap.
- (7) Measure the voltage between (-) RI and (+) SG. The meter indicates between -8 and -12 Vdc after ringing is tripped.
- (8) Measure the voltage between terminals (-) CCT and (+) SG. The meter indicates between -8 and -12 Vdc. Leaving the meter

on terminals CCT and SG and strap on terminals OH and SH (or MI), connect an additional strap between terminals DA and SH (or MI). After 2 seconds, observe that the voltage swings to between +8 and +12 Vdc.

- (9) Connect the meter between terminals KA and KA1. The meter indicates continuity between terminals.
- (10) Remove strap from between terminals A and A1. The meter indicates no continuity between terminals KA and KA1.
- (11) Measure the voltage between (-) CCT and (+) SG. The meter indicates between -8 and -12 Vdc.
- (12) Hang up the calling telephone and remove test equipment and test accessories from the coupler.

ACU Test

5.16 When an ACU is associated with the coupler, the ACU can be tested as described in the appropriate sections for the 801-type ACU (Sections 598-010-ZZZ and 598-012-ZZZ). Options required for the ACU are indicated in Fig. 12. This test requires that the customer interface leads be disconnected from the coupler in accordance with procedures outlined in 5.01. The coupler must be connected to the telephone line and KS-20426-L1 transformer connected to the coupler and plugged into the ac receptacle. Proceed with the test as follows:

- (1) While testing the ACU, use the VOM to observe that the SH (or MI) lead turns **on** at the appropriate time by measuring the voltage between terminals (+) SH (or MI) and (-) SG. The meter indicates between +8 and +12 Vdc for the **on** condition.
- (2) Disconnect test equipment and restore the connection to normal.

LCSI Test

5.17 This test should be used to verify proper operation of the LCSI. The test with option Z is performed without disconnecting the customer LCSI interface, while the test with option Y requires disconnecting the customer LCSI interface.



Take necessary precautions to ensure that the customer does not receive inadvertent signals.

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

LCSI With Option Z (EIA Interface)

- (1) Measure the voltage between terminals (-) SH (or MI) and (+) SG. The meter indicates between -8 and -12 Vdc (OFF).
- (2) Operate TST key.
- (3) Initiate a call to the coupler.
- (4) Measure the voltage between terminals (+) SH (or MI) and (-) SG. The meter should indicate between +8 and +12 Vdc (ON).
- (5) Restore TST key to normal.

LCSI With Option Y (Contact Closure)

- (1) After disconnecting the customer leads from the separate connecting block, measure the resistance between the two terminals 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 and reconnect customer leads.

503C or 503CM and 2503C or 2503CM Telephone Set Test

5.18 This test verifies that the telephone set mode indication and audible monitor features are operating properly. Requirements of this test are based on the logic sense which gives an ON (+) voltage when the telephone set is connected to the line. In all other cases, the mode indication will be OFF (-) voltage. This test can be performed without disconnecting the customer interface in

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which case necessary precautions should be taken to ensure that the customer does not receive inadvertent signals.

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

5.19 Lift telephone handset. Using the VOM, make voltage measurements between terminals MI (+) and SG (-) on the data coupler, in accordance

with the options installed and Table E. Return handset to cradle.

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

5.20 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 E
MFT SET TEST WITH 1001F DATA COUPLER

INDICATOR	OPTIONS INSTALLED	VOLTMETER READING, DC	
		EXCLUSION KEY	
		UP	DOWN
Voice Mode	A, H, K	+8 to +12	-8 to -12
Data Mode	A, I, J	-8 to -12	+8 to +12
Switchhook	A, G, J	+8 to +12	+8 to +12
Voice Mode	B, I, K	-8 to -12	+8 to +12
Data Mode	B, H, K	+8 to +12	-8 to -12
Switchhook	B, G, J	+8 to +12	+8 to +12

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	SECTION	TITLE
		167-445-101	28A1-Type Power Unit—Identification, Installation, and Connections
		167-452-101	33A Power Unit—Identification, Installation, and Connections
010-250-001	Crediting Charges on Test Calls	314-205-500	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Overall Data Transmission Test Requirements
010-521-100	Data Technical (DATEC) Support		
010-521-101	Data Technical (DATEC) Support—Designee Directory	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
167-440-201	19- and 20-Type Power Units—Identification, Installation, Connections, and Maintenance		

SECTION	TITLE	SECTION	TITLE
502-501-102	◆Reference—502-, 510-, 511-, 515-, 555-, and 558-Type Telephone Set	590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
502-501-120	Reference—503B, 503BM, 503C, 503CM, 513B, and 513BM Telephone Sets	660-101-312	Maintenance Service Charge on Services With Customer-Provided Equipment (CPE)
502-503-102	Reference—2502-, 2510-, 2511-, 2515-, 2555-, and 2558-Type Telephone Sets	6.02	Detailed information on the 1001F data coupler is contained in the following schematic drawing (SD) and circuit description (CD):
502-503-120	Reference—2503-Type Telephone Sets◆	SD-&CD-1D206-01	1001-Type Data Couplers.