

## LOCAL AREA DATA CHANNELS MAINTENANCE PROCEDURES

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**1. GENERAL**

**1.01** This section describes the maintenance considerations and procedures used to locate a trouble condition on the metallic cable pairs that make up a Local Area Data Channel (LADC). These channels provide for baseband transmission of data signals between two customer terminal locations within a single serving wire center area.

*Note:* The term “pair” or “loop” as used in this section denotes the circuit facility used to implement the channel service. It is *not* necessarily the circuit facility between a customer and the telephone central office.

**1.02** Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

**1.03** LADCs use nonloaded metallic facilities, exclusively, with limited amounts of bridged tap. The facilities may reside entirely within the customer premises or may be routed through the Serving Central Office (SCO). When the facilities are routed through a central office, some testing may be accomplished from the Local Test Desk (LTD). If the channel is not routed through the SCO, then a dispatch may be necessary whenever trouble is reported.

**1.04** LADCs are provided as either 2-wire or 4-wire channels with corresponding 2-wire or 4-wire interface to the data set. Channels are specified in lengths ranging from 1 mile to 6 miles, in 1-mile increments. Channel length is determined by the overall length of the facilities used to furnish the particular channel service, measured from data set to data set.

**1.05** LADCs should be treated as a Special Service. The Special Service Center (SSC) responsible for the territory involved should be the office that the customer is instructed to call in case of trouble. The SSC is responsible for coordinating all maintenance activities and for requesting the LTD at the SCO to perform any required testing. In the absence of an SSC, the local organization which normally receives trouble reports for data service should be designated as the Control Office.

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## SECTION 314-410-311

**1.06** Trouble analysis procedures and information given in this section are based on the results of tests made under the following conditions:

(a) Self-tests made by the customer. These tests make use of the self-testing capabilities of data sets connected to LADCs. Generally, results of these tests should indicate the source of trouble.

(b) One employee tests made at the SCO or another convenient test access midpoint. These tests are dc tests made toward either end of the circuit for the purpose of trouble analysis. If the data sets are Telephone Company (TELCO) provided, they may remain connected to the circuit.

(c) End-to-end testing of the circuit. These tests are dc and ac tests made at the customer premises with the data sets disconnected from the circuit. These tests are performed during installation (benchmarks) or for the purpose of detailed trouble analysis.

**1.07** The various tests to be performed on LADCs are outlined in Part 5 of this section. The step-by-step procedures for performing these tests and the test requirements are given in Section 314-410-312.

**1.08** In the event that a cable pair must be replaced for any reason (eg, due to a fault on the pair), the channel must still meet all the design requirements and the installation test requirements for the particular channel length provided.

### 2. MAINTENANCE

#### A. Routine Maintenance

**2.01** No routine maintenance is required on the cable pairs utilized to implement a LADC. Test results obtained during installation should be recorded to serve as benchmarks in case of trouble conditions on the channel.

#### B. Trouble Conditions

**2.02** Cable pair faults are not alarmed. A trouble condition will normally be detected and reported by the customer to the TELCO which will in turn investigate the trouble condition.

**2.03** The basic intent of a trouble investigation should be to avoid dispatching repair people to both ends, except as a last resort. Initial trouble sectionalization to the TELCO facilities should be performed by the customer. Testing by the TELCO should then be performed to isolate and clear the trouble, if necessary.

**2.04** When a legitimate trouble report is received from the customer, telephone craft employees should perform the required tests as outlined in Part 5 of this section, based on the analysis procedures in Part 4. Not all tests will be required in most cases of trouble. The analysis procedures given in Part 4 of this section should be followed to trace the most likely cause of trouble condition and the tests to be performed.

### 3. CHANNEL PROTECTION UNIT

**3.01** When customer-provided data sets are used, the channel must be equipped with a 500Z Channel Protection Unit at each end of a wire pair. This unit provides protective circuitry, with or without dc continuity, to protect the facilities against hazardous voltage and longitudinal imbalance.

**3.02** Figures 1 and 2 show the protective circuit optioned for dc and ac, respectively. The dc option is used when the data sets require dc continuity for operational or maintenance purposes. The ac option is used when dc continuity is not required.

**3.03** The presence of 500Z Channel Protection Units should be taken into account during testing and trouble isolation. The losses incurred by these units are already included in the insertion loss limits specified for the channels. If a protection unit is found to be defective (eg, 76A Fuse blown by lightning or a power cross), it should be replaced with a properly optioned new unit.

### 4. ANALYSIS PROCEDURES

**4.01** This part outlines the analysis procedures shown in Fig. 3, that should be used to isolate and clear trouble on the metallic pairs that make up a local area data channel. The detailed tests and requirements are listed in Section 314-410-312. These procedures are coordinated by the SSC.

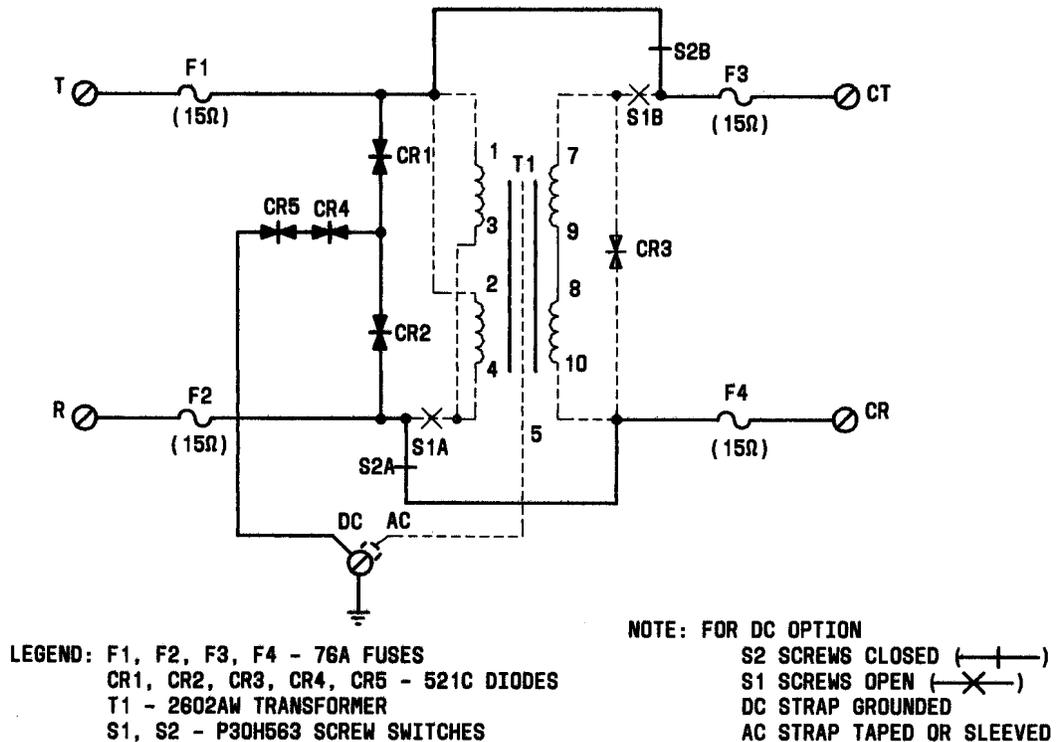


Fig. 1—DC Protective Circuit

**4.02** The procedures begin when the SSC receives a trouble report from the customer. At this point the SSC should determine, from conversation with the customer, whether or not the trouble is the TELCO responsibility. Generally, the data sets used with LADCs will have some self-testing capabilities that should enable the customer to isolate the trouble to a particular data set or the metallic facilities. Customers are expected to use all of the data set testing features before reporting any trouble and should be encouraged to do so.

**4.03** Following are some questions intended as a guide for the SSC when discussing a trouble with a customer. All questions are not expected to be applicable in every case.

- Describe the trouble—occasional errors, or does not work at all?
- Are data set power indicators ON, if any?
- Are data sets plugged in?

- Are data sets properly connected to the circuit?
- Have the self-testing features been exercised, if any? What was the outcome?
- How often does trouble occur?
- Any particular time of day that trouble symptoms are usually bad?
- Is trouble in one direction or both directions of transmission?
- Has this trouble been experienced before? If so, what was the outcome?
- Have changes been made to the system lately (eg, new equipment, new program, new operator, etc)?
- Any other pertinent information.

**4.04** All available information collected from the customer should be analyzed to locate the

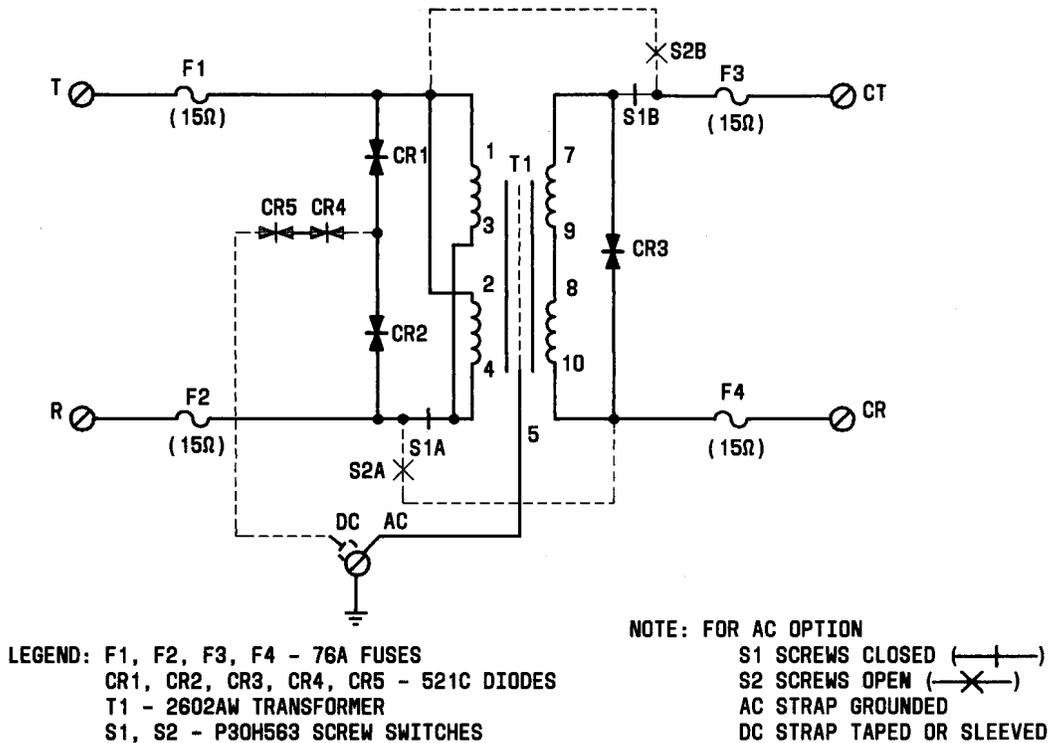


Fig. 2—AC Protective Circuit

most probable source of trouble. If results of this analysis indicate trouble in Customer Provided Equipment (CPE), the customer should be advised. If trouble is indicated in a TELCO-provided data set, the data set should be replaced in accordance with the proper practices. If channel trouble is suspected, then the procedures outlined below apply.

**4.05** The SSC should determine from the Circuit Layout Record Card (CLRC), or equivalent, whether any testing can be done from the LTD at the SCO (or from another convenient test access midpoint). If there is no test access, proceed to 4.09.

**4.06** If there is test access to the circuit, the SSC should request the LTD at the SCO (or equivalent) to perform dc Tests A, B, and C, which are listed in Table A. The tests are performed toward each data set location for the purpose of trouble isolation. (If the data sets are customer-provided, they should be disconnected.) Test access from

the LTD is obtained at the Main Distributing Frame (MDF) via patch cords to the LTD test trunk.

**4.07** If the results of Tests A, B, and C toward both data stations meet requirements, check the cross-connections and then restore the circuit continuity. Request the customer to retest the data communications system to make certain that the trouble condition still exists before dispatching any craft employees and refer to paragraph 4.09.

**4.08** If the results of Test A, B, or C fail to meet requirements, isolate the trouble and repair or replace the cable pair(s), if required. Make sure all the test requirements for the particular channel length are met before returning service to the customer.

**4.09** Dispatch craft employee(s) to the data set location(s) to perform end-to-end testing. Table A lists the tests and the test equipment required. These tests are to be performed during channel installation and on trouble cases as required.

Procedures for the tests are given in Section 314-410-312.

**Note:** The craft employee(s) must be equipped with the test equipment listed in Table A, or equivalent. If existing data sets are TELCO-provided, spare data sets of the proper list code and with the proper options installed should also be available to the craft employee(s).

**4.10** If any of the tests fail to meet requirements, isolate the trouble and repair or replace the cable pair(s), if required. Make sure all the test requirements for the particular channel length are met before returning service to the customer.

**4.11** If the test results meet requirements and the data sets are CPE, return the service to the customer. If the test results meet requirements and the data sets are TELCO-provided, replace the data sets (one at a time) with properly optioned spares and perform the data set installation tests recommended in the appropriate Bell System Practices (BSPs).

**4.12** If the data set installation tests are successful, the trouble has been cleared and the service can be returned to the customer. If the tests fail, request the aid of DATEC through normal lines of supervision.

## 5. TESTING

**5.01** This part describes each test to be performed on LADCs. The procedures and requirements are given in Section 314-410-312.

**5.02** The tests, which are listed in Table A, consist of dc and ac measurements performed between the two data stations with the data sets disconnected. The dc measurements may also be performed between a data station and the LTD when the channel is routed through the SCO. All of the tests listed in Table A should be performed during installation. For maintenance, they are performed as required.

### Apparatus Required

**5.03** The following is a list of apparatus required for performing these tests on an end-to-end basis:

- Two 6F Noise Measuring Sets (NMSs) with C-message network (497D), or equivalent
- Two Hewlett-Packard 3551A Test Sets or equivalent
- One KS-14510-L1 multimeter or equivalent
- Two 135-ohm resistors per wire pair.

**5.04** The following information is required before starting the tests:

- Determine from the CLRC if the facility is 2 wire or 4 wire. If 2 wire, only the T, R leads are tested. If 4-wire, both the T, R and T1, R1 leads are tested.
- The cable pair(s) loop resistance, measured during initial installation tests and recorded on the CLRC. [If the measurement result is not available, measure the loop resistance (Test C) and record on the CLRC.]
- The end-to-end Expected Measured Loss (EML) for an initial installation, or the Actual Measured Loss (AML) if testing is performed for trouble analysis.

## DC TESTS

### Test A—Foreign Voltage

**5.05** This test is made to check that no foreign voltage is present on the line pairs. A foreign voltage may indicate that a cable fault exists. (In some cases the foreign voltage could be caused by a data set or other source at one end of the circuit.)

**5.06** The test is made between the following leads: T to R (T1 to R1); and T, R (T1, R1) to ground. There should be no significant voltage reading (less than 1 volt) between any of these leads.

### Test B—Insulation Resistance

**5.07** This test is made to ensure adequate isolation between conductors, and between conductors

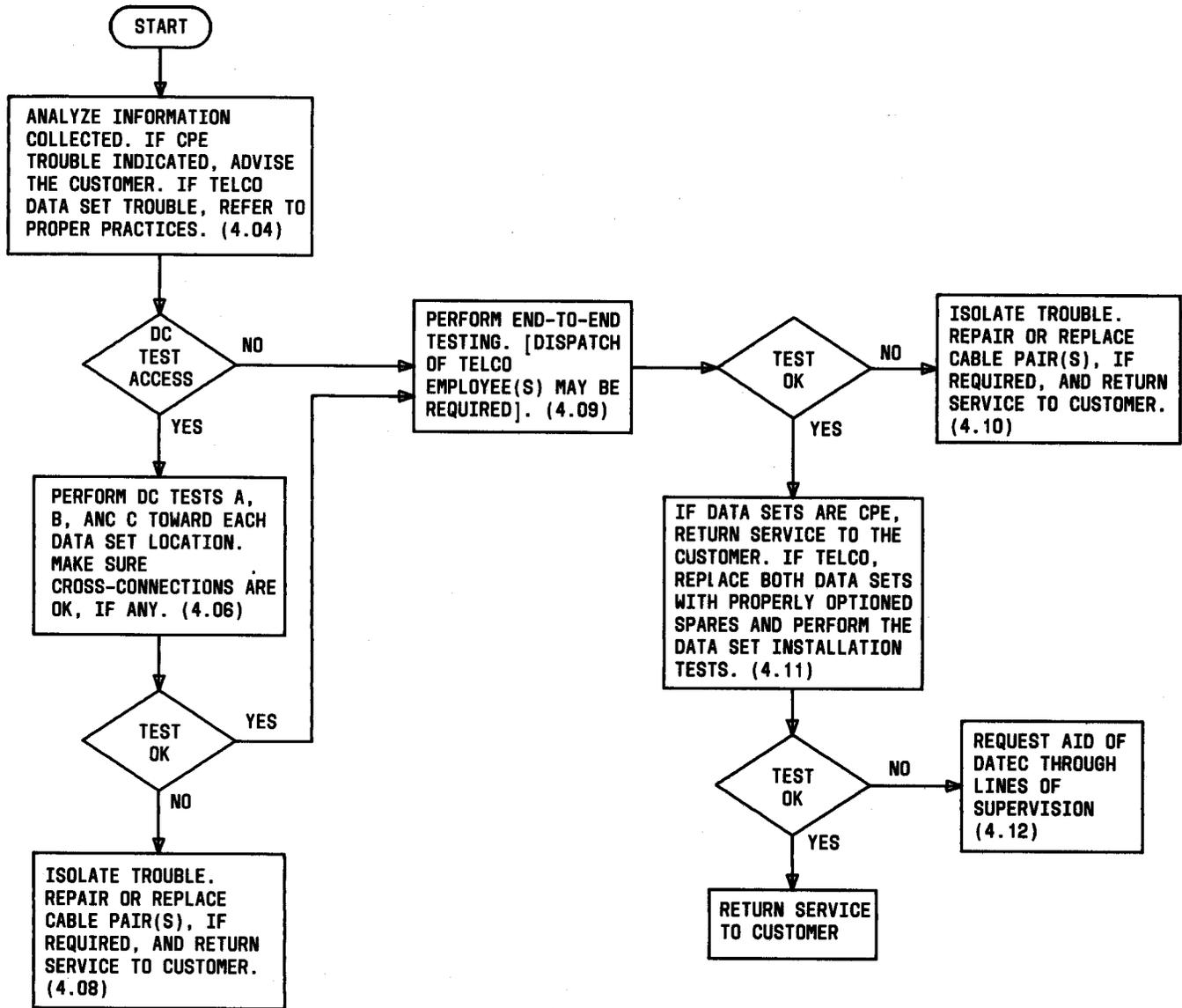


Fig. 3—Local Area Data Channels—Trouble Clearing Procedures

**TABLE A**  
**OVERALL CHANNEL TESTS**

Name of Test	Test Apparatus Required	Probable Cause of Test Failure
A. Foreign Voltage	KS-14510-L1 Multimeter or LTD	Short circuit to another cable pair
B. Insulation Resistance	KS-14510-L1 Multimeter or LTD	Short or ground in cable pairs
C. Loop Resistance	KS-14510-L1 Multimeter or LTD	Open or short in cable pairs, or splicing error
D. Insertion Loss	Two HP-3551A Test Sets	Inaccurate cable records, load coils, or excessive bridged tap
E. Background Noise	Two 6F NMSs	Pair imbalance or crosstalk
F. Impulse Noise	Two 6F NMSs	Pair imbalance or crosstalk

and ground. The test measures the insulation resistance between the line leads as follows:

- T and R; R and R1
- T and T1; R and T1
- T1 and R1; T and R1
- T and GRD; R and GRD
- T1 and GRD; R1 and GRD.

**Test C—Loop Resistance**

**5.08** The loop resistance measurement checks the dc resistance of the transmit and receive cable pairs while each is shorted at one end of the circuit. The measurement reading is taken at the other (nonshorted) end. If this is an installation test, the dc resistance for the cable pairs between the SCO and each data station (or between data stations) should be recorded on the CLRC for future reference.

**5.09** If the dc measurements do not meet the requirements given in Section 314-410-312

and a faulty cable is suspected, the cable fault-locating procedures given in Section 634-310-501 can be used to locate the trouble. This procedure is normally done by the cable repair crew.

**AC TESTS**

**Test D—Insertion Loss**

**5.10** The insertion loss measurement is made using a test signal at various frequencies. The test is used to check that the insertion loss specifications for the particular channel length being tested are met. It also verifies that the cable pairs and associated bridged taps are not loaded.

**5.11** The HP-3551A or equivalent test sets at each end of the circuit are used to generate the test signals and to measure the level of the received signals.

**5.12** If the insertion loss measurement fails to meet the test requirements as based on the EML, the problem may be due to inaccurate cable records, load coils which were not removed, or bridged taps of excessive length.

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**Test E—Background Noise**

5.13 The background and impulse noise measurements are made on the receive side of the channel at each end of the circuit. Both the transmit and receive sides are terminated with 135-ohm resistors. The 6F NMS is connected to the receive side, with the FUNCTION switch set to the 600-OHM BRIDGING position.

5.14 Instructions for operating the 6F NMS are given in Section 103-626-100. Noise measurements can be made at any time; however, it is preferable that they be made during a peak traffic load or busy-hour period.

**Test F—Impulse Noise**

5.15 The impulse noise measurement is normally made after the background noise test is completed and uses the noise counter of the 6F NMS. The NMS is set to operate for a period of 15 minutes at a particular threshold value.

**6. REFERENCES**

6.01 The following sections can be referenced for additional information:

<b>SECTION</b>	<b>TITLE</b>
103-626-100	6F and 6FR Voiceband Noise Measuring Sets — (J94006F and J94006FR) — Description, Operation, and Maintenance
634-310-501	Locating Cable Faults With the 96A Test Set
314-410-312	Local Area Data Channels — Tests and Requirements
880-102-100	Local Area Data Channels — Engineering Guidelines