86A2 DATA SELECTIVE CALLING SERVICE
HALF-DUPLEX—150-WORD PER MINUTE DATA STATION
MAINTENANCE

CONTENTS PAGE

1. GENERAL

1.01 This section describes the maintenance procedures along with the disassembly and reassembly procedures for the half-duplex (HDX), 150-word per minute teletypewriter (TTY) data stations used in the 86A2 Data Selective Calling Service.

When maintenance or troubleshooting procedures make it necessary to remove and/or replace any part of the station (whether TTY, controller, circuit pack, etc), power must be removed from all station components to prevent damage to other components thereof.

1.02 This section is reissued to make reference to the 579 division Field Maintenance Practice (FMP), to include information for the data set 108E- and 109E-type, to update the flowchart of Fig. 5, and to add 8.03, 8.04, and Table B.

1.03 Routine maintenance of the 86A2 data stations is limited to the 37-type TTYs which are used as the station terminal equipment. The routine maintenance of the TTYs should be performed in accordance with the appropriate ▶574-3 and 579 division Bell System Practices.◀

1.04 There is no routine maintenance required for data sets 108A, ▶108E, 109A, and 109E◀ data auxiliary set (DAS) 820B6 (controller), or DAS 804R3 and 804R4 (attendant set). However, when stations are suspected of being in trouble, they should be tested as described in the section entitled 86A2 Data Selective Calling Service—Half-Duplex—150-Word Per Minute Data Station—Test Procedure (581-136-501).

1.05 When a data set 108A, ▶108E, 109A, or 109E◀ does not meet test requirements, it should be replaced in order to restore service to the customer as quickly as possible. Data set replacement and adjustment are covered in Parts 6, 7, and 8 of this section.

1.06 When the DAS 820B-type does not meet the test requirements, it should be determined which circuit pack (CP) in the controller is bad, and that CP should be replaced in order to restore the service to the customer as quickly as possible. The method of gaining access to the controller and the procedure for removing and replacing the CPs are described in Part 2 of this section.

1.07 When the data set, controller, or any CPs in the controller are replaced, the station should be tested in accordance with the section referenced in 1.04.

To prevent damage to CPs, disconnect power cord plug of all station TTYs from the customer power receptacle before connecting or disconnecting CPs, connectors, or options. If the wall receptacle is not readily accessible, power may be removed by disconnecting the power and M and N connectors from the DAS 820B6 controller.

1.08 Exercise care in handling and transporting data sets and data auxiliary sets. If possible, use original cartons to store, transport, or ship them.

1.09 If maintenance spares are stocked, verify that they are checked and ready for immediate installation.

When DAS 820B6 is replaced and/or AR272 CP is replaced, the replacing CP must be encoded as given in Part 3 of this section.

2. ACCESS TO DATA AUXILIARY SET 820B6 AND REMOVAL/REPLACEMENT OF CIRCUIT PACKS

37 ASR or RO TTY Controller Access

2.01 Access to the DAS 820B6 and data set 108A-, ▸108E-, 109A-, or 109E-type◂ is available by opening the door on the right-hand side of the TTY pedestal. Maintenance of the controller is performed with the controller on the floor in front of the TTY (Fig. 1). To place the controller in the maintenance position:

(1) Open door on front right-hand side of TTY pedestal.

(2) Loosen the ▸knurled knob fastener (note that the knurled knob, a Southco fastener, screws into the molley jack nut which is attached to the floor of the 37 TTY)◂ on the front of the 93A mounting bracket and slide the controller and 93A bracket forward and out of the TTY pedestal.

(3) Carefully set the controller and bracket on the floor in front of the TTY.

37 ROTR TTY Controller Access

2.02 The DAS 820B6 and DS 108A-, ▸108E-, 109A-, or 109E-type◂ are ***not*** mounted in the 37 ROTR TTY stand (due to space limitation) when a 37 ROTR TTY is used as a primary station. A KS-20018-L1, -L2, -L3, or -L4 cabinet is required. To gain access to the controller:

(1) Apply outward pressure at the top of the KS-20018-type cabinet panel until the catches disengage.

(2) Lift the panel up to remove it from the framework. The controller is mounted inside the KS-20018-type cabinet in a position that facilitates CP removal when this panel is removed.

Removal/Replacement of Circuit Packs

2.03 When access has been gained to the DAS 820B6 and the controller is in the maintenance position, the CPs can be removed as follows:

(1) Remove the lock strip (card-retaining) bar by loosening the two screws that hold it to the apparatus mounting and slide it out from beneath the screws.

(2) Place the pivots of the 748A tool or lock strip bar assembly (card extracting tool) against the faceplate of the CP to be removed and gently push in until the pivots engage the faceplate.

(3) Grasp handle of the 748A tool or lock strip bar and pull CP straight out.

2.04 Replace CPs in the DAS 820B6 as follows:

(1) Insert the CP into the proper slot on the controller and gently push in.

(2) Verify that the CP is properly seated in its connector.

(4) Remove the 748A tool from the CP faceplate by springing the bottom pivot down to disengage it from the CP faceplate. Disengage the top pivot by lifting up on the 748A tool.

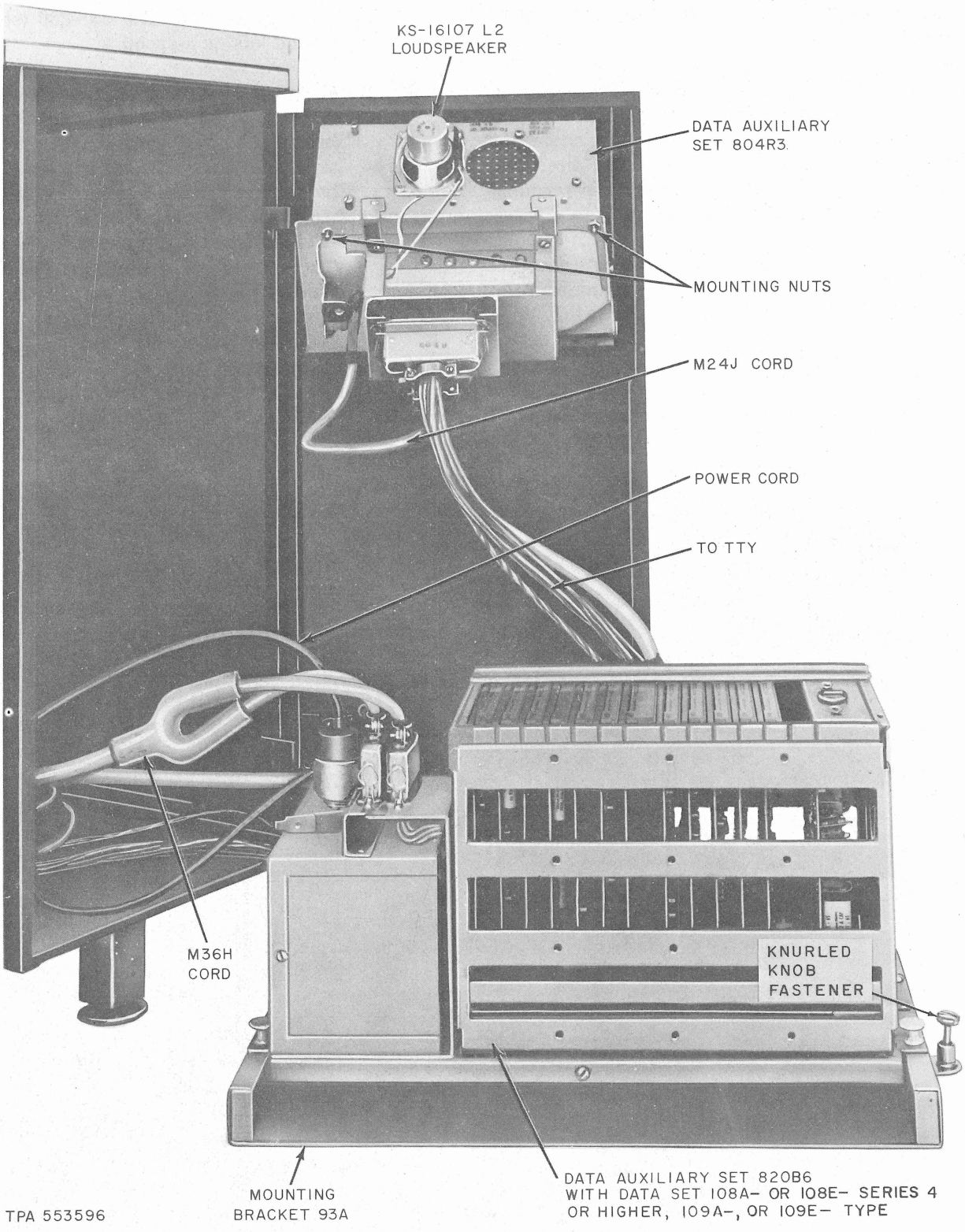

Fig. 1—DAS 820B6 Controller in the Maintenance Position

3. AR272 CIRCUIT PACK—ENCODING THE SHIFT REGISTER

3.01 The shift register of AR272 CP is encoded by connecting wires to a specific terminal on the CP, routing the wires through the eight tubes of the shift register (in a specified direction), and connecting them to another specific terminal on the same CP (see Fig. 2).

3.02 The wire required for encoding the shift register (AR272 CP) may be obtained from WE by ordering according to the following stock numbers:

WE piece part number 840-555-726 polyurethane-coated 36-gauge wire (shipped in 6-foot lengths) or RM 638-230 (shipped in 5-pound lots on a spool).

Extreme care must be exercised when threading the wires through the eight tubes. The wires should be relatively taut, but not to the point that sharp bends occur in the wires. Any excessive strain on the wires may damage the shift register. After threading, protect the wires by applying an insulating tape (E Vinyl, or equivalent) to prevent interference with adjacent CPs.

3.03 It is suggested that the encoding of the shift register be performed with the CP placed on a flat surface and precautions taken to

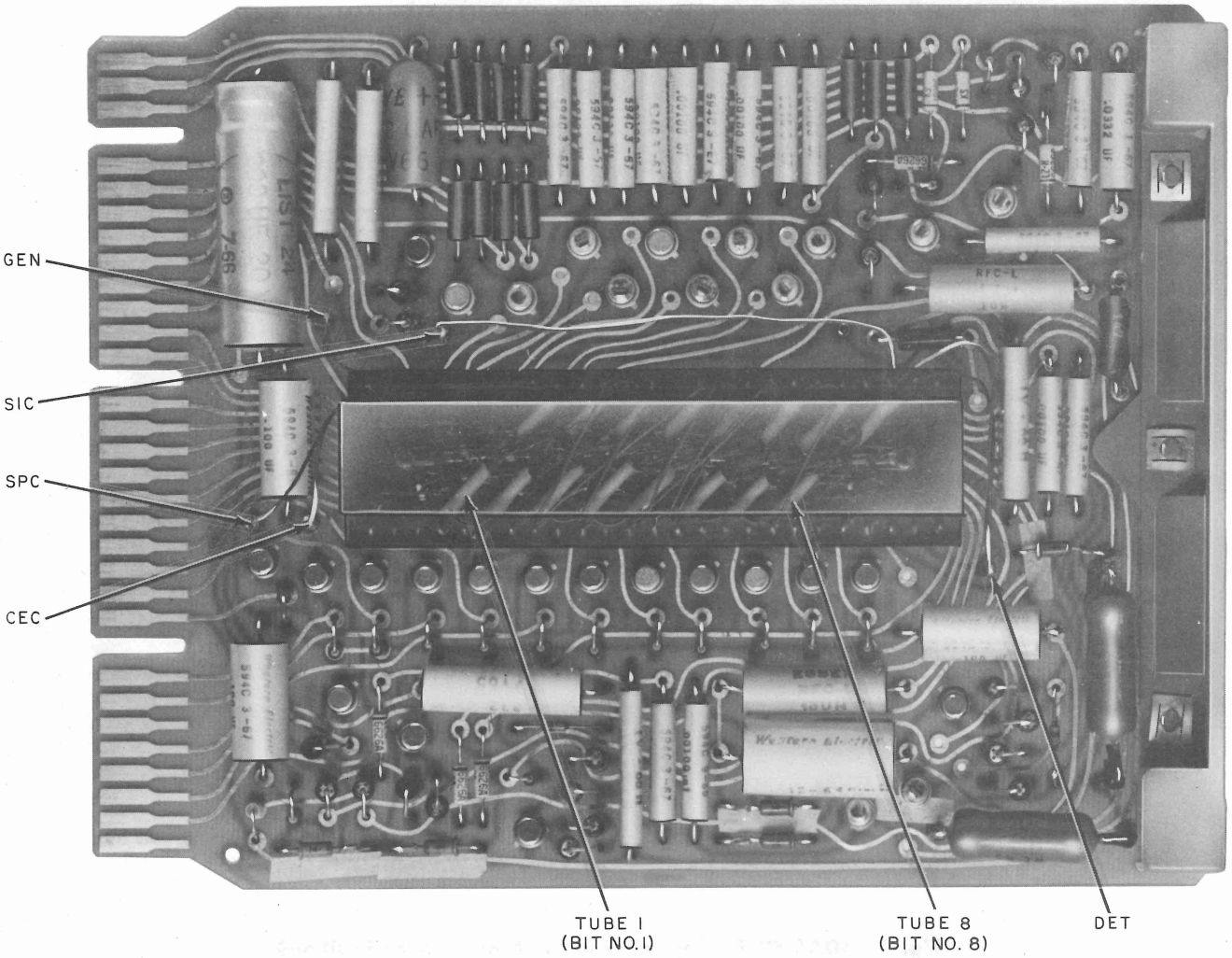

Fig. 2—AR272 Circuit Pack—Location of Terminal for Wiring Shift Register

insure that the CP is properly protected from possible damage.

3.04 The following procedure is recommended for encoding the shift register:

(1) Obtain the SPC, CEC, and SIC codes from the faceplate of the CP being replaced or, for a new installation, from the service order and/or circuit layout record card.

(2) Select proper mark and space sequence for each code by using Fig. 3.

(3) Cut three pieces of No. 36 American Wire Gauge (AWG), polyurethane-coated wire, in 2-foot lengths (see 3.02).

The following operations require the use of a KS-16346-L1 or -L2 soldering iron (or an equivalent low wattage rated iron). Extreme care must be exercised when soldering the conductors to the specified terminal at the completion of threading operations.

SIC CODE

(4) Connect an end of one previously mentioned wire (3) to the GEN terminal (Fig. 2).

(5) Starting with tube 1 (for bit one), thread the free end of this wire through each of the eight tubes in the shift register in the correct direction for each bit as indicated in Fig. 4.

(6) At the completion of threading, remove the excess length of wire and connect the free end of this wire to the SIC terminal (Fig. 2).

SPC CODE

(7) Connect one end of another of the previously mentioned wires to the SPC terminal (Fig. 2).

(8) Starting with tube 1 (for bit one), thread the free end of this wire through each of the eight tubes in the shift register in the correct direction for each bit as indicated in Fig. 4.

(9) At the completion of threading, remove the excess length of wire and connect the free end of this wire to the DET terminal (Fig. 2).

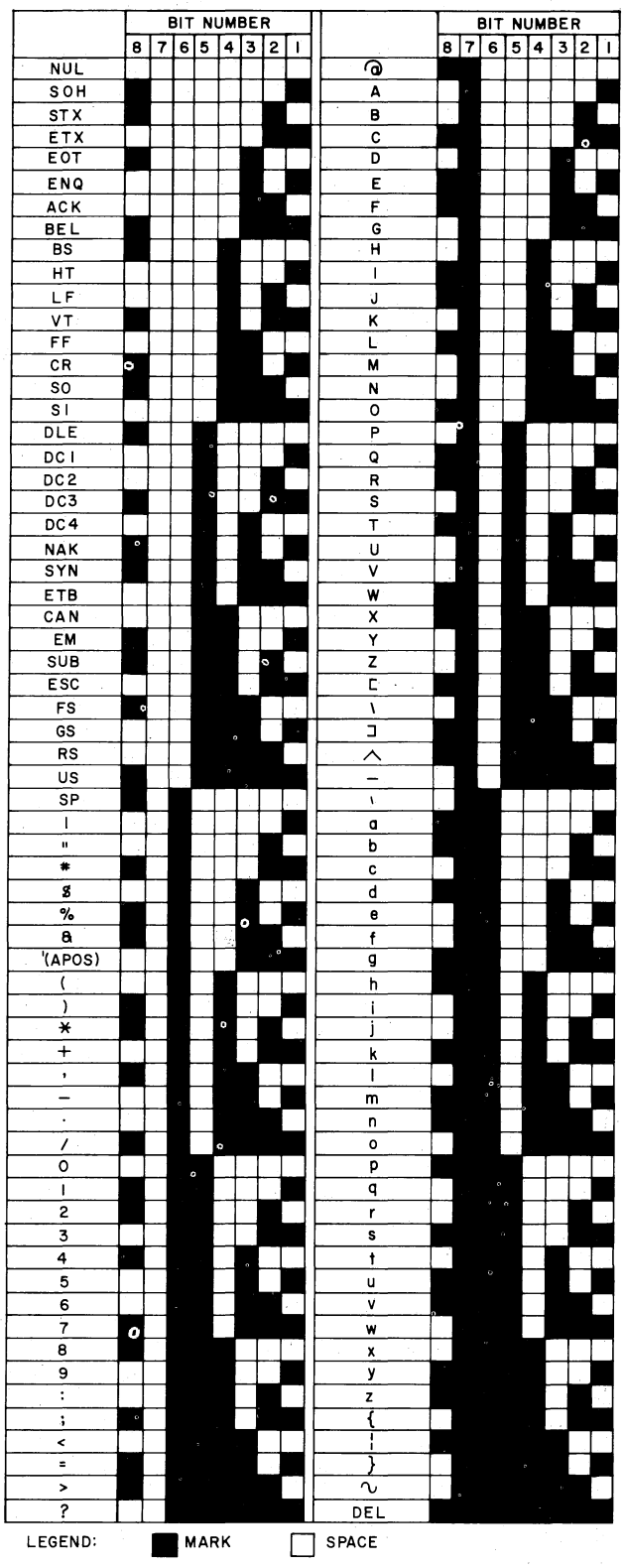

Fig. 3—American National Standard Code for Information Interchange, ASCII (ANS X3.4-1968)

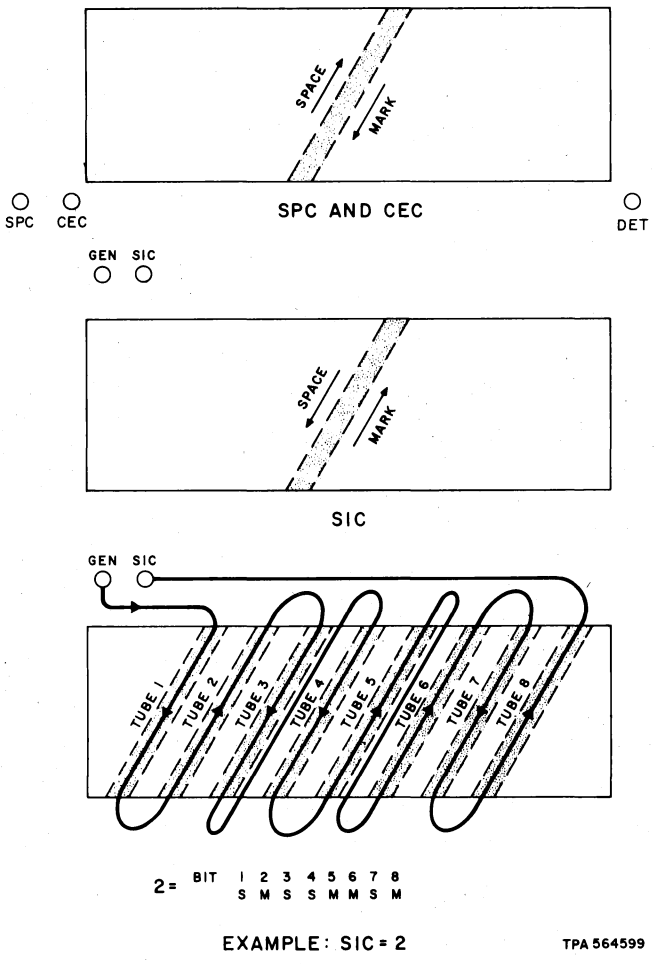

Fig. 4—Direction of Wires for Encoding Shift Register

CEC CODE

(10) Connect one end of the last of the three mentioned wires to the CEC terminal (Fig. 2).

(11) Starting with tube 1 (for bit one), thread the free end of this wire through each of the eight tubes in the shift register in the correct direction for each bit as indicated in Fig. 4.

(12) At the completion of threading, remove the excess length of wire and connect the free end of this wire to the DET terminal (Fig. 2).

4. MAINTENANCE PHILOSOPHY

4.01 Maintenance of the HDX, 150-word per minute 86A2 data selective calling service station should be in accordance with the flowchart shown in Fig. 5. This flowchart is recommended for an organized trouble investigation with a minimum amount of time spent in locating the cause of the trouble reported by the customer.

4.02 Before a trouble report is dispatched for clearance, the report should be analyzed to eliminate the obvious trouble conditions (ribbon, paper jams, appearance, etc).

4.03 When the report is obviously TTY trouble, trouble-clearing procedures and adjustments should be in accordance with the appropriate Field Maintenance Practice (FMP) and Bell System Practice (BSP).

4.04 When the report is obviously not TTY trouble and the station is equipped with a data set 108A, ▶108E, or 109E◀ inquire whether a remote loop-back test of the DAS 820B6 has been performed by the serving test center (STC) or the control serving test center (CSTC). If the remote loop-back test has been performed, find out if the results were satisfactory. If a remote loop-back test has not been performed, request the STC or CSTC to perform the test.

A remote loop-back test may be performed on a data station that is equipped with data set 108A, ▶108E, or 109E.◀ Stations equipped with data set 109A are not designed to provide remote loop-back capabilities.

4.05 If the results of the remote loop-back test of the controller were not satisfactory, a loop-back test of the data set 108A, ▶108E, or 109E◀ should be performed to isolate the trouble to either the data set or the controller. If the data set fails the loop-back test, replace it with one known to be good and repeat the test. The replacement data set should pass the test, which indicates that the replaced data set caused the trouble report. If the replacement data set fails the test, the line must be checked. Should the line fail the test requirements given in the section entitled Private Line Data Circuits—Voice Bandwidth Circuits for Miscellaneous Data—Overall Tests and Requirements (314-410-510), the line facilities should be replaced in order to restore service to the customer with a minimum amount of down time.

4.06 When the report is obviously not TTY trouble and the station is equipped with

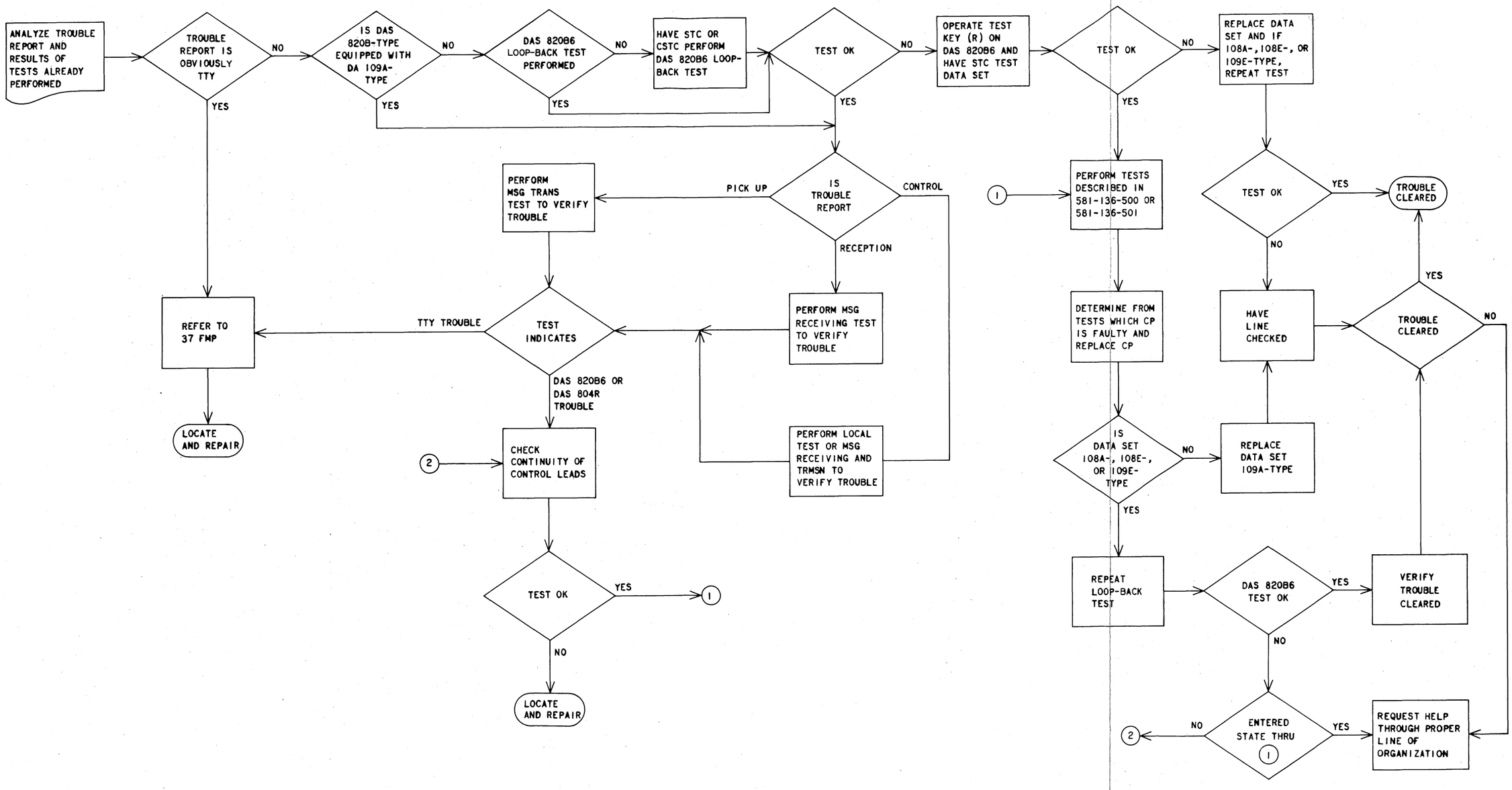

Fig. 5—Flowchart—Maintenance Test Procedures

data set 109A or the data set 108A, ▶108E, or 109E◀ meets the requirements of the loop-back test, the trouble may be located in the controller. In this case, the tests described in the section entitled 86A2 Data Selective Calling Service—Half-Duplex—150-Word Per Minute Data Station—Test Procedure (581-136-501) should be performed to determine which CP is faulty. When found, the faulty CP should be replaced and the loop-back test repeated.

If AR272 CP is found to be the faulty CP, its replacement CP will have to be encoded for the station. The encoding procedure is described in Part 3 of this section.

4.07 Should the controller pass the repeated test after replacement of the suspected CP, the trouble was in the controller.

4.08 If the controller fails the repeated test, a continuity check of the attendant set should be made.

> ***Note:*** In the event that a spare attendant set is available, substitution of the spare may reduce the time required for the repeated test of the controller. Should the controller pass the repeated test, either perform the continuity check to locate the trouble in the original attendant set and clear by repair, or replace the original attendant set with the spare.

4.09 If a spare attendant set is not available and the continuity check fails, clear the trouble by repair or replacement.

4.10 In the event that the controller passes the repeated test, further analysis of the trouble report is required to determine which mode is in trouble (message pickup or transmission, message reception, or control functions).

4.11 Message pickup trouble is verified by the message transmission test. If the results of the test indicate TTY trouble, refer to the appropriate FMP or BSP for clearance procedures. If results indicate controller or attendant set trouble, a continuity test of the attendant set should be performed. If the continuity test fails, locate the trouble and either repair or replace the defective part.

4.12 If the attendant set passes the continuity test, the controller should be tested and faulty CPs replaced as described in 4.06.

4.13 Analysis of message reception trouble should be verified by performing a message reception test. Should the results of the test indicate TTY trouble, refer to the appropriate FMP or BSP for clearance procedures. If results indicate controller or attendant set trouble, a continuity test of the attendant set should be performed. If the continuity test fails, locate the trouble and either repair or replace the defective part.

4.14 If the attendant set passes the continuity test, the controller should be tested and faulty CPs replaced as described in 4.06.

4.15 Analysis of control function trouble should be verified by performing a local test or message transmission and message reception tests to determine the cause of the trouble report.

4.16 If all of the tests do not isolate the trouble to a specific component, it is recommended that additional help be requested through proper lines of organization in order to restore service to the customer.

5. DATA AUXILIARY SET 804R-TYPE

5.01 Maintenance of DAS 804R-type is limited to the replacement of lamps, keys, cord, and/or loudspeaker (Fig. 6, 7, and 8). This requires opening the door on the right-hand side of the TTY pedestal.

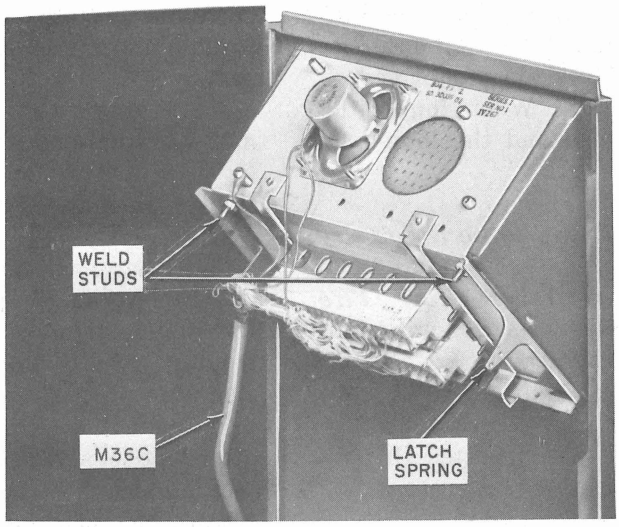

Fig. 6—DAS 804R4 in 37 ASR TTY

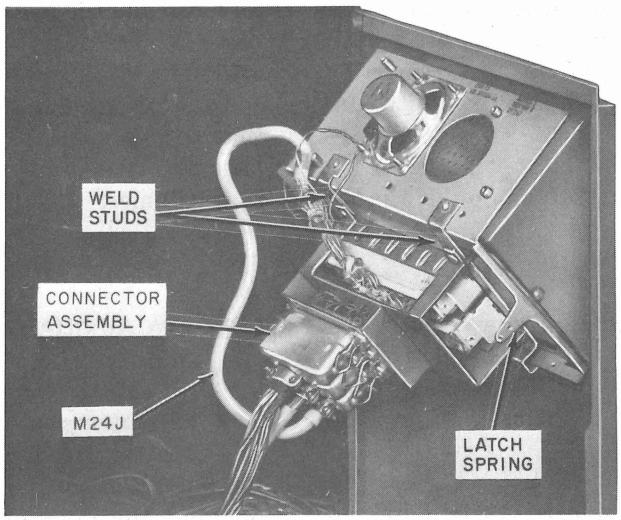

Fig. 7—DAS 804R3 in 37 RO TTY

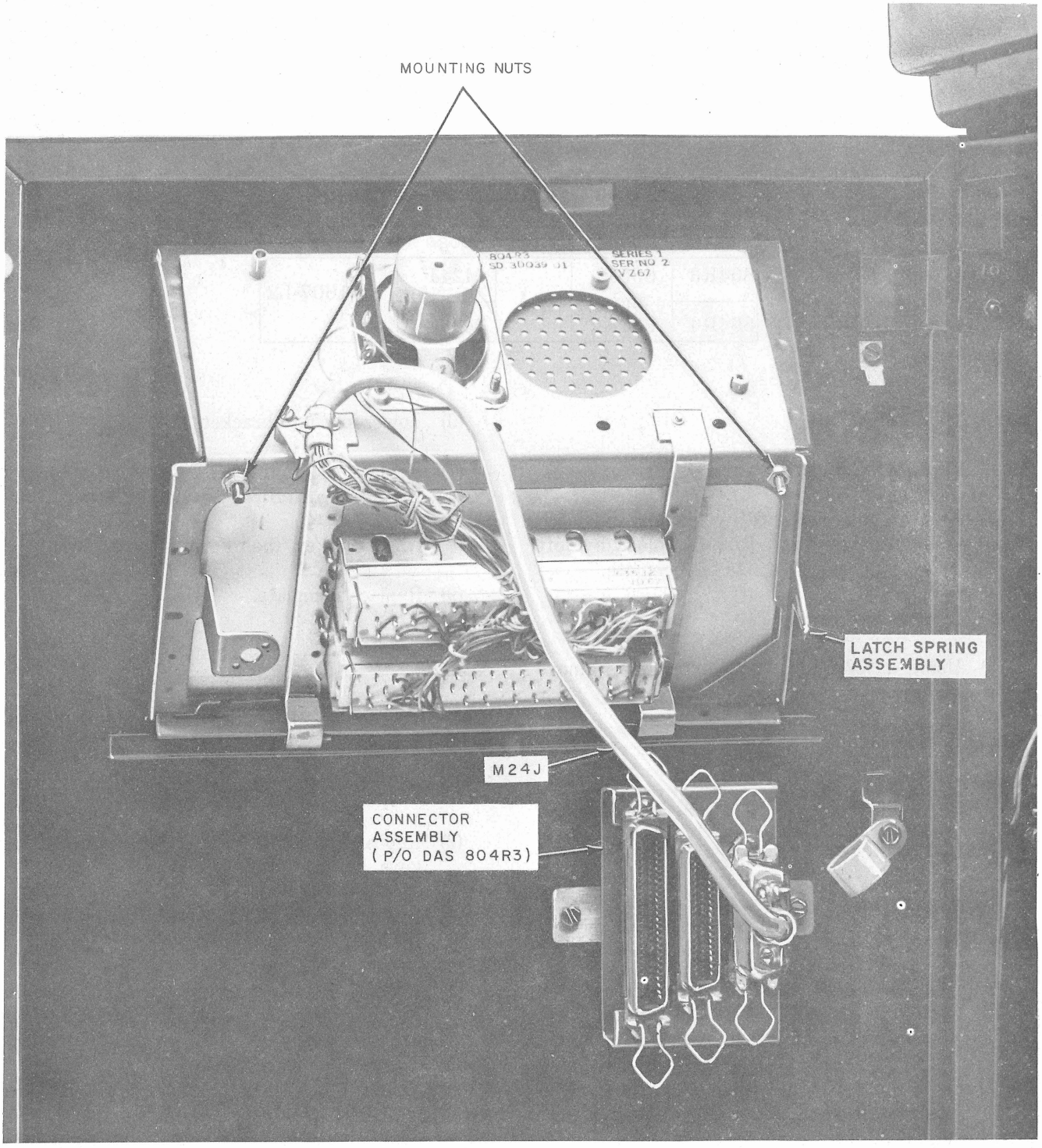

Fig. 8—DAS 804R3 in 37 ROTR TTY

5.02 The DAS 804R-type replacement parts are shown in Table A.

TABLE A

DAS 804R-TYPE REPLACEMENT PARTS

DAS	KEY	LAMP	CORD	SPEAKER
804R3	635J2 and 635K2	53A	M24J	KS-1607-L2
804R4			M36C	

Lamps

5.03 To replace lamps:

(1) Remove the faceplate by moving the latch spring to the left. Lift faceplate by left side and disengage right side of faceplate.

(2) Remove key cap.

(3) Using a 553A tool (lamp extractor), remove lamp.

(4) Replace lamp.

(5) Replace key cap.

(6) Replace faceplate.

Keys

5.04 To replace keys:

(1) Remove the faceplate by moving the latch spring to the left. Lift faceplate by left side and disengage right side of faceplate.

(2) Using a KS-6854 screwdriver, or equivalent, remove the four 4-40 Fillister head screws which hold the key to the bracket.

(3) Lift key (to be replaced) sufficiently to clear the bracket.

(4) Release spring-retaining clips which hold the plug to the key and remove plug.

(5) Connect plug to the key to be installed and lock spring-retaining clips in place.

(6) Lower key into bracket.

(7) Replace the four 4-40 Fillister head screws. ***Do not tighten the screws.***

(8) Align the key, then tighten the screws.

(9) Replace faceplate.

Cord

5.05 To replace M24J (804R3) or M36C (804R4) cord:

(1) Perform 5.04 (1) through (4).

(2) Repeat 5.04 (2) through (4) for the remaining keys.

(3) Disconnect the M24J or M36C cord plug from the connector assembly.

(4) Loosen the two screws which connect the cord to the loudspeaker. Remove spade tips from the loudspeaker.

Note: The conductors are YEL-BL and YEL-OR.

(5) Remove the screw which holds the S hook assembly and the VIO-SL conductor.

(6) Remove cord.

(7) Reverse this procedure for the cord to be installed.

Loudspeaker

5.06 To replace loudspeaker:

(1) Loosen the two screws on the loudspeaker which connect the YEL-BL and YEL-OR conductors to the loudspeaker. Remove spade tips from the loudspeaker.

(2) Remove the two mounting nuts which hold DAS 804R-type to the door (Fig. 6, 7, and 8).

(3) Remove the four screws which hold the loudspeaker to the mounting plate assembly.

(4) Remove loudspeaker.

(5) Reverse the procedure for the loudspeaker to be installed.

6. DATA SET ▶108- AND 109-TYPE◀ REPLACEMENT

6.01 The replacement of the data set is as follows:

(1) Obtain access to the controller (Part 2).

(2) Remove lock strip (card-retaining) bar by loosening the two screws which hold it to the apparatus mounting. Slide lock strip from beneath screws and remove.

(3) Grasp handle on data set 108- or 109-type and pull straight out.

7. ADJUSTMENT OF DATA SET 108-TYPE

Verify that proper options are installed in the replacement data set 108A- or ▶108E-type.◀

7.01 Disconnect incoming data line from the tip (T) and ring (R) terminals on TS A of the controller.

7.02 Connect terminals + and − on portable station test set TTS-28 to TP 1 and TP 2 of the data set 108A (Fig. 9) or data set ▶108E (Fig. 10).◀ Set FUNCTION switch of TTS-28 to DBM 900Ω TERM O position.

7.03 Connect TTY power cord to the customer-provided ac receptacle.

7.04 Adjust R11 potentiometer on data set 108A or ▶R18 on data set 108E◀ for output level specified on service order and/or circuit layout record card.

Note: If no output level is measured, operate carrier squelch (CS) switch on DAS 820B6 to OFF. Restore CS switch after adjustment of R11 ▶or R18◀ and remove TTS-28.

7.05 Connect the incoming data line (removed in 7.01) to the T and R terminals on TS A of the controller.

7.06 Perform installation tests on the replacement data set in accordance with Section 581-136-501.

8. ADJUSTMENT OF DATA SET 109-TYPE

8.01 There are no adjustments required for data set 109A-type (Fig. 11).

8.02 Perform installation tests on the replacement data set 109A in accordance with Section 580-301-502.

8.03 ▶Three adjustable screw switches (S1, S2, and S3) are used to select options on data set 109E-type (Fig. 12). Screw switch S1 is subdivided into two sections (S1A and S1B); screw switch S3 is further subdivided into twelve sections. Two of these sections (S3-1 and S3-2) are used for options; eight of the remaining sections (S3-4 through S3-7, and S3-9 through S3-12) are used in selecting the proper line pad resistance (Table B). Sections S3-3 and S3-8 are not used and should not be equipped with screws.

8.04 Install the required options and line padding in the replacement data set in accordance with Table B and the data set 109E-type being replaced.◀

9. DATA AUXILIARY SET 804R-TYPE (ATTENDANT SET) REMOVAL/REPLACEMENT

9.01 To remove DAS 804R-type:

(1) Open the magnetically latched front access door on the TTY stand.

(2) Remove the spring clip at the right rear of the attendant set mounting bracket by removing two mounting screws.

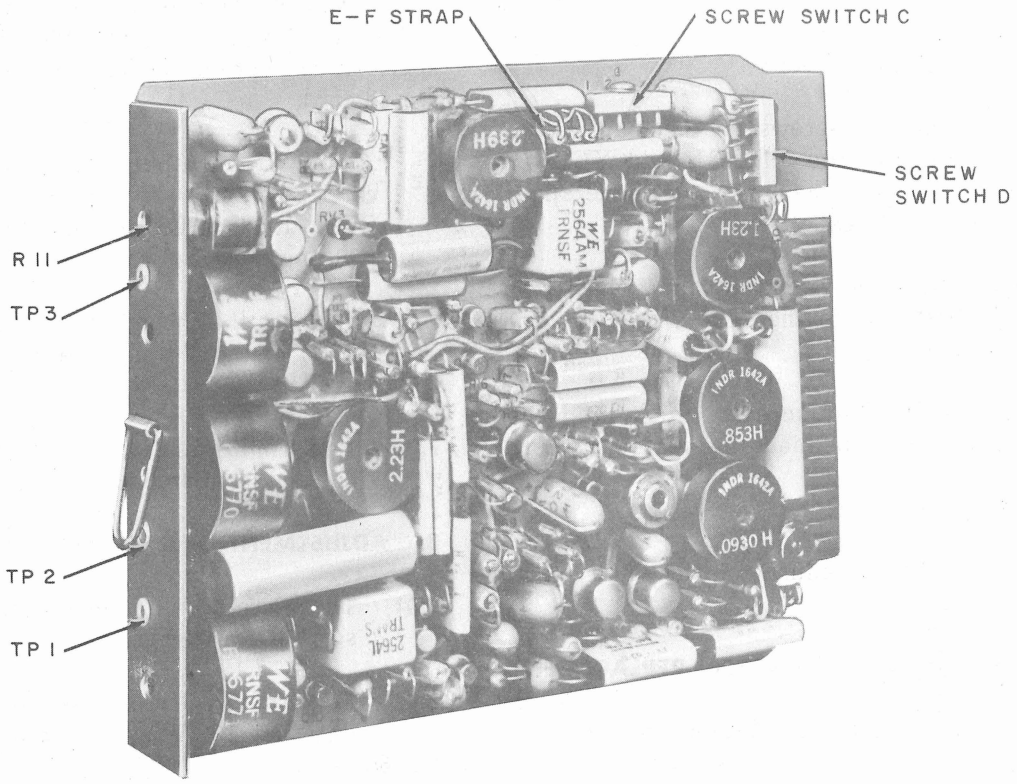

Fig. 9—Data Set 108A-Type—Location of Test Points and Screw Switches

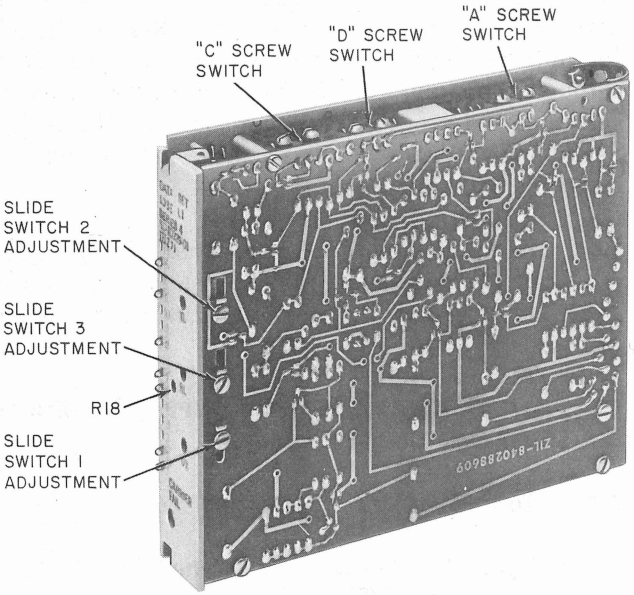

Fig. 10—Data Set 108E-Type—Location of Test Points and Screw Switches

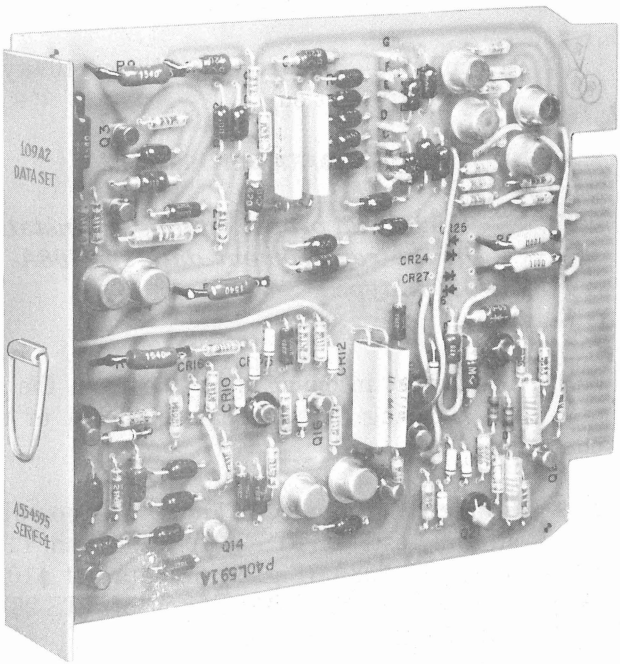

Fig. 11—Data Set 109A-Type

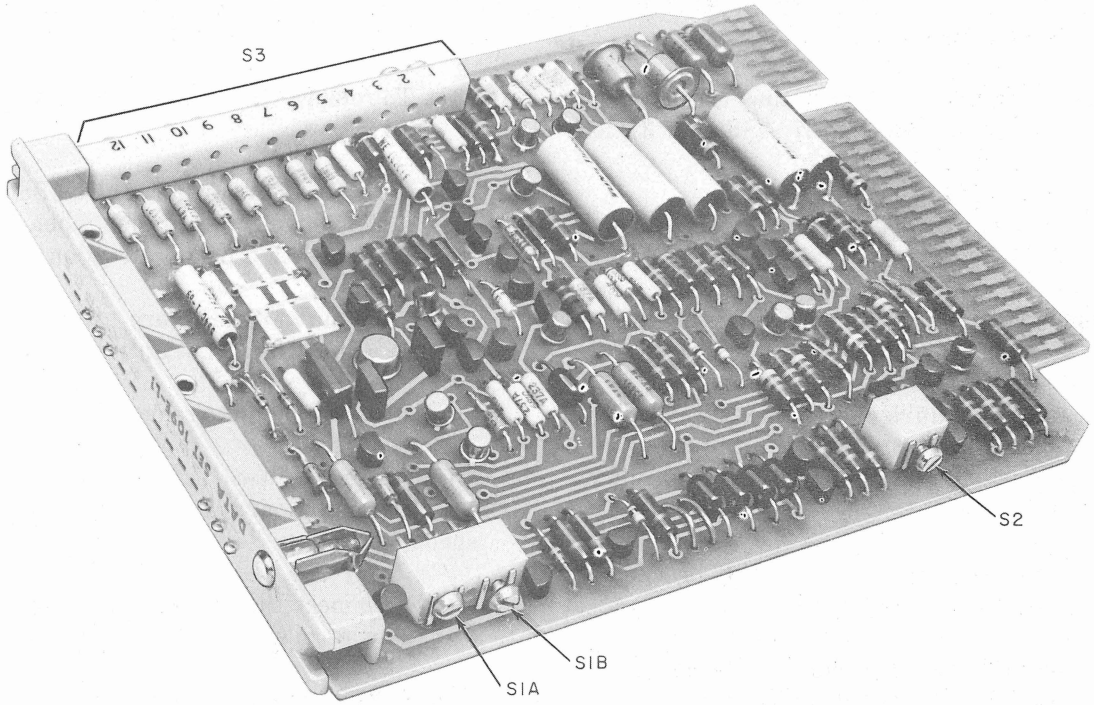

Fig. 12—Data Set 109E-Type—Location of Screw Switches

→TABLE B←

DATA SET 109E–TYPE
LINE PAD ADJUSTMENTS

LINE PAD RESISTANCE (OHMS)	SCREW SWITCH SETTINGS	
	CLOSE S3-	OPEN S3-
00.0	4,5,6,7,9,10,11,12	
136.2	4,5,6,10,11,12	7,9
266.0	4,5,7,9,11,12	6,10
402.2	4,5,11,12	6,7,9,10
522.0	4,6,7,9,10,12	5,11
658.2	4,6,10,12	5,7,9,11
788.0	4,7,9,12	5,6,10,11
924.2	4,12	5,6,7,9,10,11
1022.0	5,6,7,9,10,11	4,12
1158.2	5,6,10,11	4,7,9,12
1288.0	5,7,9,11	4,6,10,12
1424.2	5,11	4,6,7,9,10,12
1544.0	6,7,9,10	4,5,11,12
1680.2	6,10	4,5,7,9,11,12
1810.0	7,9	4,5,6,10,11,12
1946.2		4,5,6,7,9,10,11,12

(3) Lift the left side of the faceplate and disengage the faceplate locking tab.

(4) Remove the faceplate.

(5) Disconnect the attendant set plug and, at 37 ROTR TTY (Fig. 8), remove connector assembly.

(6) Remove two hex nuts and lockwashers from the weld screws on the angle bracket mounting assembly.

(7) Lower the rear of the attendant set to disengage the locking tabs.

(8) Remove the attendant set by sliding it to the rear.

9.02 To replace the DAS 804R-type, reverse the procedure of 9.01.

10. DATA AUXILIARY SET 820B6 (CONTROLLER) REMOVAL/REPLACEMENT

Note: The controller mounting arrangement is the same for both the 37 ASR and 37 RO TTY.

10.01 To remove the controller from the 37 ASR or RO TTY:

(1) Open the door on the right-hand side of the TTY pedestal.

(2) Loosen the knurled knob on the front of the 93A mounting bracket and slide the controller and 93A bracket forward and out of the TTY pedestal.

(3) Carefully set the controller and bracket on the floor in front of the TTY.

(4) Loosen the two screws on the controller terminal board (TB A) and remove the T and R spade tip leads.

(5) Disconnect the M, N, and power plugs from the controller.

(6) Remove the two mounting screws from the 93A bracket.

(7) Disengage the two plungers that secure the controller to the 93A bracket and separate the controller from the bracket.

10.02 To replace the controller reverse the procedure given in 10.01.

10.03 To remove the controller from the 37 ROTR TTY:

Note: The data auxiliary set 820B6 is mounted in a KS-20018-type cabinet when the ROTR TTY is used as a primary station.

(1) Apply outward pressure at the top front of the KS-20018 cabinet until the panel releases.

(2) Lift the panel up to remove it from framework.

(3) Loosen the two screws on the controller terminal board and remove the T and R spade tip leads.

(4) Disconnect the M, N, and power plugs from the controller connectors.

(5) Remove two mounting screws from the 95A mounting bracket.

(6) Disengage the two plungers that secure the controller to the mounting bracket.

(7) Grasp the controller and pull out from the cabinet.

10.04 To replace the controller, reverse the procedure of 10.03.