DATA SET 209A-L1
TRANSMITTER-RECEIVER
MAINTENANCE

CONTENTS PAGE

1. GENERAL

1.01 This section contains information concerning the maintenance of data set (DS) 209A-L1. The objective of this section is to coordinate the efforts of the telephone company (telco) employee with the efforts of the serving test center (STC) in locating and eliminating trouble involving a DS 209A-L1. The control STC, designated by the system engineer, coordinates all maintenance testing.

1.02 This section is reissued to include current information pertaining to DS 209A-L1, and to include DS 209A-L1 multiplex system maintenance procedures previously contained in Section 592-032-301. Since this reissue constitutes a general revision, arrows ordinarily used to denote changes have been omitted.

1.03 Data sets 209A-L1, 208A-L1A, and 201C contain self-test and loop-back test features which aid in locating the source of trouble. However, many of the normal test features do not function properly when these data sets are used in extended multiplex service. Figure 1 shows permissible loop-back tests which can be made without disconnecting data set cords or changing data set options.

Note: DS 208A-L1 does not contain a self-test feature.

1.04 Refer to Part 4 for Bell System Practices which contain information on maintenance and testing for data sets 201C, 208A-type, and 209A-L1. References concerning the maintenance of data auxiliary sets (DASs) 828A-L1 and 829-type are also given in Part 4.

1.05 If dispatch of a craft employee to the location of a suspected defective DS 209A-L1 becomes necessary, the craft employee should take along the following:

- 914C or 914B data test set (DTS)
- 903-type DTS (if 914B DTS is used)
- Maintenance kit (D-180555-L1)

1.06 The maintenance kit consists of the following:

- One carrying case (KS-21363-L1)
- Two diode test pins (white, 840806327) for use with DTS
- Two resistor test pins (yellow, 840806335) for use with DTS
- One set of data set 209A-L1 circuit packs (KD1—KD19)
- Two fan replacement fuses (AGC 1/2)
- Four option shorting jacks

- One of each BSP—592-032-100, -200, -300, and -500
- Three circuit pack (CP) shipping cartons
- One CP shipping carton (large)
- Three option stickers (E-5142).

Note: Maintenance kits should be kept on hand according to the following schedule:

NUMBER OF SETS IN SERVICE IN MAINTENANCE TERRITORY	RECOMMENDED NUMBER OF MAINTENANCE KITS
1 to 9	1
10 to 35	2
36 to 55	3
56 to 80	4
Over 80	Not more than 5 percent of number of sets in service.

1.07 If dispatched to the location of a suspected defective DS 201C or 208A-type used as an extension data set in a multiplex system, the craft employee should take along the following:

- 914C or 914B DTS
- 903-type DTS (if 914B is used)
- Spare DS 201C (if required)
- Maintenance kit D-180468 (for DS 208A-L1) or D-180497 (for DS 208A-L1A) if required.

1.08 The digital loop-back test to the distant end and the analog loop-back test require duplex capability from the DTS. The 914C DTS provides this capability; however, if a 914B DTS is used, a 903-type DTS is required to obtain duplex capability.

1.09 If a CP which contains an option strapping switch is replaced, install the correct options before testing the data set. Refer to Section 592-032-200 for information pertaining to installation of options in DS 209A-L1.

1.10 If CPs are replaced, the defective CPs should be tagged, carefully packed in one of the shipping cartons provided in the maintenance kit (D-180555-L1), and promptly returned to a Western Electric repair center for analysis and repair. ***CPs which fail within one year from the date of manufacture are replaced free of charge under General Engineering Complaint GEC 9400. Refer to Section 010-700-020.***

1.11 When DS 209A-L1 is suspected of being defective, the power supply should first be checked for correct operation. If the ON indicator is extinguished, check for the possibility of the following:

- 105—130 volts ac power not present
- Tripped data set circuit breaker.

If the ON indicator is intermittent, check for the possibility of the following:

- Inoperative data set cooling fan
- Blown fuse in cooling fan fuse mounting
- Excessive ambient room temperature.

1.12 If the cooling fan for DS 209A-L1 is determined to be defective, a replacement cooling fan (KS-21296-L1) can be ordered. Before replacing the cooling fan, check for the possibility of a blown fuse inside the fuse mounting located at the rear of the data set. A spare fuse is located inside the faceplate at the front of the data set.

2. TROUBLE VERIFICATION PROCEDURES

A. Point-to-Point

2.01 When investigating a trouble report, proceed as directed in Fig. 2. Refer to Section 592-032-500 for test procedures applicable to data set 209A-L1.

2.02 If the trouble persists:

(a) Check that the options connected in the data set agree with those called for on the service order.

(b) Check that the multiplex switch is set for correct speed.

(c) Confirm that the customer-provided equipment (CPE) has been tested and checks satisfactorily.

(d) Check for cord and connector defects.

(e) Check for intermittent trouble in the station wiring.

(f) Verify that the data set and CPE are wired to a common ground.

(g) Refer to supervision and the STC for further analysis.

B. Point-to-Point Multiplexing

2.03 When investigating a trouble report on a point-to-point multiplex system, refer to Fig. 3 and 4. Test procedures to be used at the STC are contained in Trial Instruction 405 (Section 666-511-504).

C. Many-Point and One-to-Many Multiplexing

2.04 A typical many-point multiplex system is shown in Fig. 5. A typical one-to-many multiplex system is shown in Fig. 6. The trouble investigation procedures for these systems are shown in Fig. 3, 7, and 8.

2.05 The trouble investigation procedures given are for these typical systems only. Other multiplex systems may require a different approach. However, because of the master/slave timing arrangement, certain restrictions apply.

(a) If trouble is encountered on all multiplex channels, the probable cause is the DS 209A-L1 link.

(b) When performing a digital loop-back test with external test equipment, the test cannot be done from a slave DS 209A-L1 to a master DS 209A-L1 with options as installed. If the slave option is temporarily removed and the slave out option is installed, this test can be performed.

(c) Analog loop-back self test cannot be performed at a remote extension (DS1 and DS6 in Fig. 5, DS4 in Fig. 6) with options as installed. If the internal timing option is temporarily installed at the remote extension, this test can be performed.

(d) Digital loop-back self test cannot be performed from a remote extension to a collocated data set (eg, from DS6 to DS5 in Fig. 4) with options as installed. If the internal timing option is temporarily installed at the remote extension, this test can be performed.

2.06 If it becomes necessary to dispatch a craft employee to the defective data station, the craft employee should take along the following:

- Maintenance kit for DS 209A-L1 and 208A-type (if required)
- Spare DS 201C (if required)
- 914C DTS or
- 914B and 903-type DTS.

2.07 Before the STC notifies the customer that service is restored, a digital loop-back test from the STC to each end should be made to verify satisfactory service.

3. MAINTENANCE TESTING CONSIDERATIONS

3.01 DS 201C has an internal word generator under control of the ST switch, which can be used as a self-test feature. DS 208A-L1A and 209A-L1 have self-test features which are valid only if channel continuity has been verified by the STC. If channel continuity has not been verified, external test equipment (914-type DTS) must be used.

3.02 A many-point or one-to-many multiplex system can be divided into three possible categories.

- DS 209A with collocated 201C/208A/209A
- DS 209A without collocated 201C/208A/209A
- Remote extension 201C/208A/209A.

The following is a procedure for maintaining a multiplex system, depending on the part of the system to which the telco employee has been dispatched.

DS 209A With Collocated 201C/208A/209A

3.03 ***Tests from Master 209A:*** The tests should be performed in the following sequence:

(1) Perform analog loop-back self test.

(2) Remove M8M cord if testing with external test equipment (914C DTS or 914B/903 DTS).

Note: Whenever the M8M cord is disconnected from DS 209A and external test equipment is connected, a red matrix pin must be added between row SCT and column 24.

(3) Perform digital loop-back self test or digital loop-back test using external test equipment.

Note: The digital loop-back test using external test equipment cannot be performed if the corresponding (remote) DS 209A has the slave out option (WJ) installed.

(4) Perform end-to-end test using self-test features or external test equipment.

(5) Perform analog loop-back test using external test equipment to distant collocated 201C/208A/209A (eg, between DS3 and DS5 of Fig. 5).

(6) Perform digital loop-back test using external test equipment to distant remote extension 201C/208A/209A (eg, between DS3 and DS6 of Fig. 5).

Note: The distant remote extension 201C/208A must have M23B cord connected.

3.04 ***Tests from Collocated 201C/208A/209A:*** The tests should be performed in the following sequence:

(1) Perform analog loop-back self test.

(2) Disconnect M8M cord from collocated 201C/208A/209A.

(3) Connect external test equipment (914C DTS or 914B/903 DTS).

Note: Whenever the M8M cord is disconnected from DS 201C/208A/209A and external test equipment is connected, a red matrix pin must be added between row S8 and column 24. Switch S8 must be OFF. There must be no other pins in column 24.

(4) Perform digital loop-back test using self test or external test equipment to remote extension.

(5) Perform end-to-end test using self test or external test equipment.

DS 209A Without Collocated 201C/208A/209A

3.05 The tests should be performed in the following sequence:

Note: If the system is a one-to-many multiplex system, set the multiplex selector switch in the same position as the remote DS 209A.

(1) Perform analog loop-back self test.

(2) Perform digital loop-back test using self test or external test equipment (914C DTS or 914B/903 DTS).

Note: The digital loop-back test using external test equipment cannot be performed if the corresponding (remote) data set has the slave out option (WJ) installed.

(3) Perform end-to-end test using self test or external test equipment.

(4) Perform analog loop-back test using external test equipment to distant collocated 201C/208A/209A (eg, between DS1 and DS3 of Fig. 6).

(5) Perform digital loop-back test using external test equipment to distant remote extension (eg, between DS1 and DS4 of Fig. 6).

Note: The distant remote extension 201C/208A must have the M23B cord connected.

(6) Perform end-to-end test using external test equipment. Test must be performed to distant remote extension.

Note: The distant remote extension 201C/208A must have the M23B cord connected.

Remote Extension Data Set 201C/208A/209A

3.06 For the local data set and corresponding collocated data set, the tests should be performed in the following sequence:

Note: In order to perform local analog loop-back tests with external test equipment (914C DTS or 914B/903 DTS), the M23B cord must be disconnected from the local data set. A red matrix pin must be added between row S8 and column 24. Switch S8 must be OFF. There must not be any other pins in column 24.

(1) Perform local analog loop-back test using external test equipment.

(2) Perform digital loop-back test or end-to-end test to distant remote extension using external test equipment (eg, between DS1 and DS6 of Fig. 5).

Note: The M23B cord must be connected to both the local data set and the distant remote (201C/208A) extension.

(3) Perform an analog loop-back test using external test equipment to far-end collocated data sets (eg, between DS1 and DS5 in Fig. 5).

Note: The M23B cord must be connected to the local data set.

4. REFERENCES

4.01 The following documents provide information concerning the data sets used in multiplex systems and DAS 828A- and 829-types.

SECTION	TITLE
010-700-020	General Engineering Complaint GEC-9400—Procedure for Expedited Handling of Certain Initially Defective Apparatus and Equipment
Data Set 208A-Type	
592-027-100	Description and Operation
592-027-200	Installation
592-027-300	Maintenance
592-027-500	Test Procedures
666-511-503	Test of Data Services Provided By Data Set 208A-Type From a Private Line Test Room
Data Set 201C	
592-029-100	Description and Operation
592-029-200	Installation
592-029-300	Maintenance
592-029-500	Test Procedures
666-511-501	Test of Data Services Provided By Data Set 201C From a Private Line Test Room
Data Set 209A-L1	
592-032-100	Description and Operation
592-032-180	Summarizing Specification
592-032-200	Installation
592-032-500	Test Procedures
666-511-504	Test of Data Services Provided by Data Sets 209A-L1 From a Private Line Test Room
999-100-143	How to Operate Manual
Data Auxiliary Sets	
598-080-100	828A—Description and Operation
598-082-100	829-Type—Channel Interface Units—Voiceband Private Line Channels Data Only—Description
598-082-101	829-Type— Supplementary Functions for Voiceband and Private Line Channels (Alternate

SECTION	TITLE
	Voice and Switched Network Backup)— Description
598-082-102	829-Type—Multiple Channel Arrangements (Switched Dial Backup)—Description

4.02 Detailed information pertaining to DS 209A-L1 is contained in CD- and SD-1D249-01.

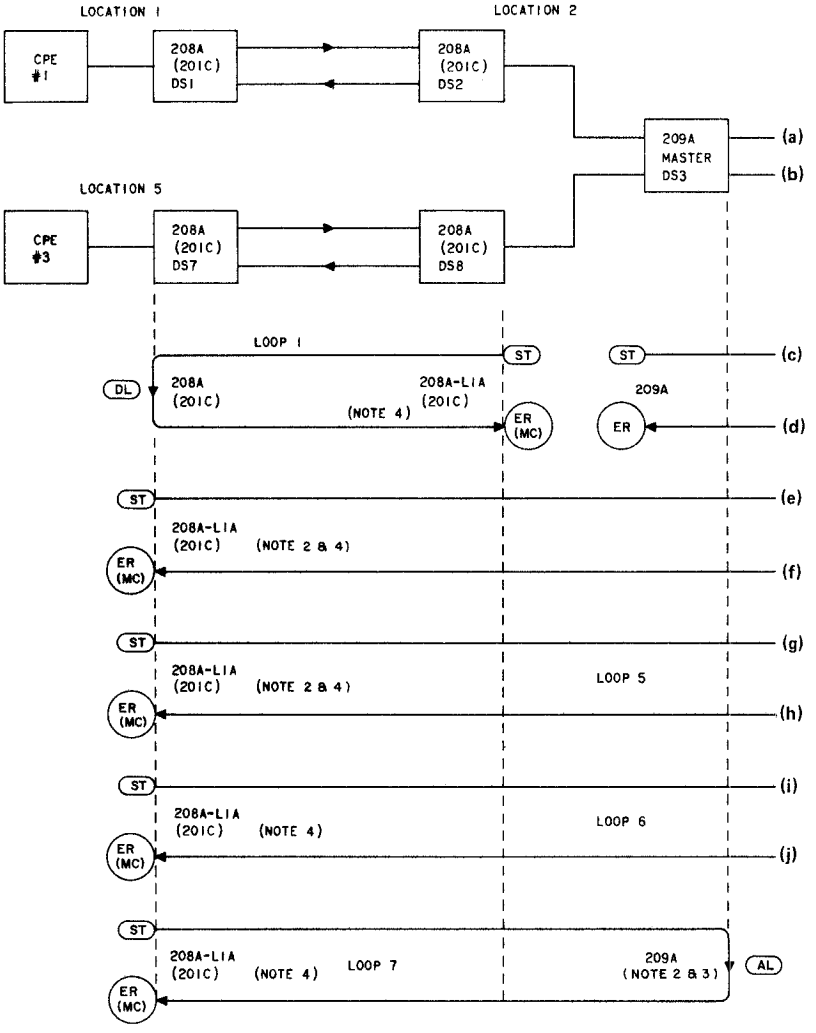
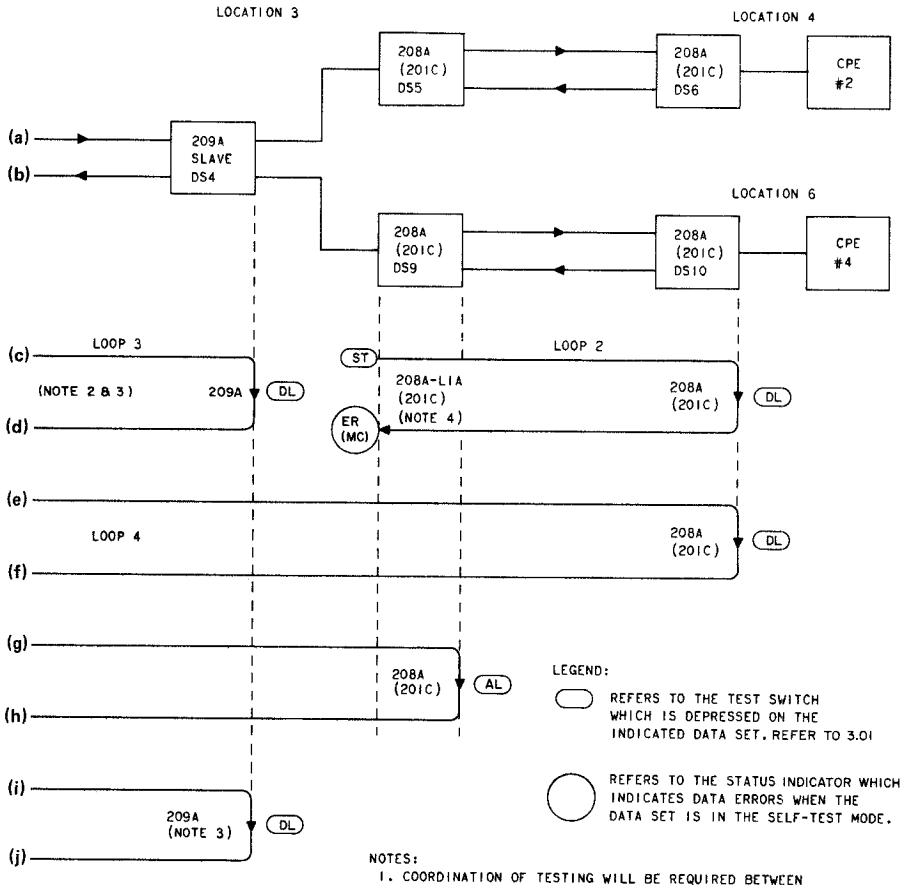


Fig. 1—Permissible Signal Loops When Testing From the Data Set Location (Sheet 1 of 2)



NOTES:

1. COORDINATION OF TESTING WILL BE REQUIRED BETWEEN LOCATIONS UNDER CONTROL OF THE CUSTOMER'S PERSONNEL. A DESIGNATED CONTROL LOCATION SHOULD BE USED.
2. THE PERMISSIBLE SIGNAL LOOPING ARRANGEMENTS SHOWN CAN BE MADE AS SHOWN (LEFT TO RIGHT) OR SYMMETRICALY OPPOSITE TO THAT SHOWN (RIGHT TO LEFT).
3. ANY TESTS USING THE ST, AL, OR DL SWITCHES ON THE DATA SET 209A WILL AFFECT OPERATION ON ALL CONNECTORS AND WILL INTERRUPT NORMAL DATA TRANSMISSION THROUGH THE 209A LINK IN THE SYSTEM.
4. THE DATA SET 208A-L1 HAS NO SELF TEST CAPABILITY. IF THIS DATA SET IS USED, EXTERNAL TEST EQUIPMENT MUST BE PLUGGED INTO THE CUSTOMER INTERFACE OF THAT DATA SET TO GENERATE TEST PATTERNS AND TO CHECK FOR ERRORS.
5. ALL OF THE LOOPS MAY BE RUN WITH THE 914C (914B/903) WITH THE RESTRICTION THAT THE MASTER 209A MAY NOT BE DIGITALLY LOOPED.

Fig. 1—Permissible Signal Loops When Testing From the Data Set Location (Sheet 2 of 2)

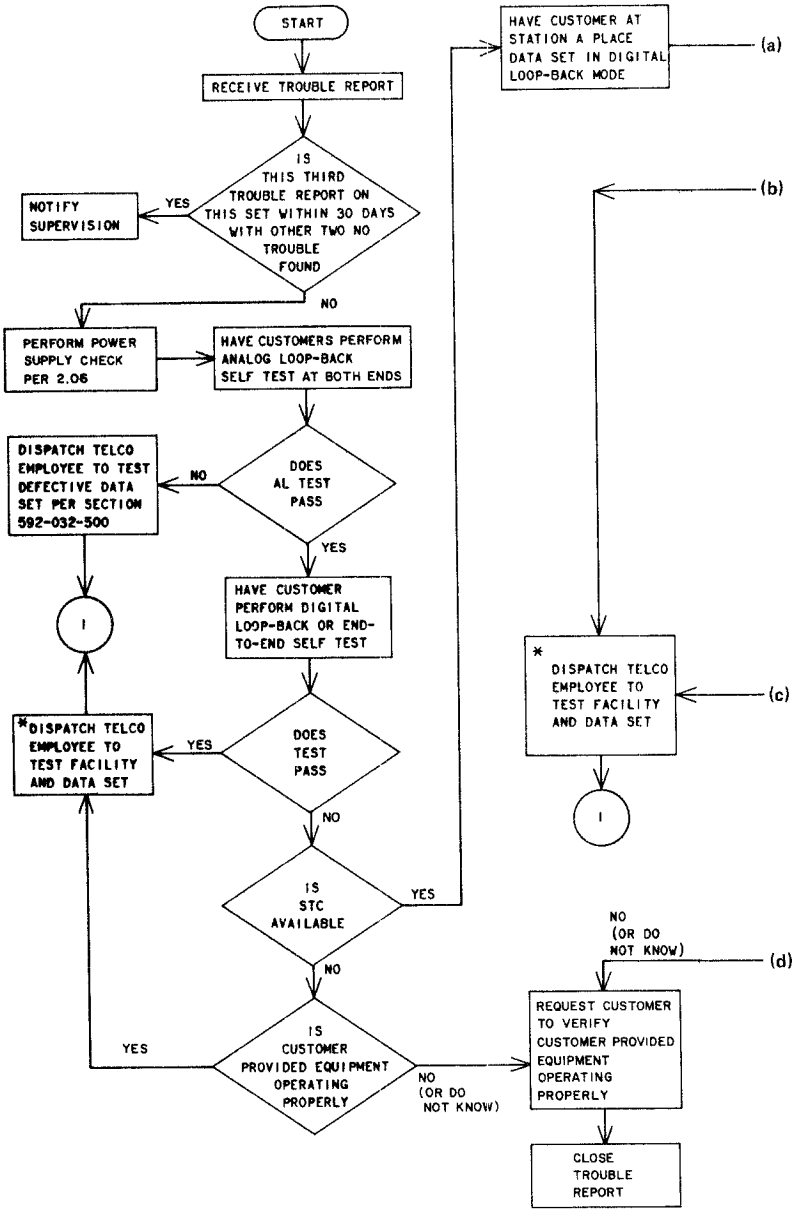


Fig. 2—Point-to-Point Maintenance Flowchart (Sheet 1 of 2)

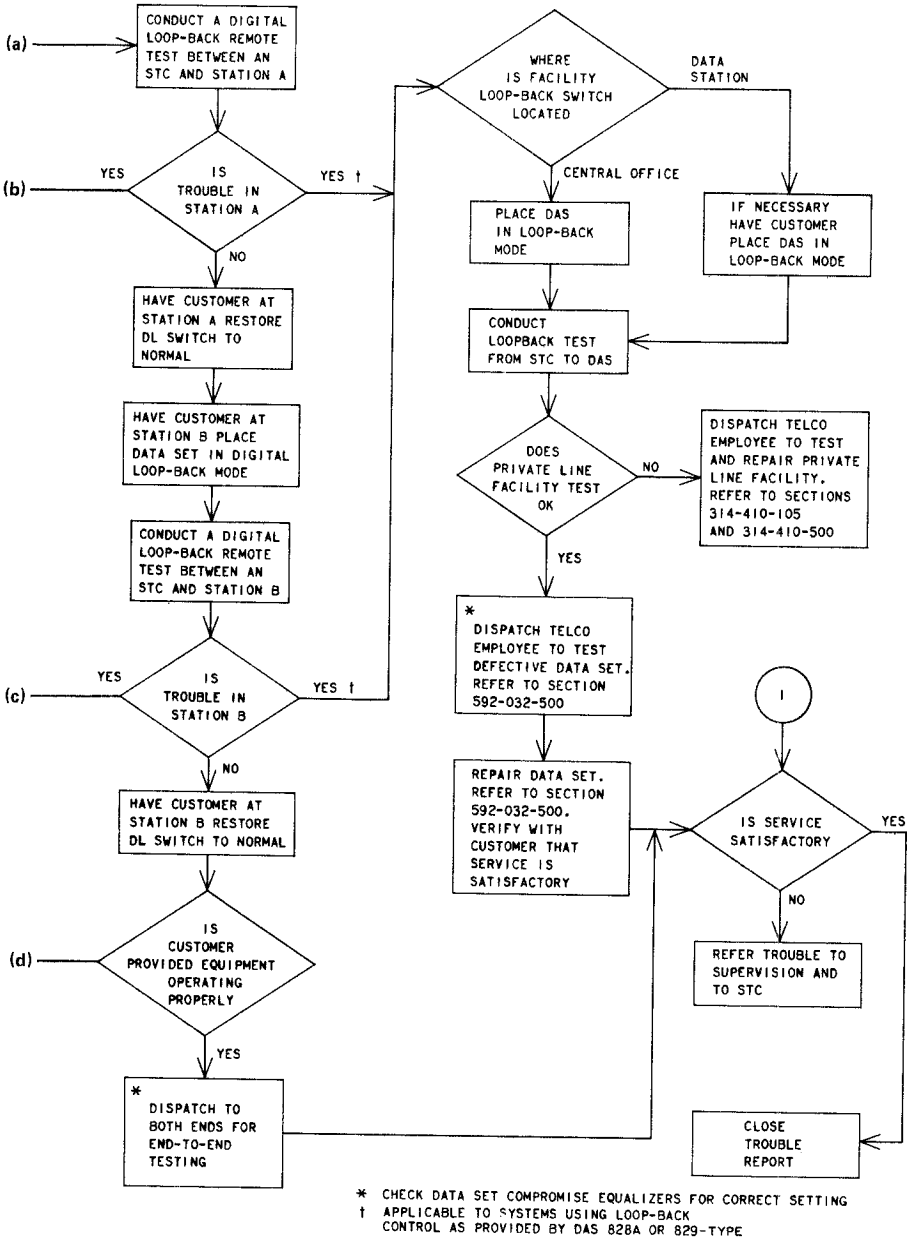


Fig. 2—Point-to-Point Maintenance Flowchart (Sheet 2 of 2)

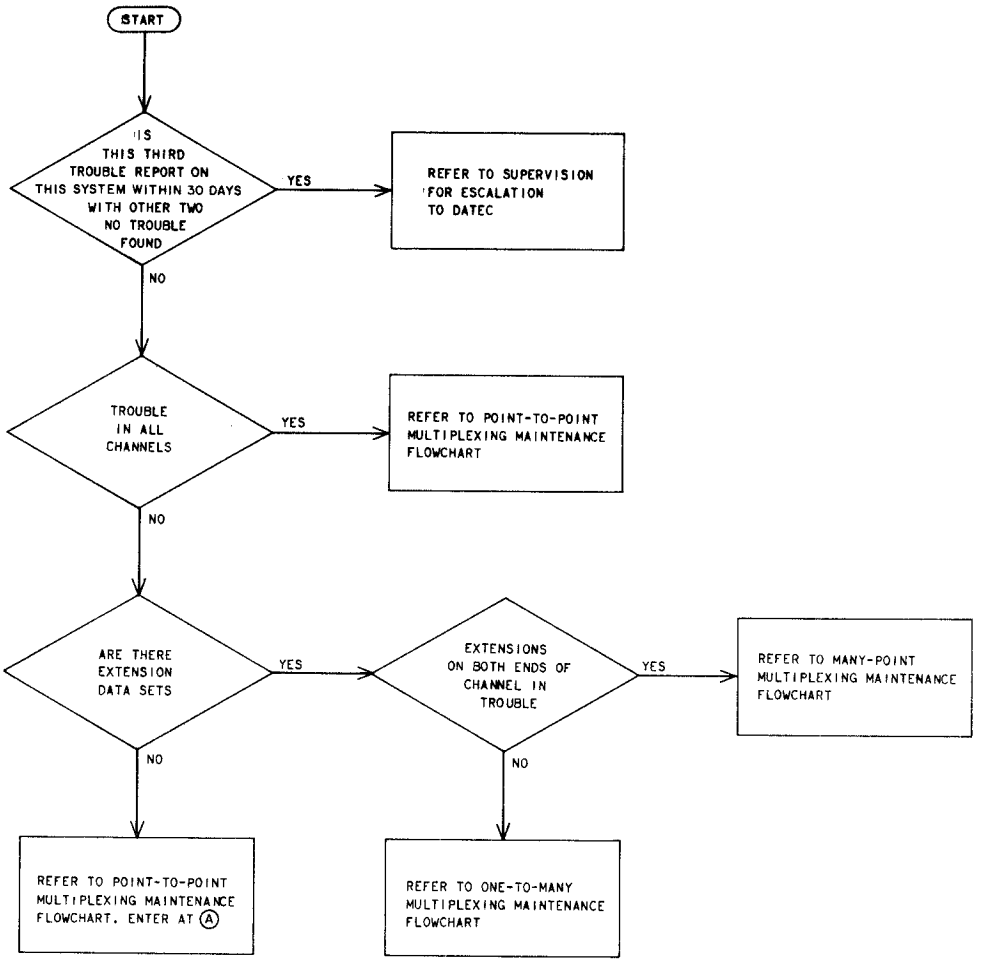


Fig. 3—Maintenance Control Flowchart for Multiplex Systems

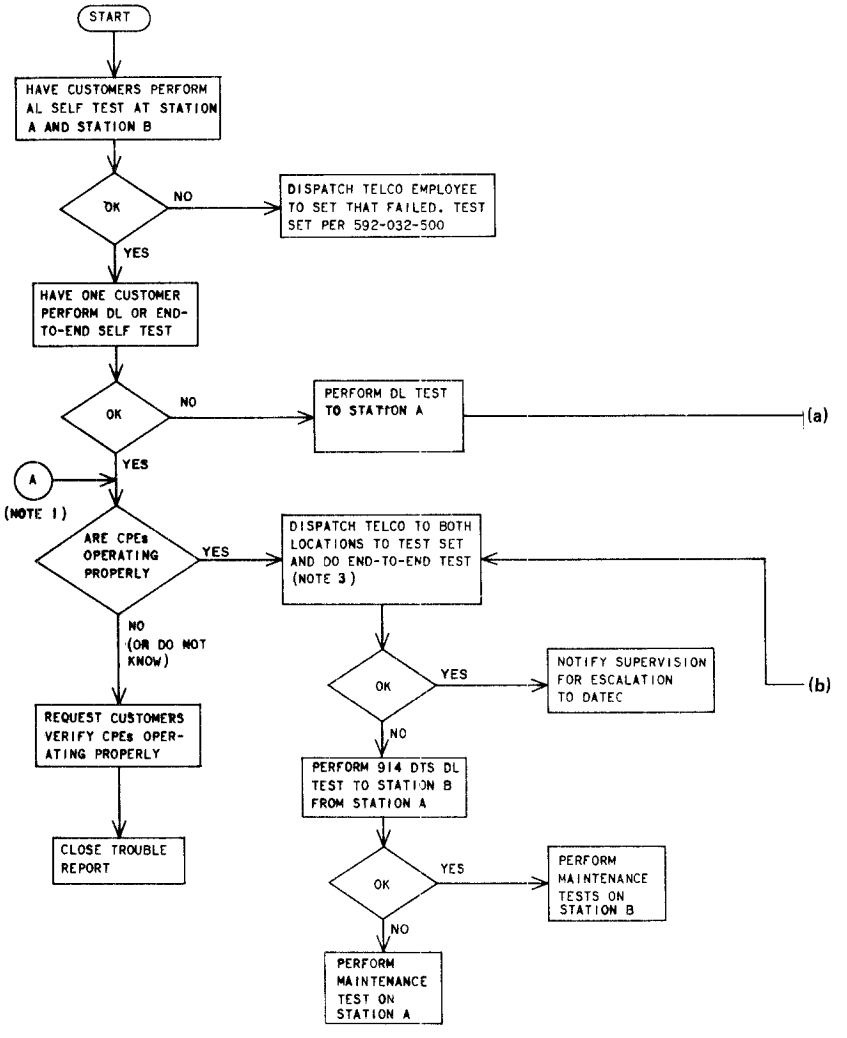


Fig. 4—Point-to-Point Multiplex Maintenance Flowchart (Sheet 1 of 2)

NOTES:
1. IF TROUBLE COMMON TO ALL CHANNELS, BEGIN AT START. IF TROUBLE APPEARS ON ONLY ONE CHANNEL, BEGIN AT (A).
2. APPLICABLE TO SYSTEMS USING LOOPBACK CONTROL AS PROVIDED BY DAS 828 OR 829-TYPE.
3. TEST EACH PORT INDEPENDENTLY USING RANDOM DATA.

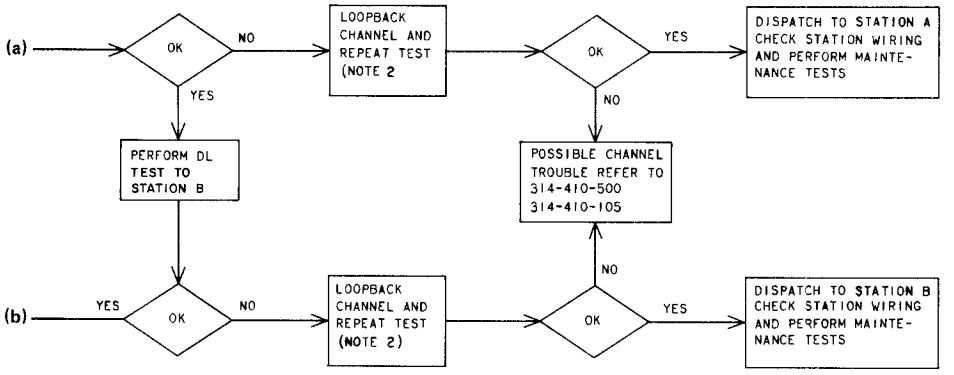
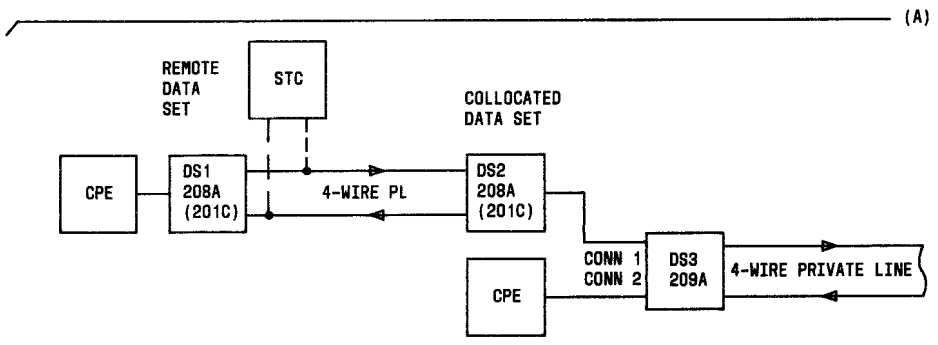


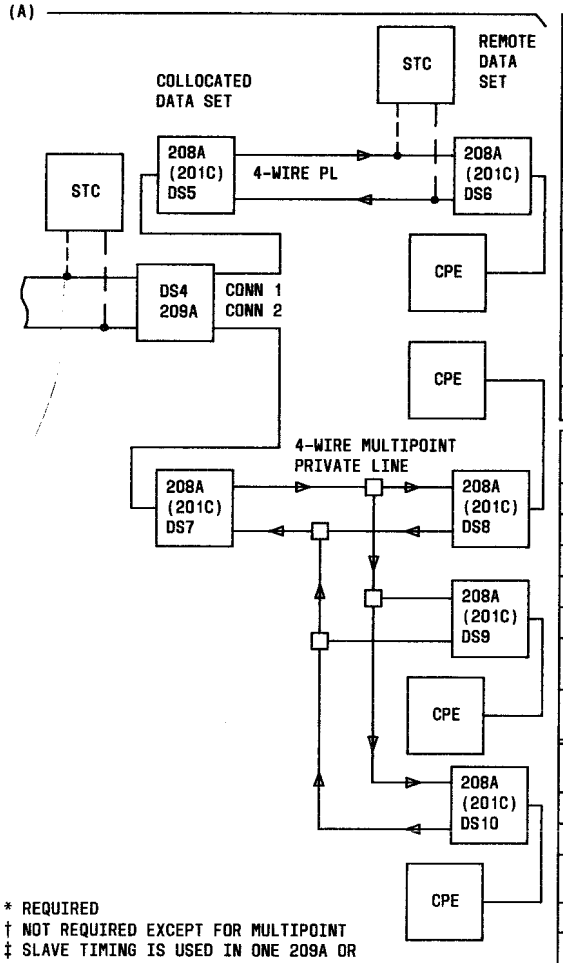
Fig. 4—Point-to-Point Multiplex Maintenance Flowchart (Sheet 2 of 2)



(REMOTE) SELECT	DATA SET 208A OPTIONS ON PT-TO-PT EXTENSION CHANNEL	(COLLOCATED) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
CONTINUOUS	CARRIER CONTROL	SWITCHED *
0 OR 8 MS PER CPE	REQUEST-TO-SEND OPERATION	SWITCHED *
IN	1-SECOND HOLDOVER	IN
NOT USED *	NEW SYNC	NOT USED *
CC ON OR CC OFF PER CPE	DATA SET READY CONDITION IN AL TEST MODE	CC OFF IN AL TEST MODE *
PER CPE OR LOCAL PRACTICE	GROUNDING	AA CONNECTED TO AB *
(REMOTE) SELECT	DATA SET 201C OPTIONS ON PT-TO-PT EXTENSION CHANNEL	(COLLOCATED) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
CONTINUOUS	CARRIER CONTROL	SWITCHED *
0 OR 7 MS PER CPE	REQUEST-TO-SEND/CLEAR-TO-SEND DELAY	7 MS *
NOT USED *	NEW SYNC	NOT USED *
PER CPE OR LOCAL PRACTICE	GROUNDING	AA CONNECTED TO AB *

* REQUIRED

Fig. 5—Typical Options, Many-Point Multiplex System (Sheet 1 of 2)

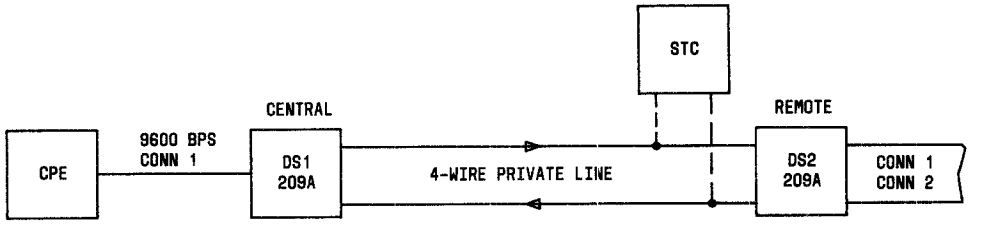


* REQUIRED
† NOT REQUIRED EXCEPT FOR MULTIPOINT
‡ SLAVE TIMING IS USED IN ONE 209A OR THE OTHER, BUT NOT BOTH.

ANY BUT 96 (48/4/ FOR EXAMPLE SHOWN)	MULTIPLEX OPTION	ANY BUT 96 (48/48 FOR EXAMPLE SHOWN)
INTERNAL *	TRANSMIITER TIMING	INTERNAL *
CONTINUOUS *	CARRIER CONTROL	CONTINUOUS *
CONTINUOUS †	REQUEST-TO-SEND CONTROL	CONTINUOUS †
1 IN 2-4 OUT (FOR EXAMPLE SHOWN)	ELASTIC STORES *	1 & 2 IN 3 & 4 OUT (FOR EXAMPLE SHOWN)
OUT IN	SLAVED TIMING‡ *	IN OUT
PER CPE AT POLLING CENTRAL (FOR EXAMPLE SHOWN)	DATA SET READY CONDITION IN AL TEST MODE	CC OFF IN AL TEST MODE *
AA CONNECTED TO AB *	GROUNDING	AA CONNECTED TO AB *
IN	1-SECOND HOLDOVER	IN

(COLLOCATED) SELECT	DATA SET 208A OPTIONS ON MULTIPOINT EXTENSION CHANNEL	(REMOTE) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
SWITCHED *	CARRIER CONTROL	SWITCHED *
SWITCHED *	REQUEST-TO-SEND OPERATION	SWITCHED *
OUT *	1-SECOND HOLDOVER	IN *
NOT USED *	NEW SYNC	NOT USED *
CC OFF IN AL TEST MODE *	DATA SET READY (CC) CONDITION IN AL TEST MODE	CC ON OR CC OFF PER CPE
AA CONNECTED TO AB *	GROUNDING	PER CPE OR LOCAL PRACTICE
(COLLOCATED) SELECT	DATA SET 201C OPTIONS ON MULTIPOINT EXTENSION CHANNEL	(REMOTE) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
SWITCHED *	CARRIER CONTROL	SWITCHED *
7 MS *	REQUEST-TO-SEND/CLEAR-TO-SEND DELAY	7 MS *
NOT USED *	NEW SYNC	NOT USED *
AA CONNECTED TO AB *	GROUNDING	PER CPE OR LOCAL PRACTICE

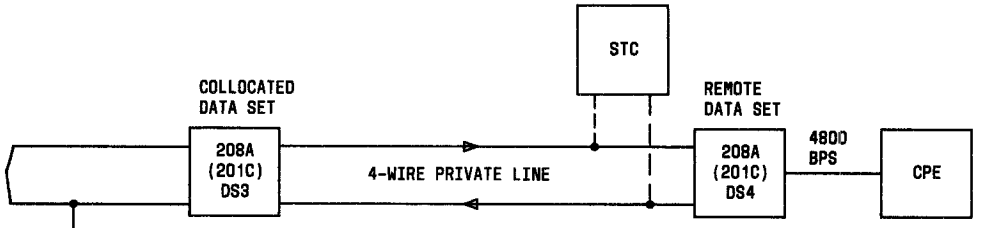
Fig. 5—Typical Options, Many-Point Multiplex System (Sheet 2 of 2)



(CENTRAL) SELECT	DATA SET 209A OPTIONS	(REMOTE) SELECT
96 *	MULTIPLEX OPTION	ANY MULTIPLEX OPTION
INTERNAL *	TRANSMITTER TIMING	INTERNAL *
CONTINUOUS	CARRIER CONTROL	CONTINUOUS *
PER CPE	REQUEST-TO-SEND CONTROL	CONTINUOUS WITH EXTENSION CHANNEL (CONT OR SWITCHED W/O EXTENSION CHANNEL)
ALL OUT *	ELASTIC STORES	1 IN * 2-4 OUT * (FOR EXAMPLE SHOWN)
OUT	SLAVED TIMING † ‡	IN (WITH EXTENSION CHANNEL) OUT (WITHOUT EXTENSION CHANNEL)
PER CPE	DATA SET READY CONDITION IN AL TEST MODE	CC OFF IN AL TEST MODE
PER CPE OR LOCAL PRACTICE	GROUNDING	AA CONNECTED TO AB * (ONLY IF USED WITH EXTENSION)
IN	1-SECOND HOLDOVER	IN

* REQUIRED
† REQUIRED WHEN AT LEAST ONE EXTENSION IS USED
‡ SLAVE TIMING IS USED IN ONE 209A OR THE OTHER, BUT NOT BOTH

Fig. 6—Typical Options, One-to-Many Multiplex System (Sheet 1 of 2)



WHEN AN EXTENSION CHANNEL IS USED, OPTIONS MUST BE SELECTED IN THE COLLOCATED AND REMOTE DATA SETS (EITHER 208A OR 201C).

(COLLOCATED) SELECT	DATA SET 208A OPTIONS ON PT-TO-PT EXTENSION CHANNEL	(REMOTE) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
SWITCHED *	CARRIER CONTROL	CONTINUOUS
SWITCHED *	REQUEST-TO-SEND OPERATION	0 OR 8 MS PER CPE
IN	1-SECOND HOLDOVER	IN
NOT USED *	NEW SYNC	NOT USED *
CC OFF IN AL TEST MODE *	DATA SET READY (CC) CONDITION IN AL TEST MODE	CC ON OR CC OFF PER CPE
AA CONNECTED TO AB *	GROUNDING	PER CPE OR LOCAL PRACTICE
(COLLOCATED) SELECT	DATA SET 201C OPTIONS ON PT-TO-PT EXTENSION CHANNEL	(REMOTE) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
SWITCHED *	CARRIER CONTROL	CONTINUOUS
7 MS *	REQUEST-TO-SEND/CLEAR-TO-SEND DELAY	0 OR 7 MS PER CPE
NOT USED *	NEW SYNC	NOT USED *
AA CONNECTED TO AB *	GROUNDING	PER CPE OR LOCAL PRACTICE

* REQUIRED

Fig. 6—Typical Options, One-to-Many Multiplex System (Sheet 2 of 2)

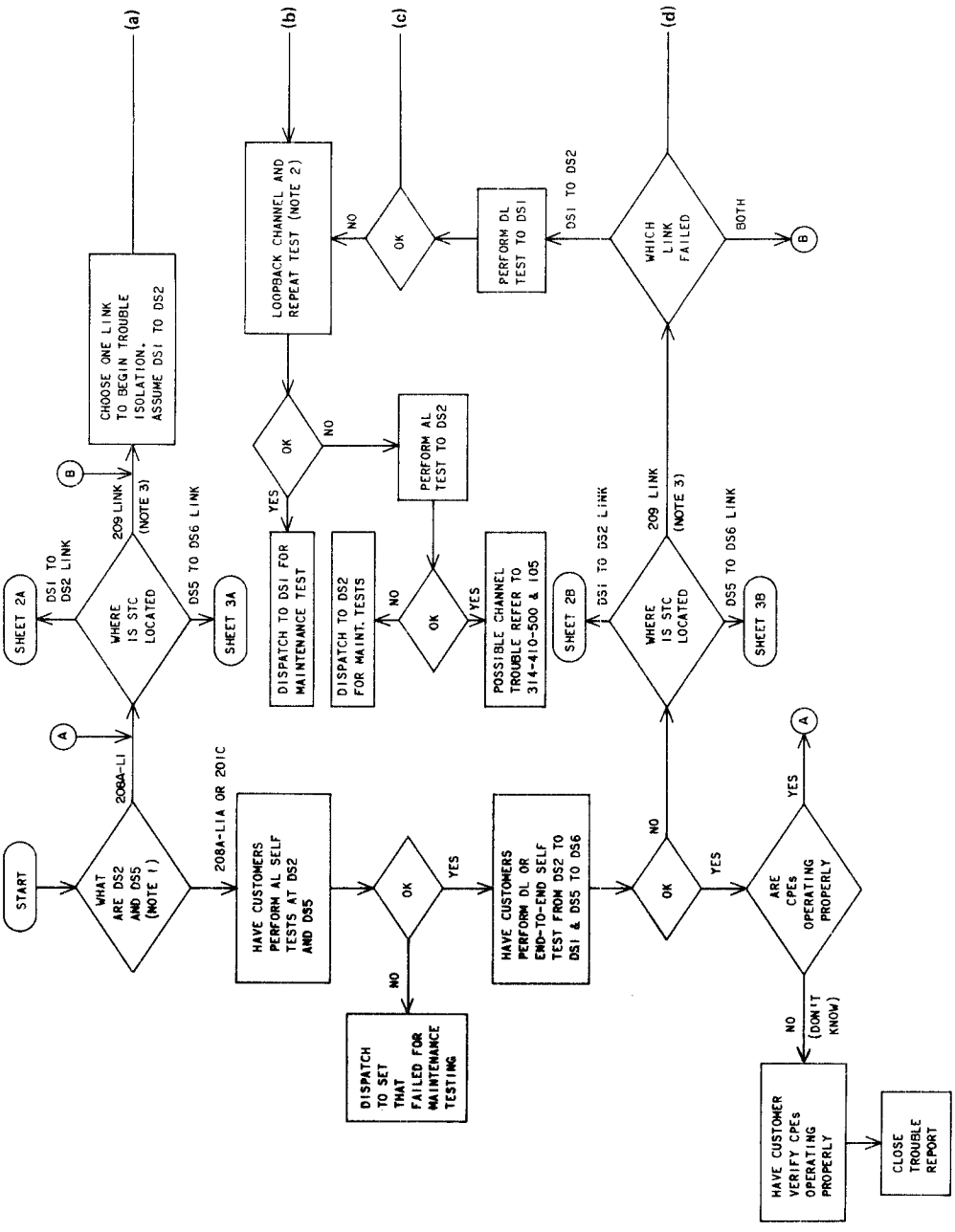


Fig. 7 — Many-Point Multiplex System Maintenance Flowchart (Sheet 1 of 3)

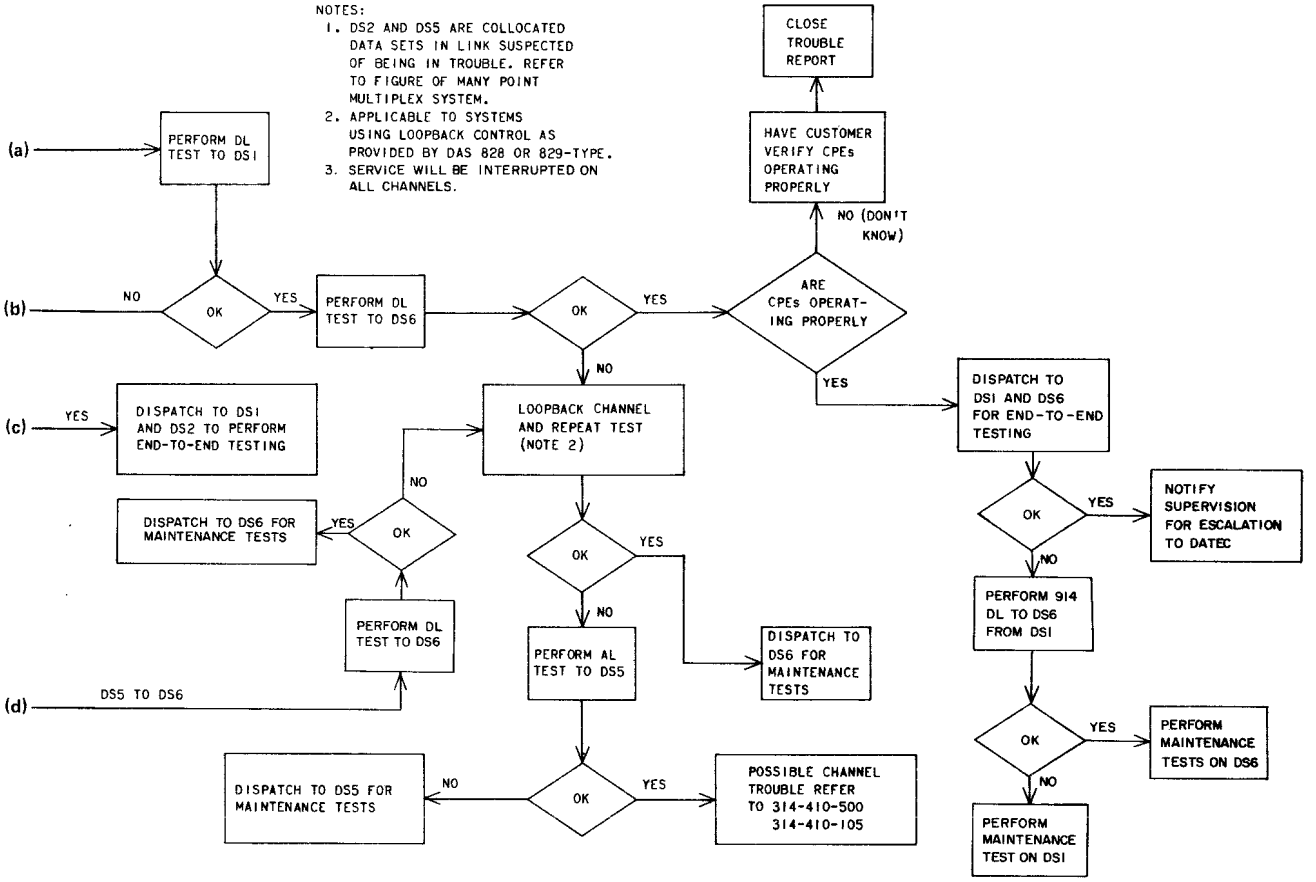


Fig. 7— Many-Point Multiplex System Maintenance Flowchart (Sheet 1.1 of 3)

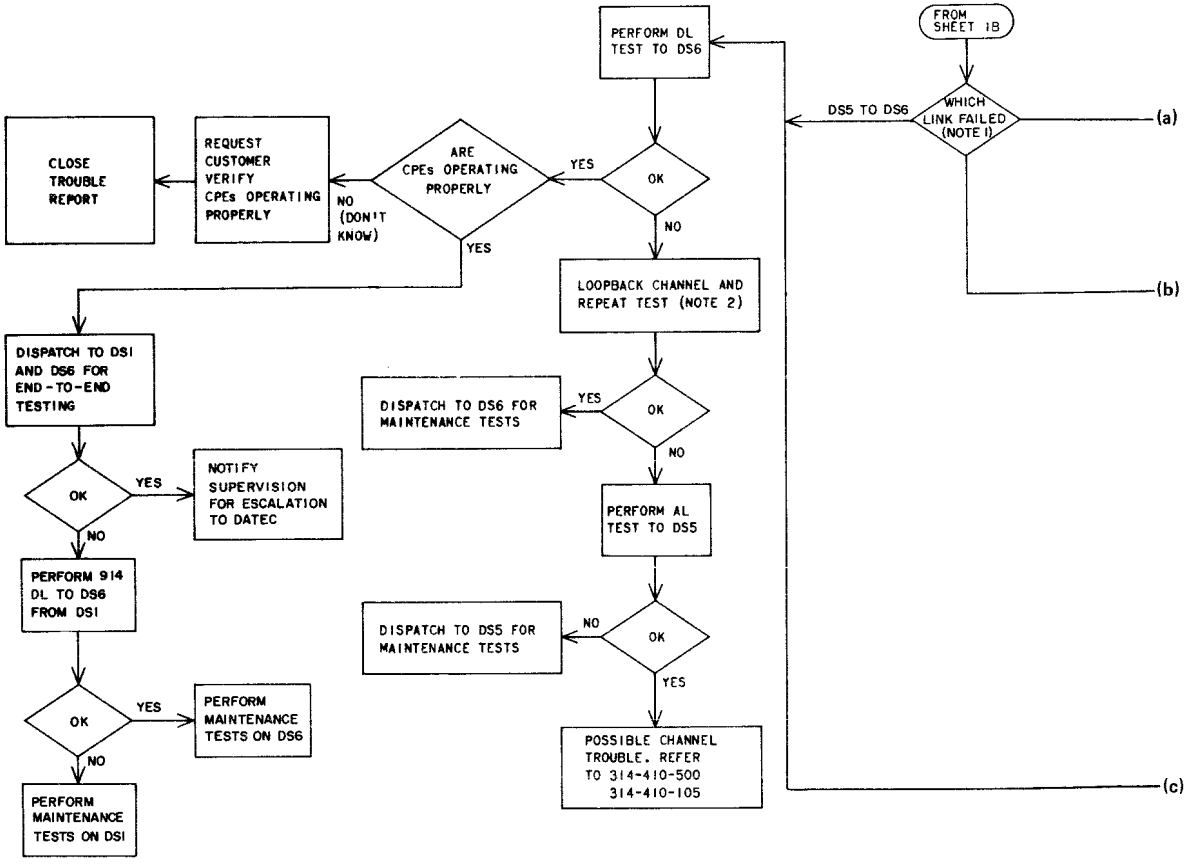


Fig. 7—Many-Point Multiplex System Maintenance Flowchart (Sheet 2 of 3)

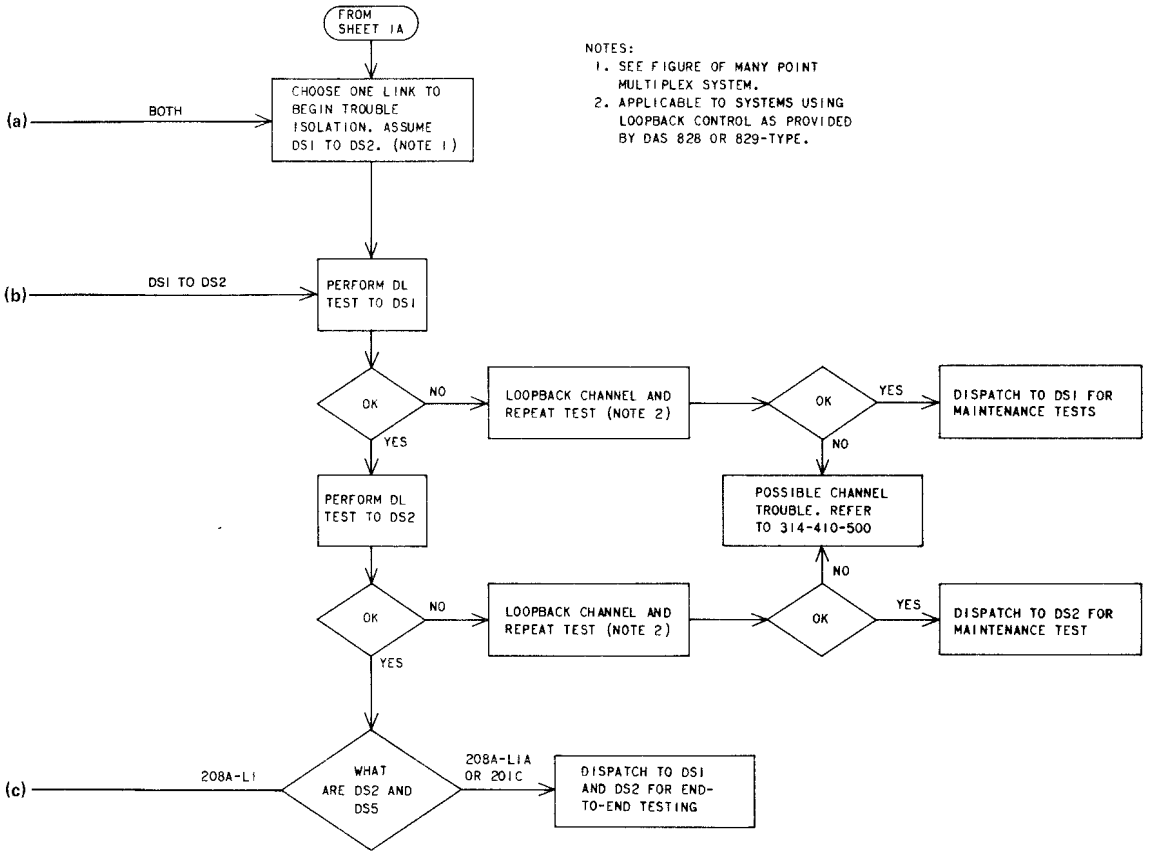


Fig. 7—Many-Point Multiplex System Maintenance Flowchart (Sheet 2.1 of 3)

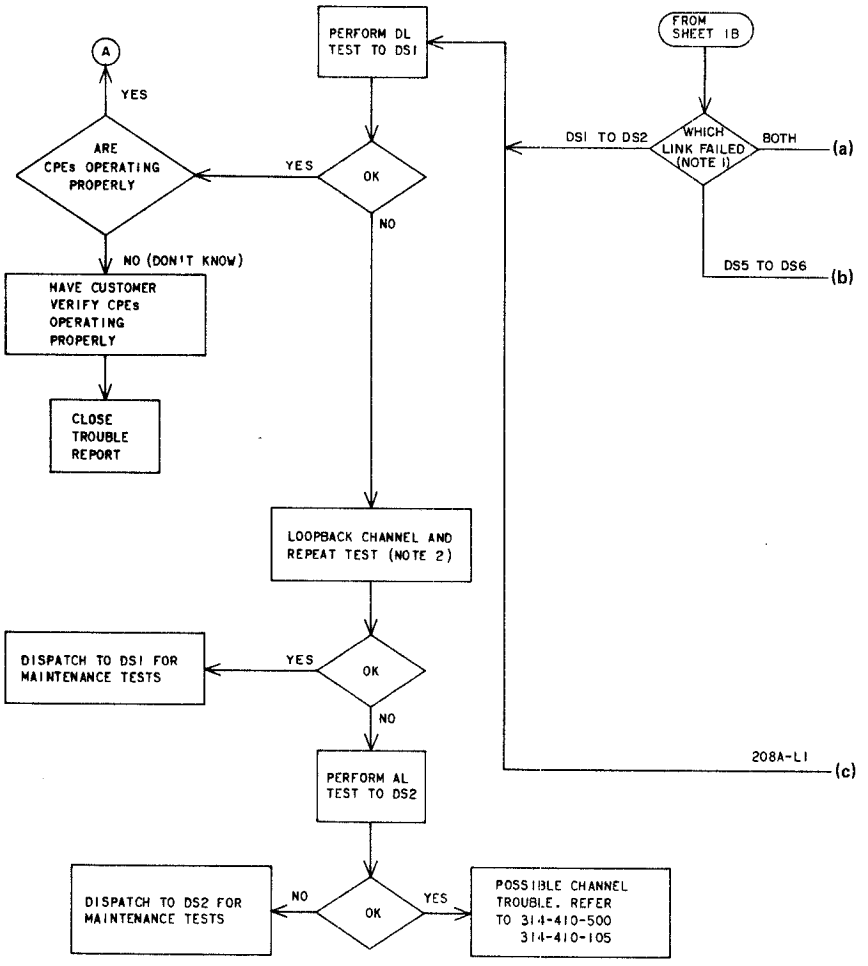


Fig. 7—Many-Point Multiplex System Maintenance Flowchart (Sheet 3 of 3)

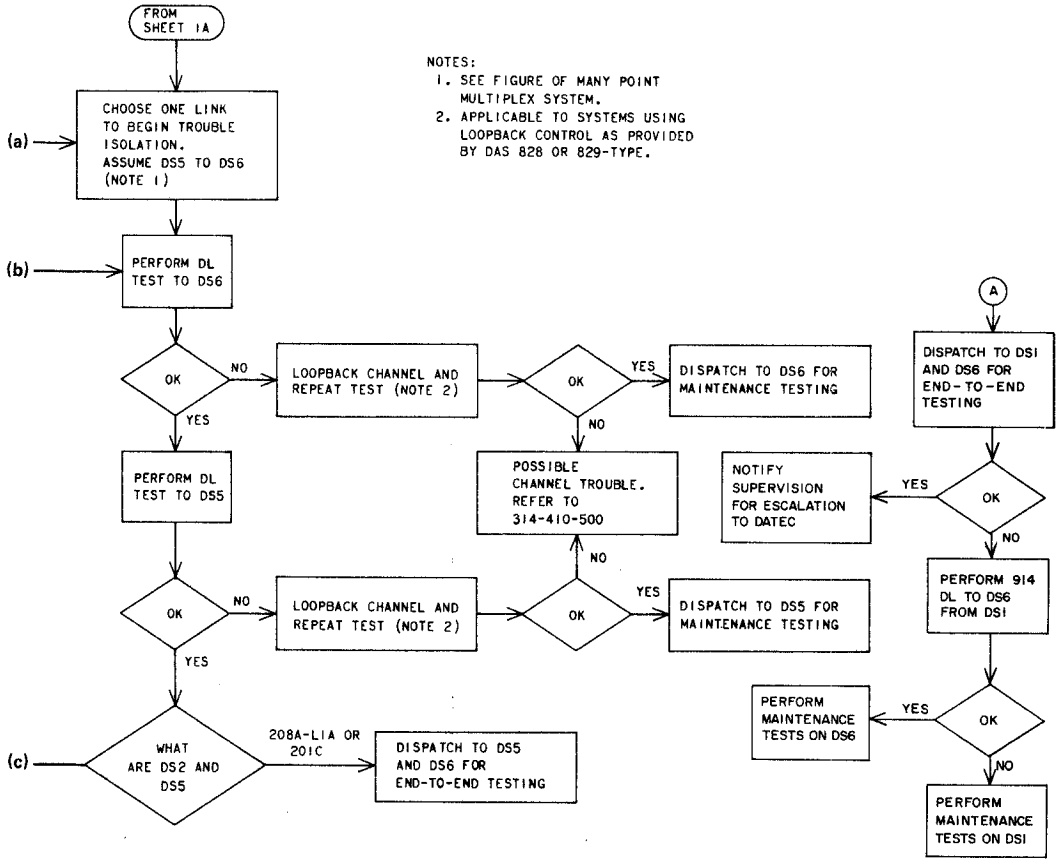


Fig. 7—Many-Point Multiplex System Maintenance Flowchart (Sheet 3.1 of 3)

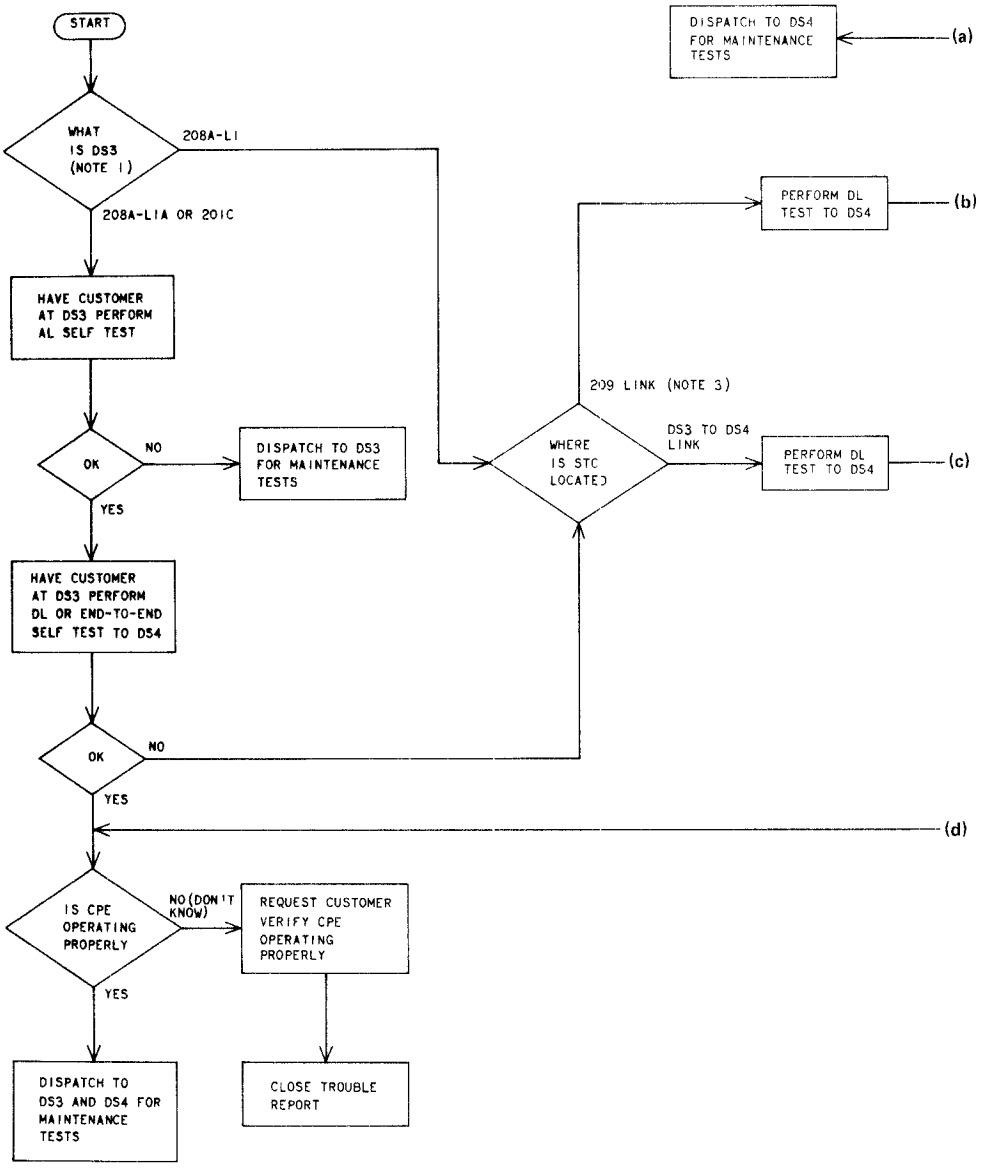
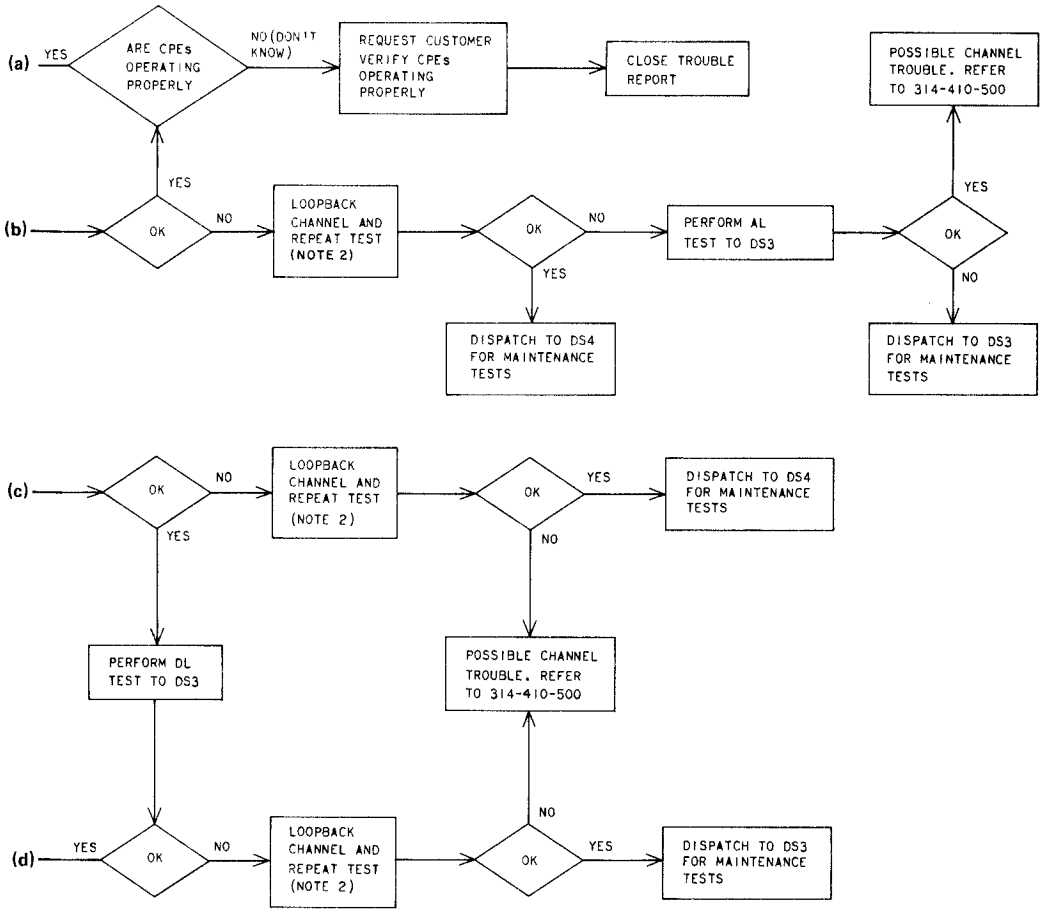


Fig. 8— One-to-Many Multiplex System Maintenance Flowchart (Sheet 1 of 2)



NOTES:
1. REFER TO FIGURE OF ONE-TO-MANY MULTIPLEX SYSTEM FOR LOCATION OF DS3
2. APPLICABLE TO SYSTEMS USING LOOPBACK CONTROL AS PROVIDED BY DAS 828 OR 829
3. SERVICE WILL BE INTERRUPTED ON ALL CHANNELS

Fig. 8—One-to-Many Multiplex System Maintenance Flowchart (Sheet 2 of 2)