

**DATA SYSTEMS—9600 BITS-PER-SECOND
MULTIPLEX SYSTEM USING DATA SET 209A-L1
MAINTENANCE**

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1. GENERAL

1.01 This section provides maintenance procedures to be used when isolating trouble reported on a 9600 bits-per-second (bps) multiplex system. It is intended to coordinate the efforts of the craft employee with those of the serving test center (STC).

1.02 Data sets 209A-L1, 208A-L1A, and 201C contain self-test and remote-test features which will aid in locating the source of trouble. However, many of the normal test features are disabled when these data sets are used in extended multiplex service. Fig. 1 shows permissible loop-back tests which can be made without disconnecting data set cords or changing data set options.

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

1.03 Refer to Part 3 for Bell System Practices which contain information on maintenance

and testing for data sets 201C, 208A-type, and 209A-L1.

2. TROUBLE VERIFICATION PROCEDURES

A. Point-to-Point Multiplexing

2.01 When investigating a trouble report on a point-to-point multiplex system, refer to Fig. 2 and 3. Test procedures to be used at the STC are contained in Trial Instruction 405.

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

2.02 A typical many-point multiplex system is shown in Fig. 4. A typical one-to-many multiplex system is shown in Fig. 5. The trouble investigation procedures for these systems are shown in Fig. 2, 6, and 7.

2.03 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 data set 209A-L1 link.

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

(c) Analog loop-back self test cannot be performed at a remote extension (DS1 and DS6 in Fig. 4, DS4 in Fig. 5) with options as installed. If the internal timing option is temporarily

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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. 3) with options as installed. If the internal timing option is temporarily installed at the remote extension, this test can be performed.

2.04 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 data set 208A-type or 209A-L1
- Spare data set 201C
- 914C data test set (DTS) or
- 914B and 903-type DTS

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

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

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.

Data Set 209A with Collocated 201C/208A

3.02 Tests from 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 M8M cord is disconnected from the data set 209A and external test equipment is connected to data set 209A, 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) data set 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 (for example, between DS3 and DS5 of Fig. 4).
- (6) Perform digital loop-back test using external test equipment to distant remote extension 201C/208A (for example, between DS3 and DS6 of Fig. 4).

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

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

- (1) Perform analog loop-back self test.
- (2) Disconnect M8M cord from collocated 201C/208A.
- (3) Connect external test equipment (914C DTS or 914B/903 DTS).

Note: Whenever M8M cord is disconnected from data sets 201C/208A 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.

Data Set 209A Without Collocated 201C/208A

3.04 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 data set 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 (for example, between DS1 and DS3 of Fig. 5).
- (5) Perform digital loop-back test using external test equipment to distant remote extension (for example, between DS1 and DS4 of Fig. 5).

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

3.05 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 (for example, between DS1 and DS6 of Fig. 4).

Note: The M23B cord must be connected to both the local data set and the distant remote extension.

- (3) Perform an analog loop-back test using external test equipment to far-end collocated data sets (for example, between DS1 and DS5 in Fig. 4).

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

4. REFERENCES

4.01 The following BSPs provide information concerning the data sets used in multiplex systems.

SECTION	TITLE
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 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

SECTION 592-032-301

SECTION	TITLE
666-511-501	Test of Services Provided By Data Set 201C From a Private Line Test Room

Data Set 209A-L1 Point-to-Point

592-032-100	Description and Operation
592-032-200	Installation
592-032-300	Maintenance
592-032-500	Test Procedures
TI-388	Test of Point-to-Point Services Provided By Data Set 209A-L1 From a Private Line Data Test Room

SECTION	TITLE
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Data Set 209A-L1 Multiplex

592-032-101	Description and Operation
592-032-201	Installation and Connections
592-032-501	Tests
TI-405	Test of 9600 Bits-Per-Second Multiplex System From a Private Line Test Room

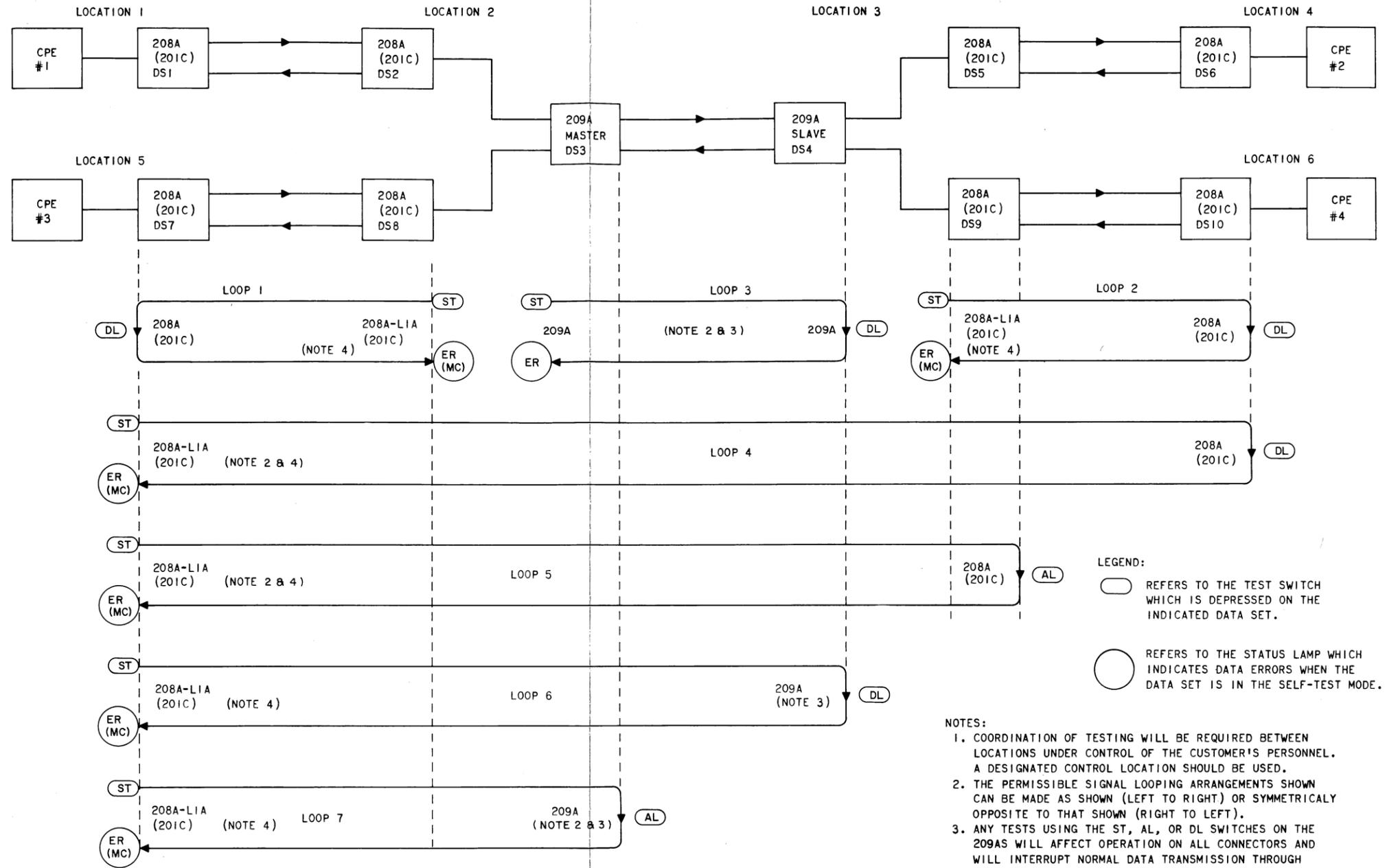


Fig. 1—Permissible Signal Loops When Testing From the Data Set Location

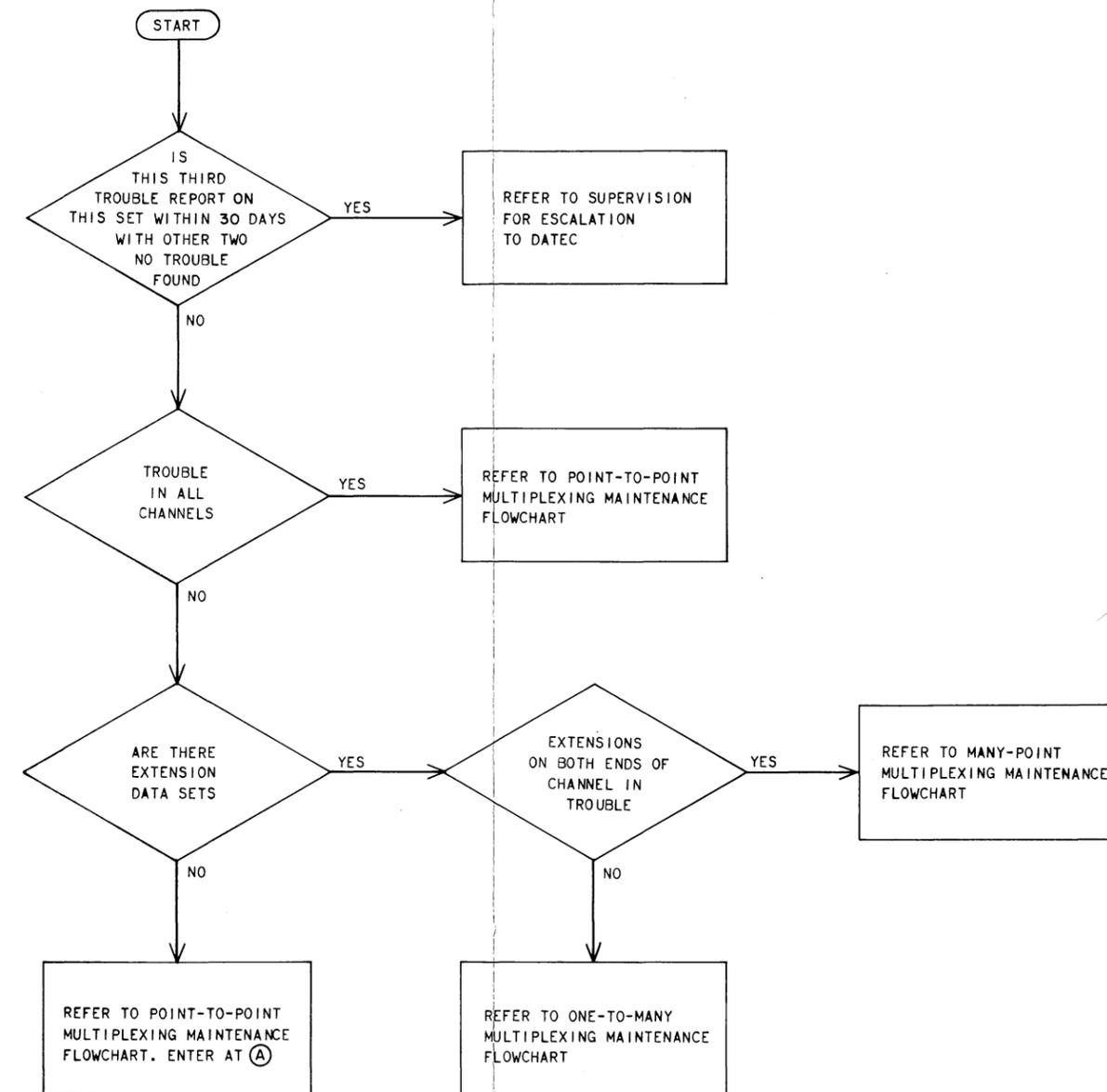


Fig. 2—Maintenance Control Flowchart

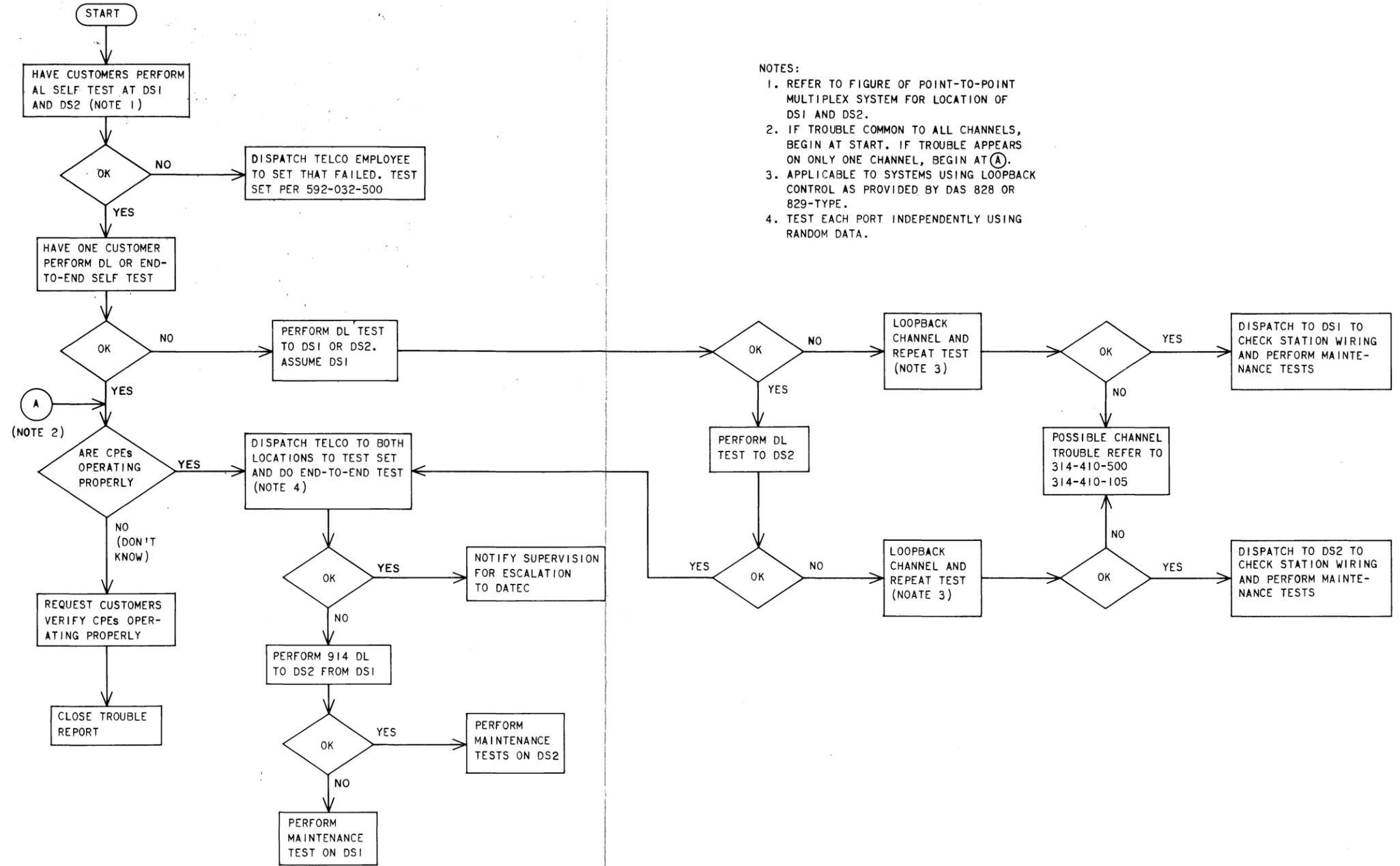
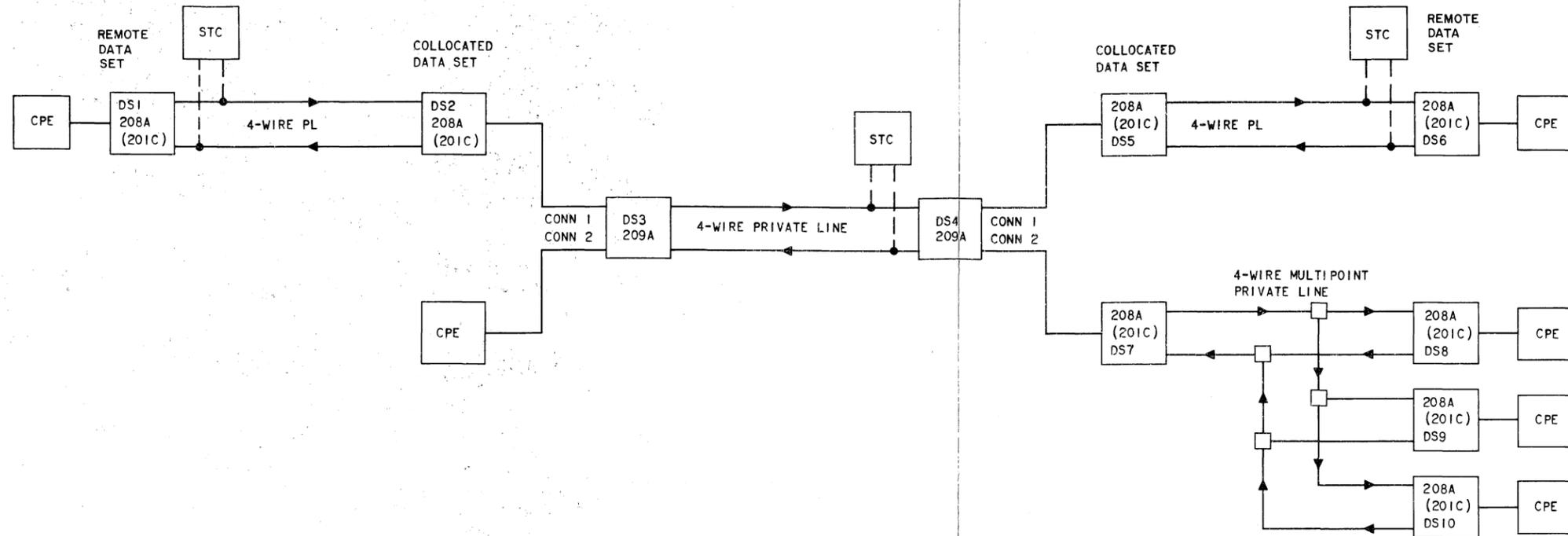


Fig. 3—Point-to-Point Multiplex Maintenance Flowchart



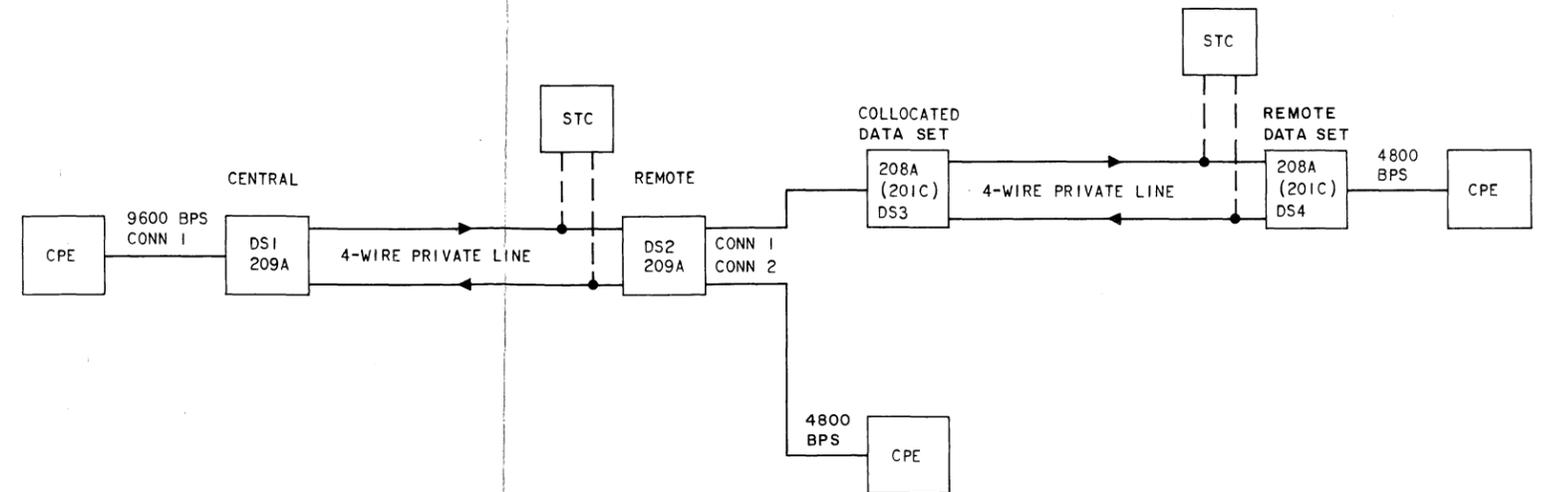
(REMOTE) SELECT	DATA SET 208A OPTIONS ON PT-TO-PT EXTENSION CHANNEL	(COLLOCATED) SELECT
EXTERNAL *	TRANSMISSION TIMING	EXTERNAL *
CONTINUOUS	CARRIER CONTROL	SWITCHED *
0 OR 8 MS PER CPE	REQUEST TO SEND OPERATION	NOT APPLICABLE
IN	1-SECOND HOLDOVER	IN
NOT USED *	NEW SYNC	NOT USED *
CC ON OR CC OFF PER 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 *

SELECT	DATA SET 209A OPTIONS	SELECT
ANY BUT 96 (48/48 FOR EXAMPLE SHOWN)	MULTIPLEX OPTION	ANY BUT 96 (48/48 FOR EXAMPLE SHOWN)
INTERNAL *	TRANSMITTER 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

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

(COLLOCATED) SELECT	DATA SET 208A OPTIONS ON MULTIPOINT EXTENSION CHANNEL	(REMOTE) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
SWITCHED *	CARRIER CONTROL	SWITCHED *
NOT APPLICABLE	REQUEST TO SEND OPERATION	NOT APPLICABLE
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. 4—Many-Point Multiplex System



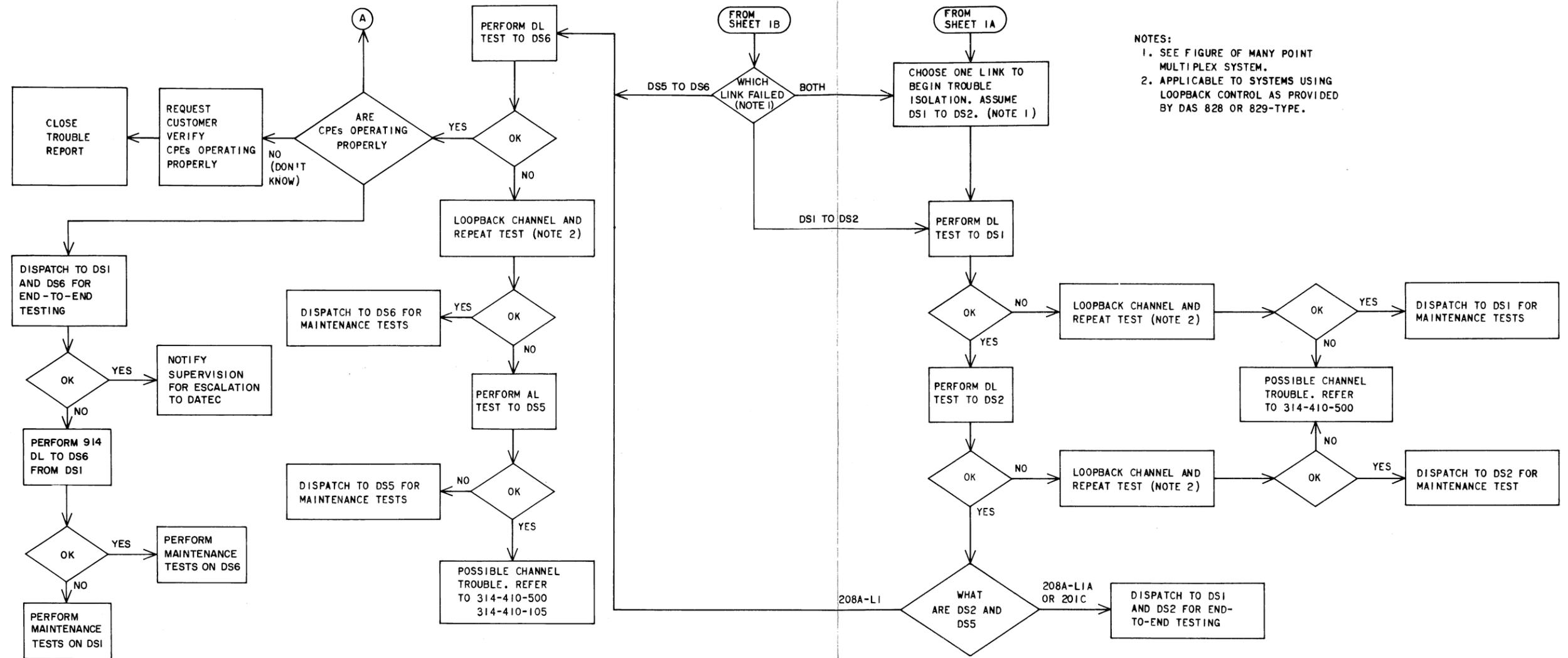
(CENTRAL) SELECT	DATA SET 209A OPTIONS	(REMOTE) SELECT
96 *	MULTIPLEX OPTION	ANY MULTIPLEX OPTION
INTERNAL *	TRANSMITTER TIMING	INTERNAL *
CONTINUOUS	CARRIER CONTROL	CONTINUOUS *
PER CPE	REQUEST TO SEND CONTROL	CONTINUOUS WITH EXTEN CHANNEL (CONT OR SWITCHED W/O EXTEN CHANNEL)
ALL OUT *	ELASTIC STORES	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 WHEN EXTENSION IS NOT USED	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

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

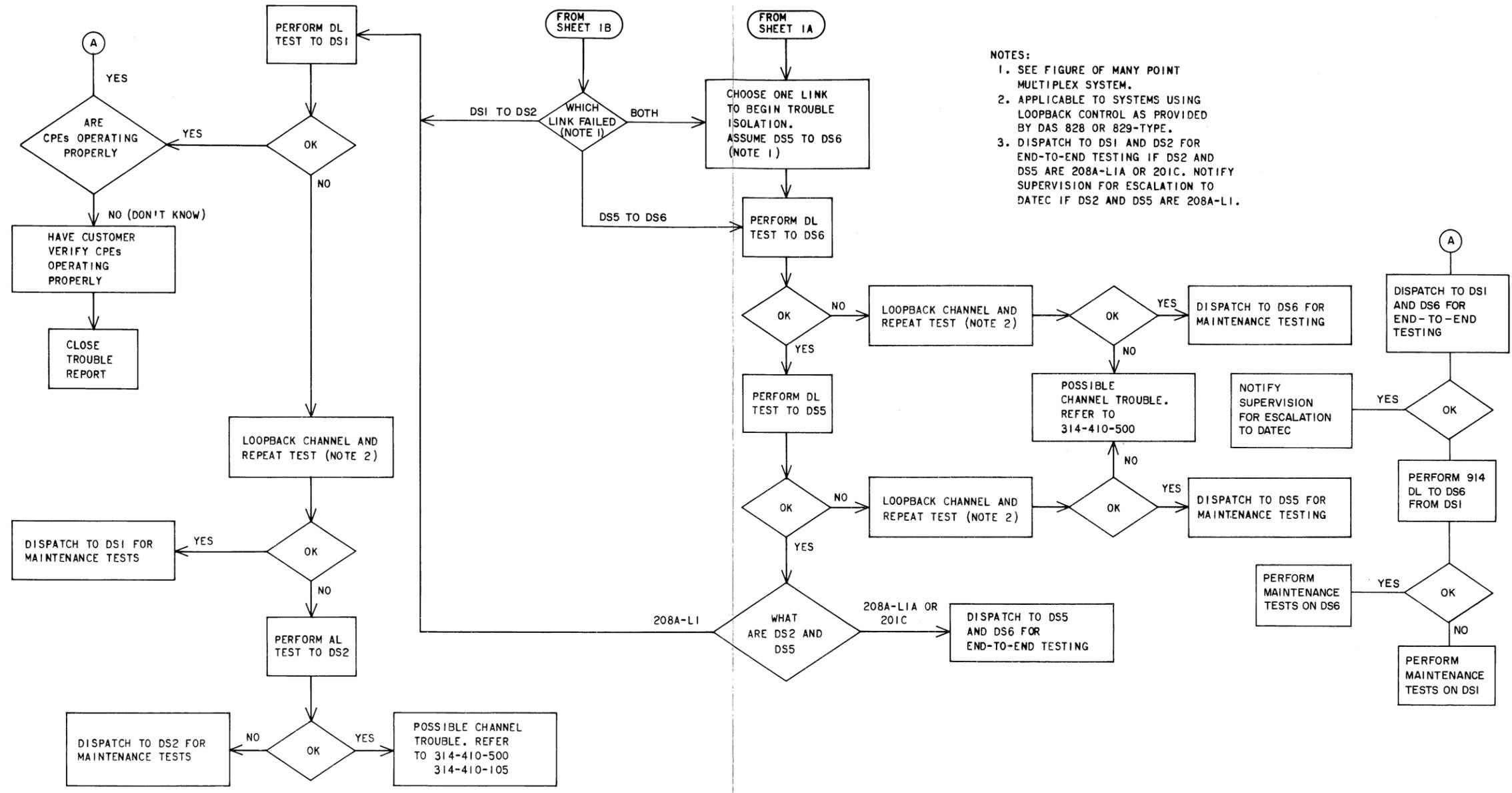
(COLLOCATED) SELECT	DATA SET 208A OPTIONS ON PT-TO-PT EXTENSION CHANNEL	(REMOTE) SELECT
EXTERNAL *	TRANSMITTER TIMING	EXTERNAL *
SWITCHED *	CARRIER CONTROL	CONTINUOUS
NOT APPLICABLE	REQUEST-TO-SEND OPERATION	0 OR 8 MS PER CPE
IN	1-SECOND HOLDOVER	IN
NOT USED *	NEW SYNC	NOT USED *
CC OFF IN AL TEST MODE *	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

Fig. 5—One-to-Many Multiplex System



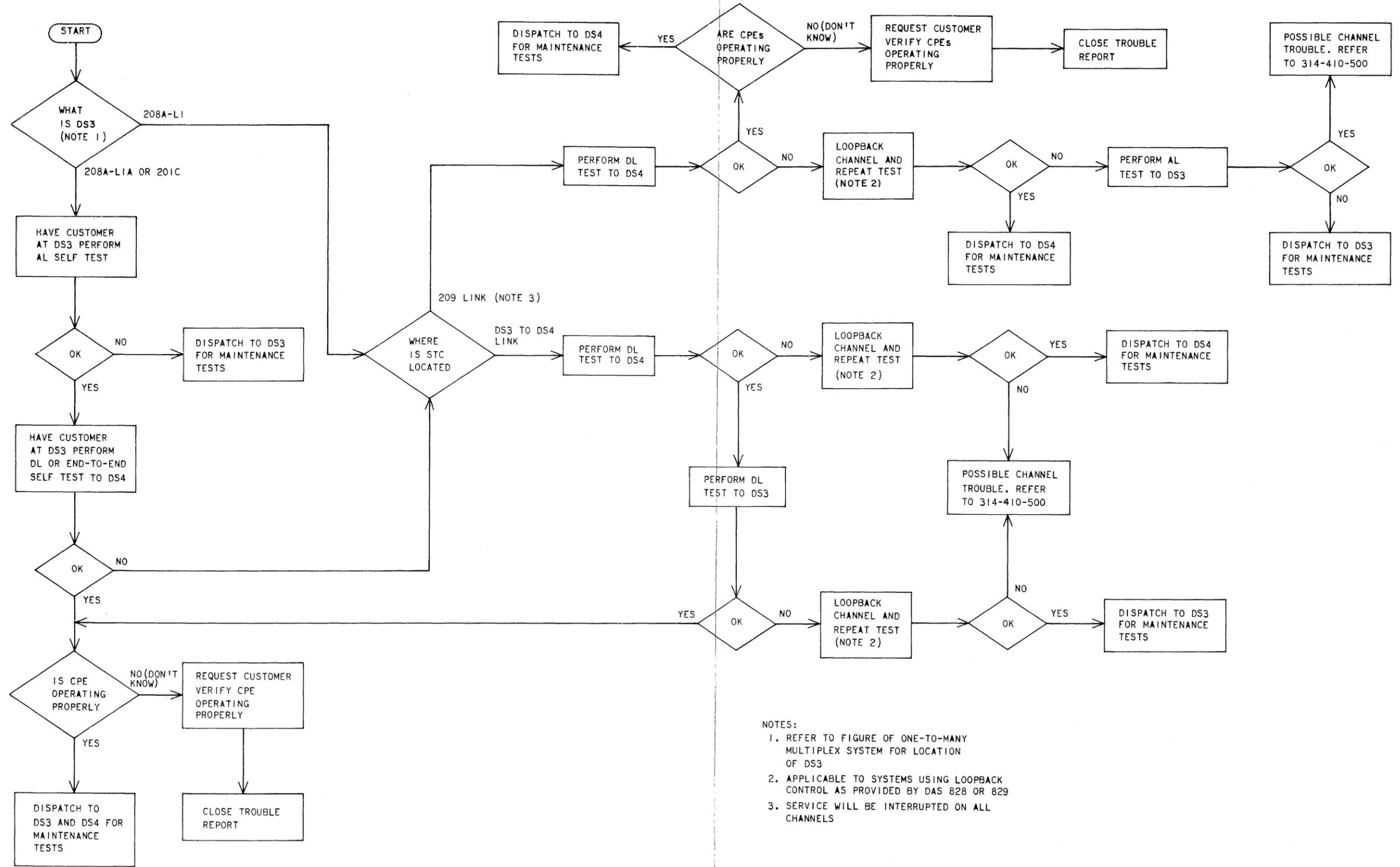
NOTES:
 1. SEE FIGURE OF MANY POINT MULTIPLEX SYSTEM.
 2. APPLICABLE TO SYSTEMS USING LOOPBACK CONTROL AS PROVIDED BY DAS 828 OR 829-TYPE.

Fig. 6—Many-Point Multiplex System, Maintenance Flowchart (Sheet 2 of 3)



NOTES:
 1. SEE FIGURE OF MANY POINT MULTIPLEX SYSTEM.
 2. APPLICABLE TO SYSTEMS USING LOOPBACK CONTROL AS PROVIDED BY DAS 828 OR 829-TYPE.
 3. DISPATCH TO DS1 AND DS2 FOR END-TO-END TESTING IF DS2 AND DS5 ARE 208A-LIA OR 201C. NOTIFY SUPERVISION FOR ESCALATION TO DATEC IF DS2 AND DS5 ARE 208A-LI.

Fig. 6—Many-Point Multiplex System, Maintenance Flowchart (Sheet 3 of 3)



- 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. 7—One-to-Many Multiplex System, Maintenance Flowchart