SECTION 579-201-350
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mode 33 teletypewriter stations

FOR PRIVATE LINE
(General Purpose Point-To-Point)
AND dataphone® SERVICES

FIMP

Bell System

MODEL 33 TELETYPEWRITER STATIONS FOR PRIVATE LINE (GENERAL PURPOSE POINT-TO-POINT) AND "DATA-PHONE" SERVICES

CONTENTS

Prepared for American Telephone and Telegraph Company by Teletype Corporation

CONTENTS

1. GENERAL

1.01 This Field Installation and Maintenance Practice provides requirements and procedures at end-user locations for installation, routine maintenance, operational testing, and trouble analysis with corrective procedures for Model 33 Teletypewriter Stations in DATA-PHONE and Private Line (General Purpose, Point-To-Point) Services.

1.02 Trained service personnel using this practice should be familiar with teletypewriter and data equipment principles, with Data Test Center (DTC), Serving Test Center (STC), Private Line Servicehoard (PLS), and Hub Services and their use, and with local engineering requirements, changes, or other items that may affect station operation. For detailed information, refer to associated BSP Sections, BSTSEA A-Plans and W-Plans, and related Wiring Diagrams.

1.03 Model 33 Automatic Send-Receive (ASR), Keyboard Send-Receive (KSR), and Receive-Only (RO) Teletypewriter Stations are arranged by services (DATA-PHONE or Private Line). The wiring plans, interface logic, and data equipment for these services are as follows:

	DATA-PHONE	Private Line (General Purpose, Point-To-Point)
BSTSEA Wiring Plan	W-H3JDC	W-H3JPC
Interface Logic Assembly	TP186627	TP186680
Data Equipment	113A- Type Data Set	820D-L1- Type Data Auxiliary Set
	103G- Type Data Set	108A-, C-, D-, E- Type Data Set
	103A2 Type Data Set	109A-, E- Type Data Set
	103A3 Type Data Set	1A Data Station (SCA), Binary
	403E4, E7 Type Data Set	

1.04 Installation (Part 2) provides instructions for initial installation of the station.

1.05 Routine Service Procedure — Teletypewriter Set (Part 3) includes service time interval recommendation, visual inspection, lubrication, cleaning, and cursory operation checks. Routine maintenance of data equipment is not necessary.

1.06 Operating Tests (Part 4) include station (teletypewriter set and data equipment) on-line checks and teletypewriter set local (off-line) checks. References are made to Trouble Analysis Table (Part 6).

1.07 Trouble Call Procedure (Part 5) charts the steps to be followed during a trouble call.

1.08 Trouble Analysis Table (Part 6) analyzes specific troubles and gives direct correction or directs to specific teletypewriter set Adjustments (Part 7) or Wiring Diagrams (Part 8).

2. INSTALLATION

2.01 UNPACKING

(a) The teletypewriter set is packed in one carton. Observe all cautions and instruction labels on the carton before unpacking.

(b) Remove tape from bottom edge of carton and unfold interlock flaps.

(c) Raise outer carton off teletypewriter.

(d) Remove tape holding copyholder and cnad box (if present) from bottom of packing detail.

(e) Remove all tape and packing detail from teletypewriter.

2.02 PLACEMENT

(a) Place the set in its operating location. Make sure there is enough room between the rear of the stand and adjacent walls or objects so back panel can be removed as necessary.

(b) Adjust leveling screws at rear of stand so set is level and does not rock from side to side (see Figure 1).

(c) Remove screw and spacer from underside of front center of set.

CAUTION: WITH THIS SCREW AND SPACER REMOVED, THE SET IS "FLOATING" AND SHOULD NOT BE TIPPED. RETAIN THE SCREW AND SPACER TO SECURE THE SUBBASE IF THE SET IS EVER MOVED OR SHIPPED.

2.03 ANSWER-BACK CODING

(a) If answer-back is to be coded at the installation site, remove cover from teletypewriter (see Figure 2).

(b) To remove answer-back drum, press down answer-back brace tab with screwdriver until it detents in its open position (Figure 3), then lift feed pawl slightly (do not overextend its spring) and remove drum.

(c) Code the drum in a counterclockwise direction, starting with row no. 1. The numbers of the rows are stamped on one end, as shown in Figure 4. The character levels are also shown in this figure.

NOTE: The ST row is the first row sensed at the beginning of the answer-back cycle. It is coded at the factory for character suppression and must not be recoded.

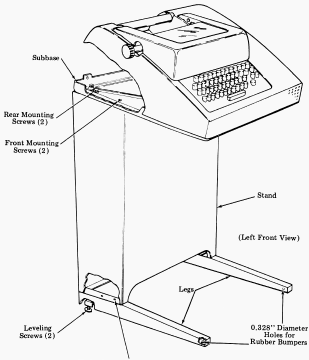


Figure 1 - 33 Teletypewriter Mounted on Stand

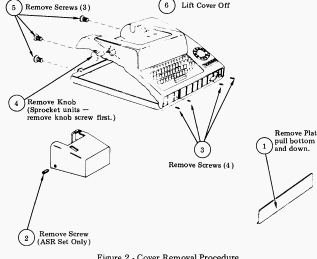


Figure 2 - Cover Removal Procedure

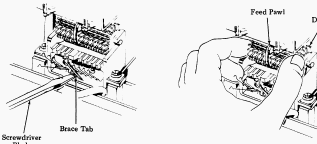


Figure 3 - Answer-Back Drum Removal Procedure

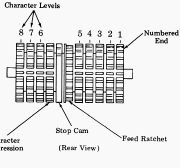


Figure 4 - Structure of Answer-Back Drum

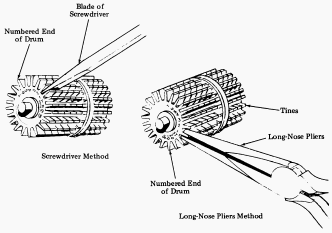
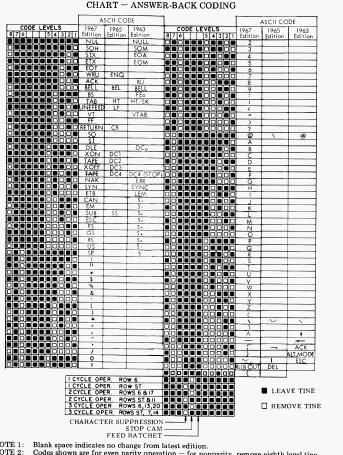


Figure 5 - Removing Tines from the Answer-Back Drum

CHART — ANSWER-BACK CODING



NOTE 1: Blank space indicates no change from latest edition.
NOTE 2: Codes shown are for even parity operation — for nonparity, remove eighth level tine.

(d) Code the characters by either retaining (space) or removing (mark) tines in a row as indicated in the Answer-Back Coding Chart. A tine may be removed by grasping it with a fine tool or long-nose plier and breaking it off, or by placing a small screwdriver between rows of tines and pressing against the tine to be removed (Figure 5). If the screwdriver is used, make sure the blade is inserted to the base of the tooth between rows to prevent breaking off the adjacent tine.

NOTE: If a coding error is made, or for some other reason it is necessary to "erase" characters from the drum, remove the character suppression tine from the row.

(e) For short sequences, code the drum for 2-cycle or 3-cycle operation by removing the tines as indicated in the Answer-Back Coding Chart.

(f) Removing the character suppression tine from a row prevents transmission from the answer-back mechanism. For an answer-back sequence shorter than the full cycle, remove the character suppression tine from each unused row after the end of the message.

(g) Replace the answer-back drum by reversing the removal procedure. With the drum shaft firmly seated in the control block slots, release the feed pawl and brace. Rotate the answer-back drum to assure proper seating of parts. Make sure the contact wires are in the right slots.

2.04 RIBBON INSTALLATION

(a) If cover is installed on set, raise the cover lid.

(b) Remove the spool of ribbon from the left ribbon spool shaft, and the empty spool from the right spool shaft. Remove the wrapper from the spool of ribbon.

(c) Engage the hook at the end of the ribbon in the hub of the empty spool (see Figure 6). If there is no hook, pierce the end of the ribbon on the barb in the hub of the empty spool.

(d) Wind a few turns of ribbon onto the empty spool in the direction of the arrow of Figure 6. Make sure the reversing eyelet has been wound onto the spool.

(e) Place the spools on the shafts as shown. Turn each spool slightly until the spool drive pin engages the hole in the spool, then press down to seat the spool.

(f) Guide the ribbon around the vertical posts, into the slots on the reversing arms, and into the ribbon guide as shown in Figure 6. Rotate the spools to take up any slack.

2.05 PAPER INSTALLATION (Friction Feed)

(a) A friction feed teletypewriter accommodates a standard roll of paper 8-1/2 inches wide and 5 inches in diameter.

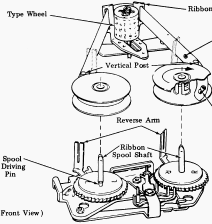


Figure 6 - Ribbon Installation

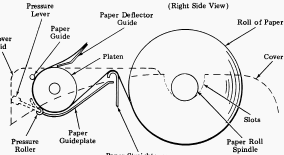


Figure 7 - Paper Installation (Friction Feed)

(b) Insert the paper roll spindle into the roll of paper so that an equal length of spindle is exposed at either end.

(c) With cover in place on set, place roll into cover recess with the ends of the spindle resting in the slots so the paper unrolls from the bottom (see Figure 7).

(d) Raise the cover lid. Release pressure roller tension by moving the pressure lever forward.

(e) Prepare a smooth leading edge of paper, then pass the paper over the paper straightener, under the platen, and under the paper guide. Straighten the paper, then reapply the pressure roller tension. Close the cover lid.

NOTE: When typing units are stored or out of service for an extended period of time, release the pressure roller tension.

2.06 FORM INSTALLATION (Sprocket Feed)

(a) A sprocket feed teletypewriter accommodates forms 8-1/2 inches wide and of various lengths. The forms are normally passed to the typing unit from a conveniently located supply at the rear of the set.

(b) With cover in place on set, place the paper roll spindle into the paper recess of the cover so that it rests in the slots provided.

(c) Raise the cover lid. Pass the leading edge of the first form under the paper roll spindle. Thread the form under the low-paper and paper-out arms, if used, and between the platen and paper guideplate (see Figure 8).

(d) Guide the form squarely into the platen and rotate the platen until the form is advanced by the sprocket pins. Lift the wire guide and continue to rotate the platen until the form is under the wire guide and positioned for the first typing line. Lower the wire guide and cover lid.

NOTE: After the first form is fed out, lift the form over the paper roll spindle to separate the incoming forms from the outgoing forms.

(e) Figure 9 illustrates the zeroizing position of the platen drive mechanism for one cam lobe operation. For platen drive mechanisms using more than one cam lobe, see the Cam Zero Position (Platen Drive Area, Sprocket Feed Mechanism) adjustment in Section 574-122-700.

(f) Zeroized Position: Position a form at its first printing line in the typing unit. Depress the zeroizing button and rotate the pulley until the index plate is lined up with the pointer. Release the zeroizing button.

2.07 PAPER TAPE INSTALLATION (ASR Only)

(a) Install the tape roll on the spool as shown in Figure 10. For 2-inch inside diameter tape rolls, use the tube-type spool. For 1-inch inside diameter tape rolls, use the 2-piece spool.

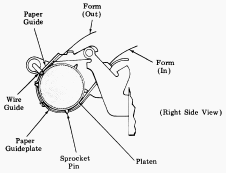


Figure 8 - Form Installation (Sprocket Feed)

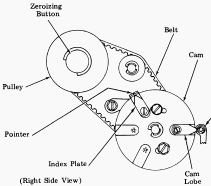


Figure 9 - Zeroizing Position of Platen Drive Mechanism (Sprocket Feed)

(b) With cover in place on set, place the spool of tape in the tape punch cover so that the leading edge of the tape is at the top of the roll.

2.08 INSTALLING THE CHAD BOX (ASR Only)

(a) Assemble the chad box under the tape punch pan by inserting the back of the flanged surface between the stand and the typing unit subbase (see Figure 11).

(b) Push the chad box toward the rear until the bent surface at the front of the chad box engages the stand. An embossing on the bottom front of the flanged surface engages an oblong hole in the stand to hold the chad box in place.

(c) To empty the chad box, lift the front slightly and pull the chad box forward until it disengages.

2.09 INSTALLING THE COPYHOLDER (Optional Feature)

(a) With the line guide facing forward (see Figure 12), insert the rear mounting tabs in the lower mounting slots.

(b) Pivot the copy holder to align the front mounting tabs above their mounting slots.

(c) Push copyholder downward until the tabs are fully seated.

2.10 DATA SET INSTALLATION

"DATA-PHONE" SERVICE

(a) The data set and data auxiliary set, as required, should be installed according to existing practices covering installation of station sets (Section 590.010-200, "Data Sets and Data Access Arrangements – General Installation and Connection Information").

(b) Data set/data auxiliary set should be located apart from but not more than 50 feet from the teletypewriter set, or less than this as required by the data set/data auxiliary set.

(c) To minimize possibility of data errors due to a potential difference between data set ground and teletypewriter ground, the data set and teletypewriter power receptacles should be served from the same primary ac distribution panel. Both power receptacles must be capable of accepting plugs with two parallel blades and a round-shaped grounding pin. Do not apply ac power to teletypewriter set or data set until installation is complete.

(d) Install data set/data auxiliary set options specified on the service order, work sheet, or circuit layout card. For definitions and information on how these options are implemented, refer to the BSP Section for the data set/data auxiliary set being installed (Table A).

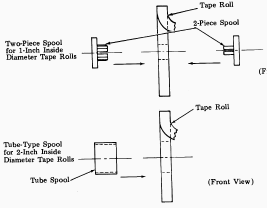


Figure 10 - Installation of Tape Roll

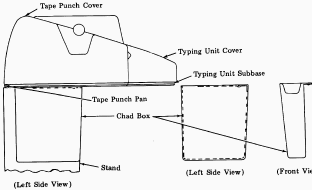
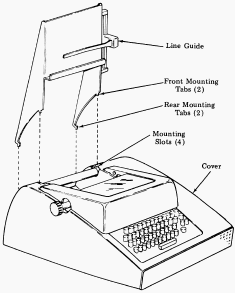


Figure 11 - Installation of Chad Box



(Left Front View)

Figure 12 - Installation of Copyholder

(e) Verify that the overall data transmission network or loop facility has been tested and meets transmission requirements specified in Section 314-205-501, "Data Systems — DATA-PHONE Service and Data Access Arrangements on Direct Distance Dialing Network — Test Requirements For Subscriber, Foreign Exchange, and Remote Exchange Lines".

TABLE A

REFERENCE BSP SECTIONS ("DATA-PHONE")

DATA SET/DATA AUXILIARY SET	REFERENCE BSP SECTION
113A- Type Data Set	591-033-200
103G- Type Data Set	591-026-200
103A2 Type Data Set	591-014-200
804B1 Type Data Aux Set	598-031-100
103A3 Type Data Set	591-014-201
565HK Telephone Set	502-541-415
2565HK Telephone Set	502-543-405
662A1 Telephone Set	502-617-402
2662A1 Telephone Set	502-619-402
403E4, E7 Type Data Set	592-026-200
804G- Type Data Aux Set	598-048-100

(f) Connect P2 of cable of TP186627 Interface Logic Assembly mounted in teletypewriter set to receptacle at rear of data set (for 403E- Type Data Set, to connector on customer interface cable).

(g) If the service order does not specify the transmitter power level to be used, measure the transmission facility loop loss:

(1) Data set not connected to telephone transmission line.

(2) Connect 1013- Type (or equivalent) Dial Hand Test Set to telephone line.

(3) Place a call to the 1000 Hz 1 mW terminal in the Serving Central Office.

TABLE B

TRANSMIT LEVEL

1000 Hz MEASURED LOSS (dB)	OUTPUT LOSS (dBm)
Above 12	0
10 to 12	-2
8 to 10	-4
6 to 8	-6
4 to 6	-8
2 to 4	-10
0 to 2	-12

(4) When the 1000 Hz tone is received, connect the positive (+) and negative (-) leads of the TTS-28 Transmission Measuring Set (TMS), or equivalent, across the tip and ring of the transmission facility. Set TTS-28 function switch to DBM900 Ω-TERM 0 position. This terminates the telephone with the required 900 Ω impedance and the received signal is filtered to provide at least 25 dB attenuation at 60 Hz.

(5) Line loss of the transmission facility is the dBm level of the received tone indicated on TTS-28 meter. Record this value.

(h) Using the procedures specified in the BSP Section for the data set being installed (Table A), adjust the data set transmitter power output level to the value specified on the service order; or to correspond to the value of the transmission facility loss (specified on service order or measured in Step (g)) using Table B.

(i) Upon completion of installation, connections, and adjustments of the data set, perform the Local (Off-Line) Tests, 4.03, to verify operation of the teletypewriter set. Then proceed to 4.04, On-Line Tests, to check the on-line operation of the station either with a Data Test Center or with another station on the customer's network.

PRIVATE LINE, GENERAL PURPOSE POINT-TO-POINT SERVICE

(a) Data Auxiliary Set 820-L1- Type with Data Sets 108A-, C-, D-, E- Type or 109A-, E- Type and AR17 Circuit Pack, or 1A Data Station (Single Channel Arrangement), as required, are installed in the knee well of the teletypewriter stand, and connected to the teletypewriter set.

(b) AR17 Circuit Pack, used in DAS 820D-L1- Type, is option arranged for EIA (Electronic Industries Association) interface (voltage). Additional options in this circuit pack, data set, and data auxiliary set are to be installed as specified on the service order, work sheet, or circuit layout record card. For definitions and for information on how the options are implemented, refer to the BSP Section for the data set/data auxiliary set or data station (Table C).

(c) The 1A Data Station (SCA) is to be arranged for line EIA interface (DP66 Line EIA INTF Circuit Pack, or equivalent) and binary transmission mode (DP51 RCV INTF Circuit Pack, or equivalent). Check the Transmitter Circuit Pack (DP1-DP25) and Demodulator Circuit Pack (DP26-DP50) and make sure they are of the frequencies and channels specified on the service order, work sheet, or circuit layout record card. Also check the options of all circuit packs for correct installation as required on the service order. Refer to the appropriate BSP Section (Table C) for the definition and implementation of these options.

TABLE C

REFERENCE BSP SECTIONS (PRIVATE LINE)

DATA SET/DATA STATION	REFERENCE BSP SECTION
108A-, C- Type Data Set	591-023-201
108D-, E- Type Data Set	591-028-201, 591-028-301
109A- Type Data Set	591-024-201, 591-024-301
109E- Type Data Set	591-036-202, 591-036-302
1A Data Station (SCA), Binary	591-813-201, 591-813-301

(d) Verify that the overall data transmission network or line loop facility has been tested and meets transmission requirement specified in Section 413-410-500, "Private Line Data Circuits — Voice Bandwidth Circuits for Miscellanous Data — Overall Tests and Requirements."

(e) For stations arranged with Data Sets 109A-, E- Type:

(1) Primary ac power and transmission line not connected to DAS 820D-L1- Type. Set function selector of KS-20538-L1, or equivalent, Volt-Ohm-Milliameter (VOM) to measure 12 volts dc. On DAS 820D-Type, connect VOM negative (-) lead to TB1 terminal 1 and positive (+) lead to TB1 terminal 2. Apply ac power to data auxiliary set. VOM indicates within range of +3.0 through +4.7 volts dc. Remove ac power, then remove VOM, from data auxiliary set.

(2) As indicated on the circuit layout record card, determine the transmission line loop resistance and far-end data set line pad resistance. Add these two values together and subtract this total from the optimum 2000-ohm total transmission line loop resistance. The remaining amount is the pad resistance to be set in the data set to be inserted in the transmission line loop. The difference in pad resistance in the near-end and far-end data sets should not exceed 1000 ohms. When the transmission loop actual resistance is between 2000 and 2500 ohms, the pad resistance in the near-end and far-end data sets must be set at zero.

(3) Check for proper amount of signal current on transmission loop data line as described in 4.05, C. (1) and (2). If signal current is greater than upper limit, additional resistance must be added to line loop by opening additional data set line pad screw switches. If measured signal current is less than the lower limit, the data set line pad screw switches must be closed to remove some line pad resistance.

(f) For stations arranged with Data Sets 108A-, C-, D-, E- Type:

(1) If the transmission line loop facility is 4-wire, no line adjustments in the data set are necessary to interface with the line facility (Data Sets 108D-, E- Type only). If the transmission line loop facility is 2-wire, the data set hybrid network must be adjusted to provide proper impedance loss, as determined by the loop impedance of the transmission line facility. The data set hybrid network strapping or switching arrangement should be provided on the service order or circuit layout record card. These strapping or switching arrangements for typical transmission line loop facility impedances are found in the data set BSP Section (Table C).

(2) The data set receive level (sensitivity) is also determined by the transmission line loop facility impedance loss. This setting is to be made according to the service order or circuit layout record card. These strapping or switching arrangements for typical transmission line loop facility impedances are found in the data set BSP Section (Table C).

(3) The data set transmit level is set with transmission line loop facility disconnected from Data Auxiliary Set 920D-L1. With no ac power applied to data auxiliary set, connect positive (+) and negative (-) or equivalent to test points TP1 and TP2, respectively, on faceplate of data set. Set TTS-28 TMS FUNCTION switch to DBM900 TERM 0 position. Connect ac power to data auxiliary set. Adjust potentiometer R11 on Data Set 108A-, C- Type or R18 on Data Set 108D-, E- Type for output level specified on service order or circuit layout record card. If TTS-28 TMS indicates no output level, and R option (Carrier Squelch on Carrier Fail) is installed on AR17 Circuit Pack, pull AR17 approximately 2 inches from mounting to obtain measurement. Adjust output level, then replace AR17 fully into mounting. Remove ac power, then disconnect transmission line tip and ring to data auxiliary set and data set. Connect data transmission line tip and ring to data auxiliary set TB1 terminals 1 and 2 (if 2-wire), or transmit line pair to TB1 terminals 1 and 2 and receive line pair to TB1 terminals 3 and 4 (if 4-wire on Data Set 108D-, E- Type). Reconnect ac power to DAS 820D-L1.

(g) For stations arranged with 1A Data Station (SCA) Binary Mode:

(1) Check, and adjust if necessary, the send (transmit) signal level necessary to work into the transmission line loop facility, as follows: Remove ac power from the teletypewriter station (including 1A Data Station). Remove connector P2 of cable to TP186680 Logic Assembly on teletypewriter set from 1A Data Station 31A2 Data Mounting (DM) 25-pin EIA connector J5. Connect the connector of W25A test cord of J79901B-L3 Interface Test Adapter (ITA) (cover of 901B Data Test Set) to 31A2 DM connector J5. Ensure that shorting bars are closed on 901B cover. Connect plug P2 of cable of TP186680 Logic Assembly on teletypewriter set to the 25-pin connector of 901B cover. Apply ac power to the teletypewriter station. Proceed according to 6.03 Trouble Analysis 31K.

(2) Verify that the far-end station send signal level has been adjusted to the specified level. Then verify that the received signal on the transmission line loop circuit at the near-end station is within the requirements specified on the service order or circuit layout card. This can be done using the 901B cover setup as in (g) (1) and the procedures in 6.03 Trouble Analysis 31I. Check, and adjust if necessary, the receive gain level in the 1A Data Station according to Trouble Analysis 311 in 6.03.

(3) Check, and adjust if necessary, the receive carrier fail level according to Trouble Analysis 31J of 6.03. For this adjustment, the 901B cover is removed and plug P2 of the teletypewriter set logic assembly is connected to 31A2 DM connector J5, as for normal operating conditions.

(h) Upon completion of installation, connections, and adjustments of the data set/data auxiliary set or 1A Data Station, perform the Local (On-Line) Tests, 4.03, to verify operation of the teletypewriter set. Then proceed to 4.05, On-Line Tests, to check the on-line operation of the station either with a Data Test Center, Private Line Serviceboard, or Hub facility, or with another station in the customer's network.

3. ROUTINE SERVICE PROCEDURE — TELETYPEWRITER SET

3.01 Routine service of the teletypewriter set should be performed after the first 200 hours or 4 weeks (whichever comes first) of service and, thereafter, every 1500 hours or 6 months (whichever comes first) of service, at the convenience of the customer or attendant. Obtain station release from attendant and then notify Data Test Center that the station will be out of service. If possible, give Data Test Center the number of a nearby phone to which station calls may be rerouted.

3.02 PERFORM VISUAL INSPECTION – EXTERNAL

(a) Check for and correct any visible defects in the station, including defective cords and connectors.

(b) If teletypewriter does not stand level, adjust leveling feet – tighten all leg mounting screws.

(c) Depress LOCAL button and then several graphic keys on keyboard of teletypewriter. Determine if set is basically operable — observe copy and listen for gear noise.

(d) Depress OFF button on teletypewriter.

3.03 COVER REMOVAL

WARNING: REMOVE ELECTRICAL POWER FROM THE STATION.

(a) Remove punch tape (ASR) and printer paper.

(b) Remove set cover as shown in the numbered steps of Figure 13.

3.04 PERFORM VISUAL INSPECTION — INTERNAL

(a) Check unit for dry bearings, oxide deposits, etc, which indicate lubrication breakdown.

(b) Check for deformed or missing springs or wicks, and cut or worn wiring insulation.

(c) Check for excessive wear in the areas shown in Figure 14. If permitted on customer premises, replace worn parts that are likely to cause operational failure before the next routine visit.

3.05 LUBRICATION

NOTE: Except as indicated, thoroughly lubricate set as follows. Avoid overlubrication which might permit lubricant to drip or be thrown into adjacent areas.

(a) The following areas must be kept dry (free of all lubrication).

(1) All electrical components including terminals

(2) Distributor brushes and disc face

(3) All magnet core faces and any surfaces which contact them

(4) All parts normally touched by an operator, including keytops and exposed surfaces in ribbon and paper handling areas

(5) All large flat areas.

(b) Use KS7470 oil in the following areas:

(1) All pivot surfaces

(2) All sliding contacting surfaces (unless otherwise noted)

(3) All spring hooks, comb guides, etc

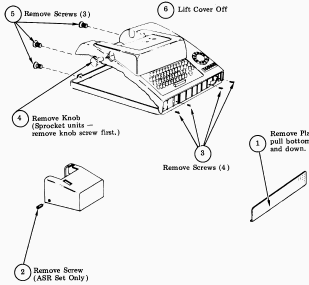


Figure 13 - Cover Removal Procedure

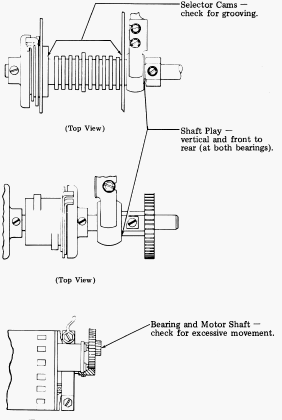
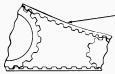
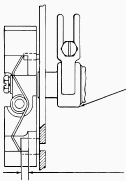


Figure 14 - Check Points for Excessive Wear





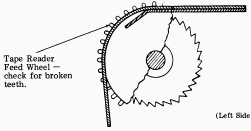


Figure 14 - Check Points for Excessive Wear (continued)

(4) Motor bearings

(5) All felt wicks (saturate)

(6) Long bearings (oil each end)

(7) Wipe inside dashpot cylinder with a lint free oiled cloth.

(c) Use KS7471 grease in the following areas:

(1) All drive gears and pinions.

(2) Intermediate shaft gear assembly bearing (Remove gear — pack grease between its two sintered metal bearings.)

(3) Extreme tips of magnet armature — where levers or latches contact armature extensions.

(4) Keyboard contact reset bail cam surface.

(d) The lubrication interval is dictated by the hours of use (including idle time) on a daily basis. The following chart and notes list the appropriate lubrication intervals.

LUBRICATION INTERVALS IN WEEKS BASED ON 5-DAY WEEK

	DAILY USE		
	0 to 8 Hours	8 to 16 Hours	16 to 24 Hours
INITIAL LUBRICATION	3 Weeks	2 Weeks	1 Week
REGULAR LUBRICATION (NOTE 2)	26 Weeks	13 Weeks	6 Weeks

NOTE 1: Reduce lubrication intervals 15 percent when usage is 6 days per week; 30 percent when usage is 7 days per week.

NOTE 2: Teletypewriters with typing unit serial numbers above 144,000 — use lubrication intervals given above; sets with typing units below 144,000 — reduce lubrication intervals 33 percent.

NOTE 3: The lubrication intervals are for the set as a whole — all components of the set should be lubricated at these intervals.

NOTE 4: At initial lubrication, recheck all clutch gaps in the typing unit to insure that the parts, after seating themselves, have not caused the gaps to open more. Reset if necessary. Standard readjustment periods are to be maintained thereafter.

3.06 SET CLEANING

CAUTION: DO NOT ALLOW SOLVENT TO COME INTO CONTACT WITH THE COVER, CLEAR WINDOW, CONTACT BLOCK ASSEMBLY, OR ANY OTHER PLASTIC PART.

(a) If type wheel characters are clogged, remove typing ribbon and place cloth under type wheel. Clean type wheel with a brush and, if necessary, mineral spirits (KS14722 or KS7860). Remove cloth and dirt particles, and replace ribbon.

(b) Wipe off any ink smudge or excessive lubricant.

(c) Remove paper dust, ribbon threads, spilled chad, etc.

(d) Clean external surfaces with a soft cloth and mild soap or detergent solution. Thoroughly rinse and buff surface dry.

3.07 OPERATION CHECK — GENERAL

(a) Check that selector thumbscrew is tight. Replace cover — do not fasten with mounting screws. Replace paper tape, printer paper rolls, and platen knob. Feed leading edge of tape from top of roll to punch (ASR) and leading edge of printer paper from bottom of roll to the printer.

(b) Connect station to electrical power source. Perform operating tests (Part 4).

(c) Upon successful completion of operating tests, secure cover with previously removed mounting screws. On sprocket feed units, check that platen knob is fully seated with its mounting screw tightened.

(d) Return station to service.

4. OPERATING TESTS

4.01 Use the following tests after installation, maintenance, or trouble call servicing. Perform the tests in the order presented, as applicable to the teletypewriter (ASR, KSR, or RO) tested.

4.02 Each numbered test operation is followed by its required response (preceded by .). If the unit does not respond as required, analyze the problem per associated Trouble Analysis No. in the Trouble Analysis Table (Part 6). If there is no reference number given, proceed as outlined in 6.02.

	TROUBLE ANALYSIS
4.03 LOCAL (OFF-LINE) TESTS	
A. RO, KSR, AND ASR TELETYPEWRITERS	
(1) Depress LOCAL button.	
• LOCAL lamp lights.	1
• Set motor turns on and unit runs closed.	2,3,4
• For Private Line station, PROCEED lamp lights.	1,5

(2) Remove paper from typing unit.
- For Private Line station, ALARM lamp lights. 1,6
- For DATA-PHONE station, PAPER ALARM lamp lights. 1,6
- ALARM or PAPER ALARM lamp goes out when paper is replaced.

(3) Manually change position of ribbon feed reversing arm.
- Ribbon feed operates in both directions.

(4) Depress OFF button.
- LOCAL lamp turns off. 2
- Set motor turns off.

(5) Release pressure roller (friction feed).
- Paper is free to move under platen.

(6) Check that wire paper guide is positioned for least interference with printed copy.

B. KSR AND ASR TELETYPEWRITERS ONLY

(1) Depress LOCAL button.
- LOCAL lamp lights.
- Set motor turns on and unit runs closed. 2,3,4
- For Private Line station, PROCEED lamp lights. 1,5

(2) Rapidly depress several keys on keyboard.
- Keyboard trips once for each key. 7
- Keys free of binds. 7
- Printer prints keyboarded characters. 3,8

(3) Depress each graphic key.
- Associated character is printed. 8

(4) Depress DELETE key.
- Printer cycles but does not space or print. 8,9

(5) Simultaneously depress CTRL and G (BELL) keys.
- Printer bell rings. 7
- Printer cycles but does not space or print. 8,9

(6) Depress RETURN key.
- Carriage returns fully to left margin without bouncing. 10,11

(7) Simultaneously depress REPT key and any other graphic key.
- Characters print repeatedly and are equally spaced. 11,12
- Printed characters are of uniform density. 13

(8) Depress NEW LINE key and SPACE bar at various positions along the platen.

(a) If new line feature is not disabled:
- Carriage returns to left margin. 10,11
- Line feed occurs. 14

(b) If new line feature is disabled:
- Line feed occurs. 14

(9) Repeatedly depress a graphic character key to determine number of character positions (from left margin) at which bell rings.
- Bell rings at about 60th character position. 9

(10) Place single/double line feed lever (if present) in single line feed position. Simultaneously depress REPT and a graphic character key to print several characters.
- Characters are printed.

(11) Depress NEW LINE (and RETURN) key. Depress any graphic key several times.
- Printer should provide single line feed as observed by positions of lines of printed characters. 9,14

(12) Repeat Step 11 two more times to check accuracy of line feed.

(13) Place line feed lever in double line feed position. Perform Steps 11 and 12 several times.
- Printer provides double line feed as evident by positions of lines of printed characters. 9,14

(14) Return single/double line feed lever to single line feed position.

(15) Sprocket feed sets only:
Depress LF then simultaneously depress CTRL and L (FF) keys.
- Form feeds out. 9,15
- After feed out, zero position pointers are aligned.

(16) Check printed customer form.
- Printing conforms to format.
- No printing over perforations.

(17) Depress NEW LINE and RETURN keys.
Type two lines of THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK TESTING 1234567890123 . . . (add or delete characters to match specific line length).

- Carriage returns to left margin and line feeds.
- Typing unit prints message with evenly spaced and aligned characters.
- Left margin is even.
- Carriage stops at end-of-line position.

(18) Depress HERE IS key.
- Answer-back turns on and cycles. 7,16
- Printer prints answer-back message.

(19) Simultaneously depress CTRL and E (ENQ) keys.
- Answer-back mechanism does not trip. 16
- Printer cycles but does not space or print. 8,9

(20) Simultaneously depress CTRL and E (ENQ) keys (printer cycles), then manually trip codebar clutch.
- Answer-back turns on and completes one cycle. 16
- Printer functions and prints.

(21) Manually trip answer-back magnet armature.
- Answer-back turns on and completes one cycle. 16
- Printer functions and prints.

(22) Depress HERE IS key, and during answer-back cycle, depress BREAK key.

(a) On DATA-PHONE station (TP186627 logic assembly):
- Printer runs open as long as BREAK key is depressed. (Random characters may be printed.) 17
- BREAK lamp does not light. 17
- Answer-back completes one cycle. 16

(b) On Private Line station (TP186680 logic assembly):
- Printer is not interrupted and continues to print answer-back message. 17

C. PUNCH AND READER (ASR Only)

(1) Simultaneously depress CTRL and R (DC2) keys. Depress several character keys.
- Selected character codes are punched in tape. 18
- Graphic characters are printed on printer.

(2) Simultaneously depress CTRL and T (DC4) keys. Depress several character keys.
- DC4 is last punched character in tape. Subsequent characters are not punched. 18

(3) Depress punch ON button. Depress several character keys.
- Selected character codes are punched in tape.
- Graphic characters are printed on printer. 18

(4) Depress nine character keys.
- Selected character codes are punched in tape.

(5) Depress B.SP. button five times, then depress DELETE key five times.
- Tape backs up one position each time B.SP. button is depressed.
- Overpunched code holes are aligned (not elongated) with previously punched code holes. 18

(6) Hold down REL. button.
- Tape can be pulled freely through punch.

(7) Depress tape punch ON button. Place stability test tape (TF326743 or equivalent) in tape reader and operate control lever to MANUAL START position.
- Check tape perforations for 10 holes per inch. 18
- Check for error-free copy on printer.
- Check copy for even left margin and for proper line feed. 11,14

(8) If test tape is not available, hold carriage print suppression mechanism forward with spring hook and depress REPT and NEW LINE keys simultaneously.
- Check for equal vertical spacing of printed asterisks. 14

(9) After reader reads a full cycle of test tape, replace test tape with tape from punch. Place reader control lever at MANUAL START and let reader operate for several minutes.
- Check for error-free copy on printer. 19
- Check for left-hand margin alignment. 11

(10) Operate control lever to MANUAL STOP, then to MANUAL START, repeating this several times to alternately stop and restart reader.
- Reader stops and restarts repeatedly without malfunction.
- Printer copies without error.

(11) As reader is operating (reading tape), release tape lid.
- Reader stops.

(12) Close reader tape lid. Place reader control lever in FREE position.
- Tape can be pulled through in either direction.

(13) Operate reader control lever to MANUAL START position to read tape. Raise reader tight-tape bail (back part of tape lid) by holding back end of tape as it feeds into reader.
- Reader operates, then stops when tight-tape bail is raised.

(14) Release tight-tape bail (back end of tape).
- Reader restarts to read tape and printer prints.

(15) Allow end of tape to enter into reader.
- Reader operates (and printer prints without error) until end of tape is sensed, then reader stops operating.

(16) Prepare test tape with punched characters as follows:
10 DELETES NEW LINE RETURN
MMMMMMMMM DC2 (CTRL R) DELETE
TTTTTTTTTT DC1 (CTRL Q) DELETE
OOOOOOOOO DC2 (CTRL S) DELETE
IIIIIIIII EOT (CTRL D) DELETE
DDDDDDDDD ENQ (CTRL E) DELETE NEW LINE RETURN
YYYYYYYYY ACK (CTRL F)
EEEEEEEEE DC4 (CTRL T)
XXXXXXXXX 10 DELETES

(17) Depress punch OFF button. Place test tape prepared in Step 16 in reader. Operate reader control lever to MANUAL START position.
- Reader turns on and reads tape.
- Punch does not operate.
- Printer prints ten M letters.
- When reader senses DC2 character:
  Punch turns on.
  DELETE and ten T characters are punched in tape.
  No M characters are punched.
- Printer prints ten T letters.
- When reader senses DC1 character:
  Reader stops operating.
  DC1 and DELETE characters are punched in tape.
  Punch stops operating.
  Printer stops printing.
  No O characters are punched or printed.

(18) Operate reader control lever to MANUAL START position.
- Reader turns on and reads tape.
- Punch punches ten O characters.
- Printer prints ten O letters.
- When reader senses DC3 character:
  Reader stops operating.
  DC3 and DELETE characters are punched in tape.
  Punch stops operating.
  Printer stops printing.
  No I characters are punched or printed.

(19) Operate reader control lever to MANUAL START position.
- Reader turns on and reads tape.
- Punch punches ten I characters.
- Printer prints ten I letters.

- When reader senses EOT character:
  Reader stops operating.
  EOT and DELETE characters are punched in tape.
  Punch stops operating.
  Printer stops printing.
  No D characters are punched or printed.

(20) Operate reader control lever to MANUAL START position.
- Reader turns on and reads tape.
- Punch punches ten D characters.
- Printer prints ten D letters.
- When reader senses ENQ character:
  Reader stops operating.
  ENQ and DELETE characters are punched in tape.
  Punch stops operating.
  Printer stops printing.
  No other characters are punched in tape.

(21) Operate reader control lever switch to MANUAL START position.
- Reader turns on and reads tape.
- Punch punches LINE FEED, CARRIAGE RETURN, ten Y characters, ACK, and ten E characters.
- Printer line feeds, carriage returns and prints ten Y letters and ten E letters.
- When reader senses DC4 character:
  DC4 character is punched in tape.
  Punch stops operating.
  No X characters are punched.
  Printer prints ten X letters.
- Reader continues to operate through DELETE characters at end of tape, then turns off.

For Sprocket Feed Sets Only

(22) Prepare test tape with punched characters as follows:
  10 DELETES NEW LINE RETURN
  AAAAAAAAAA FF (CTRL L) EOT DELETE
  PPPPPPPPPP 10 DELETES

(23) Depress punch ON button. Place test tape prepared in Step 22 in reader. Operate reader control lever to MANUAL START position.
- Reader reads tape.
- Printer prints ten A letters.
- Punch punches LINE FEED, CARRIAGE RETURN, ten A characters.
- When reader senses FF character:
  FF character is punched in tape.
  Printer forms-out and carriage returns.

- When reader senses EOT character:
  Reader stops operating.
  EOT and DELETE characters are punched in tape.
  Printer stops printing.

(24) Check each accessory (tape winder, paper winder, etc) under normal operating conditions.

4.04 ON-LINE TESTS — "DATA-PHONE" SERVICE (TP186627 Logic Assembly)

NOTE: Refer to 8.05 (c) for lighting of lamps and operation of the keys of the TP186627 Logic Assembly and Data Set/Data Auxiliary Set.

A. VOICE-MODE/SWITCHED TELEPHONE FACILITY CHECKS

(1) On Data Set (DS)/Data Auxiliary Set (DAS), lift handset off switchhook (go off-hook).
- If TALK key is depressed, dial tone is heard in receiver.
- If TALK key is not depressed, dial tone may not be heard — depress TALK key to get dial tone in receiver. (This operation depends on type of DS/DAS).

(2) Dial (rotary or TOUCH-TONE®) number of nearby telephone.
- When called telephone is answered, voice connection is completed and voice messages can be exchanged. 20A

(3) Replace handset on switchhook (go on-hook) to disconnect, then call station from nearby telephone.
- DS/DAS ringer rings. 20A

(4) Remove handset from switchhook, then replace.
- Ringer stops ringing. 20A

(5) If DS/DAS is equipped with card-dialer, place call to nearby telephone using card-dialer.
- Completed call indicates card-dialer operates properly. 20A

(6) Depress TALK key and remove handset from switchhook (in either sequence). Listen for dial tone, then depress DATA key.
- TALK and DATA keys may light, lock, and release, depending on DS/DAS type (see 8.05(c)). 20B

(7) Replace handset on switchhook.
- Teletypewriter set motor turns on and teletypewriter runs closed. 1,2,3,4
- ON lamp lights when DATA key is depressed for some DS/DAS types, or when handset is replaced on switchhook for other DS/DAS types.

(8) Remove paper from teletypewriter printer (reservoir if friction feed; platen if sprocket feed). 1,21
- ALARM lamp lights.
- Teletypewriter set continues to run closed.

(9) On DS/DAS, depress TALK key. 2
- Teletypewriter set turns off. 2,1
- ON lamp turns off.

(10) Depress TALK key and remove handset from switchhook (in either sequence). Listen for dial tone, then depress DATA key, as in Step 6. 21
- Teletypewriter set will not turn on.

(11) Replace handset on switchhook. Replace paper in teletypewriter printer reservoir or platen. 21
- ALARM lamp turns off.

(12) Continue this test according to the type of data set as follows:

DATA SET TYPE	TEST PROCEDURES TO FOLLOW	REFERENCE BSP SECTIONS	
		STATION TEST PROCEDURES WITH 904- TYPE DATA TEST CENTER	DATA SET TEST PROCEDURES
113A-	Par. 4.04 B.	668-400-300 668-101-511	591-033-500
103G-	Par. 4.04 C.	668-400-300 668-101-503	591-026-500
103A2	Par. 4.04 D.	668-400-300 668-101-500	591-014-500
103A3	Par. 4.04 E.	668-400-300 668-101-503	591-014-501
403E4, E7	Par. 4.04 F.	668-400-300 668-104-532	594-026-500

B. DATA SET 113A- TYPE

TROUBLE ANALYSIS

(1) Call the Serving Central Office (SCO) and request a remote test, or call direct to a 904- Type Data Test Center (DTC) and request Data Set 113A- Type Loop-Back Test (Test H in Sections 668-400-300 and 668-101-511). Give station telephone number. SCO or DTC will disconnect call.
- DTC establishes a voice connection with station. 20

(2) When instructed by DTC, depress DATA key when f2 Mark tone is heard in receiver.
- DATA lamp lights. 20
- TALK key comes up. 20

(3) Depress TEST key, then replace handset on switchhook.
- Teletypewriter does not turn on.
- Data set is in Test mode. 20
- DTC performs Loop-Back Test. 22

(4) As instructed by DTC, after test period (completion of Loop-Back Test), pick up handset and depress CLEAR-TALK key.
- TEST key comes up. 20
- DATA lamp turns off. 20
- DTC will give results of the test. 22

(5) Inform DTC that you will establish another voice connection from a nearby telephone for control purposes during the following tests. Maintain the data set voice connection while establishing the new voice connection from a nearby telephone in procedures worked out with the DTC.

(6) Inform DTC about placing station in Data mode at this time.

(7) With data set still voice-connected, as instructed by DTC, when f2 Mark tone is heard in data set receiver, depress DATA key and replace handset on switchhook.
- DATA lamp lights. 20
- TALK key comes up. 20
- Teletypewriter turns on and runs closed. 2C
- ON lamp on TP186627 Logic Assembly lights. 2C

(8) On nearby telephone connected with DTC, request Test E (Sending Distorted Signals to Station) in Section 668-400-300. Also perform supplementary procedures in Table D for this test.

(9) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test F (Measure Station Signal Distortion) in Section 668-400-300. Also perform supplementary procedures in Table E for this test.

(10) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test G (Check Ability of Station to Send and Receive a Timed Break) in Section 668-400-300. Also perform supplementary procedures in Table F for this test.

(11) On nearby telephone connected with DTC, request Stress Test and Other On-Line Control Tests according to Table G.

C. DATA SET 103G- TYPE

(1) Call the Serving Central Office (SCO) and request a remote test, or call direct to a 904- Type Data Test Center (DTC) and request Data Set 103E-, G-, H- Type Loop-Back Test (Test H in Sections 668-400-300 and 668-101-503). Give station telephone number, SCO or DTC will disconnect call.
- DTC establishes a voice connection with station. 20

(2) When instructed by DTC, during second ring cycle depress TEST key and hold down until TEST lamp lights.
- TEST lamp lights. 20
- Ringing stops. 20
- Teletypewriter does not turn on.
- Data set is in Test mode. 20
- DTC performs Loop-Back Test. 23

(3) As instructed by DTC, after test period (completion of Loop-Back Test) pick up handset and depress CLEAR-TALK key.
- TEST lamp turns off. 20
- DTC will give results of the test. 23

(4) Inform DTC that you will establish another voice connection from a nearby telephone for control purposes during the following tests. Maintain the data set voice connection while establishing the new voice connection from a nearby telephone in procedures worked out with the DTC.

(5) Inform DTC that you are going on-hook with the data set and disconnect from line, and request DTC to call station in Data mode.

(6) When data set rings, without removing handset from switchhook depress DATA key.
- DATA lamp lights. 20
- Teletypewriter turns on and runs closed. 2C
- ON lamp on TF186627 Logic Assembly lights. 2C

(7) On nearby telephone connected with DTC, request Test E (Sending Distorted Signals to Station) in Section 668-400-300. Also perform complementary procedures in Table D for this test.

(8) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test F (Measure Station Signal Distortion) in Section 668-400-300. Also perform complementary procedures in Table E for this test.

(9) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request a Break test similar to Test G (Check Ability of Station to Send and Receive a Timed Break) in Section 668-400-300. Also perform complementary procedures in Table F for this test.

(10) On nearby telephone connected with DTC, request Stress Test and Other On-Line Control Tests according to Table G.

(11) When teletypewriter station is released from telephone transmission line, place in Automatic Answer mode by depressing AUTO key on data set.
- AUTO key stays down and lamp lights. 20

(12) Request DTC to call teletypewriter station.
- DATA lamp lights. 20
- Ringer rings once. 20
- ON lamp lights. 2C
- Teletypewriter turns on and runs closed, and station is connected on-line. 2C

(13) Depress and release CLEAR-TALK key.
- DATA and ON lamps turn off. 20,2C
- Teletypewriter turns off. 2C
- Station is released from telephone transmission line. 20

D. DATA SET 103A2 TYPE WITH DATA AUXILIARY SET 804B1 TYPE

(1) Call the Serving Central Office (SCO) and request a remote test, or call direct to a 904-Type Data Test Center (DTC) and request Data Set 103A2 Type Loop-Back Test (Test H in Sections 668-400-300 and 668-101-500). Give station telephone number. SCO or DTC will disconnect call.
- DTC establishes a voice connection with station. 20

(2) When instructed by DTC, when fl Space tone is heard in receiver, depress TEST 1 key and hold down until TEST 1 lamp lights.
- TEST 1 lamp lights. (DATA lamp may light before TEST 1 lamp lights.) 20

(3) Replace handset on switchhook.
- Teletypewriter does not turn on.
- Data set is in Test mode. 20
- DTC performs Loop-Back Test. 24

(4) As instructed by DTC, after test period (completion of Loop-Back Test) pick up handset and depress TALK key.
- TEST 1 lamp turns off. 20
- DTC will give results of test. 24

(5) Inform DTC that you will establish another voice connection from a nearby telephone for control purposes during the following tests. Maintain the data set voice connection while establishing the new voice connection from a nearby telephone in procedures worked out with the DTC.

(6) Inform DTC about placing station in Data mode at this time.

(7) With data set still voice-connected, as instructed by DTC, depress DATA key when fl Space tone is heard in data set receiver, and replace handset on switchhook.
- DATA lamp lights. 20
- TALK key comes up. 20
- TEST 1 lamp turns off. 20
- Teletypewriter turns on and runs closed. 2C
- ON lamp on TP186627 Logic Assembly lights. 2C

(8) On nearby telephone connected with DTC, request Test E (Sending Distorted Signals to Station) in Section 668-400-300. Also perform complementary procedures in Table D for this test.

(9) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test F (Measure Station Signal Distortion) in Section 668-400-300. Also perform complementary procedures in Table E for this test.

(10) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test G (Check Ability of Station to Send and Receive a Timed Break) in Section 668-400-300. Also perform complementary procedures in Table F for this test.

(11) On nearby telephone connected with DTC, request Stress Test and Other On-Line Control Tests according to Table G.

(12) Arrange with DTC to call station in order to check ability of station to answer a call directly in the Data mode. Procedure will depend on whether or not data set is strapped for permanent answering option.

(a) If data set is strapped for permanent answering option, upon receipt of a call from DTC,
- DATA lamp lights. 20
- ON lamp lights. 2C
- Teletypewriter turns on and runs closed, and station is connected on-line in Data mode. 2C

(b) If data set is not strapped for permanent answering option, depress AUTO key.
- AUTO key stays down and lamp lights. Upon receipt of call from DTC, 20
- DATA lamp lights. 20
- Ringer rings once. 20
- ON lamp lights. 20
- Teletypewriter turns on and runs closed, and station is connected on-line in Data mode. 2C

(13) Request DTC go into Talk mode, and place station in Talk mode by depressing TALK key. If data set is not strapped for permanent answering option,
- AUTO key comes up and lamp turns off. 20
- TALK key stays down. 20
- DATA and ON lamps turn off. 20,2C
- Teletypewriter turns off. 2C
- Station is released from telephone transmission line. 20

E. DATA SET 103A3 TYPE WITH TELEPHONE SET 565HK, 2565HK, 66ZA1, OR 2662A1 TYPE

(1) Call the Serving Central Office (SCO) and request a remote test, or call direct to a 904-Type Data Test Center (DTC), and request Data Set 103A3 Type Loop-Back Test in Section 668-101-503, Addendum 1 to Issue 3. If the data set has been modified to operate in the "inverted" frequency mode (Data Set 103E5 Type replaced with either Data Set 103E2 or 103E4 Type so optioned), inform DTC of the change. Give station telephone number. SCO or DTC will disconnect call.
- DTC establishes a voice connection with station. 20

(2) When instructed by DTC, with MANUAL ANS key depressed, during second ring cycle depress TEST key and hold down until TEST lamp lights.
- TEST lamp lights. 20
- Ringing stops. 20
- Teletypewriter does not turn on.
- Data set is in Test mode. 20
- DTC performs Loop-Back Test. 23

(3) As instructed by DTC, after test period (completion of Loop-Back Test), pick up handset and depress CLEAR-TALK key.
- TEST lamp turns off. 20
- DTC will give results of test. 23

(4) Inform DTC that you will establish another voice connection from a nearby telephone for control purposes during the following tests. Maintain the data set voice connection while establishing the new voice connection from a nearby telephone in procedures worked out with the DTC.

(5) Inform DTC that you are going on-hook with the data set and disconnect from line, and request DTC to call the station in the Data mode.

(6) When data set rings, without removing handset off-hook, depress DATA key.
- DATA lamp lights. 20
- Teletypewriter turns on and runs closed. 2C
- ON lamp on TP186627 Logic Assembly lights. 2C

(7) On nearby telephone connected with DTC, request Test E (Sending Distorted Signals to Station) in Section 668-400-300. Also perform complementary procedures in Table D for this test.

(8) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test F (Measure Station Signal Distortion) in Section 668-400-300. Also perform complementary procedures in Table E for this test.

(9) For ASR and KSR teletypewriter stations only, on nearby telephone still connected with DTC, request Test G (Check Ability of Station to Send and Receive a Timed Break) in Section 668-400-300. Also perform complementary procedures in Table F for this test.

(10) On nearby telephone connected with DTC, request Stress Test and Other On-Line Control Tests according to Table G.

(11) When station is released from telephone transmission line, place in Automatic Answer mode by depressing AUTO ANS key on data set.
- AUTO ANS key stays down and lamp lights. 20

(12) Request DTC to call teletypewriter station.
- DATA lamp lights. 20
- Ringer rings once. 20
- ON lamp lights. 2C
- Teletypewriter turns on and runs closed, and station is connected on-line. 2C

(13) Depress and release CLEAR-TALK key.
- CLEAR-TALK lamp momentarily lights during disconnect sequence. 20
- AUTO ANS key comes up and lamp turns off. 20
- DATA and ON lamps turn off. 20,2C
- Teletypewriter turns off. 2C
- Station is released from telephone transmission line. 20

F. DATA SET 403E4, E7 TYPE WITH DATA AUXILIARY SET 804G- TYPE

(1) Call the Serving Central Office (SCO) and request a remote test, or call direct to a 904- Type Data Test Center (DTC) and request Data Set 403E7 (and 403E4) Loop-Back Test per Section 668-104-532. Give station telephone number. SCO or DTC will disconnect call.
- DTC establishes a voice connection with station. 20

(2) When instructed by DTC, depress TEST key. 20
- TEST lamp lights. 20
- TALK key stays down. 20

(3) Replace handset on switchhook.
- TALK lamp turns off (but remains down). 20
- Telephone line releases but data set remains locked in Test mode. 20

(4) DTC originates a call to data set.
- DATA lamp lights, and ringer rings once. 20
- Data set is in Test mode. 20
- DTC performs Loop-Back Test. 25A

(5) As instructed by DTC, after test period (completion of Loop-Back Test) pick up handset from switchhook.
- TALK lamp lights. 20
- DATA and TEST lamps turn off. 20
- DTC will give results of the test. 25

(6) Inform DTC that you will now establish another voice connection from nearby telephone for control purposes during the following tests. Maintain the data set voice connection while establishing the new voice connection from a nearby telephone in procedures worked out with the DTC.

(7) Inform DTC that you are going off-hook with the data set and disconnect from telephone transmission line. Replace handset on switchhook.
- TALK lamp turns off. 20

(8) On nearby telephone connected with DTC, request DTC to use TOUCH-TONE dial to call teletypewriter station.
- Data set rings once. 20
- DATA lamp lights. 20
- Teletypewriter turns on and runs closed. 2C
- ON lamp on TP186627 Logic Assembly lights. 2C

(9) Request DTC to depress all ten number keys on TOUCH-TONE pad in sequence, for five sequences.
- Teletypewriter prints five sequences of numbers. 25I
- If ASR, characters should punch on tape. 25I

(10) Request DTC to depress * key on TOUCH-TONE pad.
- Teletypewriter will function with the ASCII character for which the C1 (*) option is strapped, per the service order at time of installation. Generally this function is Line Feed (LF). 25J

(11) Request DTC to depress # key on TOUCH-TONE pad.
- Teletypewriter will function in accordance with the ASCII character for which the C2 (#) option is strapped, per the service order at time of installation. Generally this function is Carriage Return (CR), and if "New Line" feature is enabled, the set will line feed and carriage return. 25J

(12) Request DTC to depress # key on TOUCH-TONE pad twice in succession.
- Teletypewriter will function in accordance with the ASCII character for which the C3 (##) option is strapped, per the service order at time of installation. Generally this function is End of Transmission (EOT), in which case station turns off and releases from telephone transmission line. 25J

TABLE D

RECEIVING DISTORTED SIGNALS FROM DATA TEST CENTER
(SUPPLEMENT TO TEST E OF SECTION 668-400-500)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1. Teletypewriter station must be in Data mode with DTC, and voice connection must be maintained with DTC on nearby telephone.		
2. On voice-connected telephone, request DTC to send a distorted signal to be received at the teletypewriter station with 33% Switched Combination Distortion*. (If teletypewriter is ASR, depress tape punch ON button.)		
3. On voice-connected telephone, request test message to start.	Test message is printed (and punched, if ASR) ungarbled and error-free.	26,9,11,8, 12,13,14, 18

*DTC must set Test Sentence Generator (TSG) controls as follows: BIAS to SWC, DIST 5% and DIST 1% to a value of 33% MINUS 1/2 the value measured in a Loop-Back Test plus 1-1/2%.

Example:
Distortion measured in Loop-Back Test — 18% (max)
One-half this amount of distortion — 9%
33 - 9 + 1-1/2 = 25-1/2%

The DIST 5% control should be set to 5, and the DIST 1% control to 0.

TABLE E

MEASURE STATION SIGNAL DISTORTION FROM TELETYPEWRITER STATION TO DATA TEST CENTER
(SUPPLEMENT TO TEST F OF SECTION 668-400-300)

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	Teletypewriter station must be in Data mode with DTC, and voice connection must be maintained with DTC on nearby telephone.		
2.	On voice-connected telephone, inform DTC you are going to keyboard a series of U*.	Amount of distortion received at DTC is reported back on voice-connected telephone.	27
3.	Inform DTC you are going to operate HERE IS key several times. Each time HERE IS key is depressed, wait for answer-back drum to complete cycle before again depressing key.	Amount of distortion received at DTC is reported back on voice-connected telephone.	27,16
4.	For ASR only, inform DTC you are going to send a message from tape reader. Place stability test tape (TP326743 or equivalent) in tape reader and operate control lever to MANUAL START position.	Amount of distortion received at DTC is reported back on voice-connected telephone.	27,19

TABLE F

CHECK ABILITY OF STATION TO SEND AND RECEIVE A TIMED BREAK
(SUPPLEMENT TO TEST G OF SECTION 668-400-300)

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	Teletypewriter must be connected in Data mode with DTC, and voice connection must be maintained with DTC on nearby telephone.		
2.	On voice-connnected telephone, inform DTC you are going to keyboard a continuous series of graphic characters, and request DTC send or Break (interrupt) signal during this series of characters.	When Break signal is received, printer runs open for 3 or 4 characters, then runs closed. Printing of random character permissible. BRK RLS lamp lights when Break signal is received. Keyboard is blinded and no data can be sent on line. Check that DTC receives no data. If station is in HDX (Half-Duplex) mode, printer prints from own keyboard until Break signal is received.	17 17
3.	Depress BRK RLS button. Send characters from keyboard.	BRK RLS lamp goes out. DTC receives subsequent keyboarded characters.	17
4.	If teletypewriter is ASR, place test tape in tape reader. Operate control lever to MANUAL start position. Request DTC to send Break (interrupt) signal during tape transmission.	DTC receives test message. When Break signal is received from DTC, reader turns off. When Break signal is received, printer runs open for 3 or 4 characters, then runs closed. Printing of random character permissible.	

TABLE F (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
4 (Cont)	BRK RLS lamp lights. If station is in HDX mode, printer prints from tape reader. Upon receipt of Break signal, printer stops printing.	17
5. Depress BRK RLS button. Operate tape reader control lever to MANUAL START position.	BRK RLS lamp goes out. Reader turns on and DTC receives data.	17
6. Operate tape reader control lever to MANUAL STOP position.	Reader turns off.	
7. Have DTC send message to station. If teletypewriter is ASR, depress tape punch ON button.	Printer prints and tape is punched with incoming message.	
8. During receipt of incoming message, depress BREAK button MOMENTARILY (holding BREAK button down too long will disconnect station from line).	Printer stops printing incoming message, and punch stops operating if ASR.	17

TABLE G

STRESS TEST AND OTHER ON-LINE CONTROL TESTS

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1. Teletypewriter station must be connected in Data mode with DTC, and voice connection must be maintained with DTC on nearby telephone.		
2. On voice-connected telephone, request DTC to send Stress Test for Model 33 Teletypewriter Station.	From the data transmission line, this tests the maximum mechanical capabilities of the teletypewriter set, as well as checking the capability of the data set to receive without distorting the received data.	28
3. With teletypewriter station still turned on, request DTC to send ENQ (or WRU, CTRL E).	Answer-back mechanism operates and answer-back message is received at DTC.	16
4. If teletypewriter is ASR, place punched test tape in tape reader. Request DTC to send DC1 (or X-ON, CTRL Q).	Tape reader starts. Message is sent to DTC, and if station is in HDX mode, is also printed out. Message received by DTC is error-free.	19A 19B
5. If ASR teletypewriter is in Full Duplex (FDX) mode, and not copying on own printer, request DTC to send DC3 (or X-OFF, CTRL S). If in HDX mode, operate tape reader control lever to MANUAL STOP position.	Tape reader stops operating.	
6. Request DTC to send ACK (CTRL F).	Tape reader starts. Message is copied on printer (if in HDX mode) and received by DTC error-free.	19A,19B

TABLE G (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
7. If ASR teletypewriter is in FDX mode, and not copying on own printer, request DTC to send ENQ (or WRU, CTRL E). If in HDX mode, operate tape reader control lever to MANUAL STOP position.	Tape reader stops operating.	
8. Depress punch OFF button.		
9. Request DTC to send DC2 (or TAPE, CTRL R), then a test message.	Punch turns on and punches all characters received from line.	18A,18C
10. Request DTC to send DC4 (or TAPE, CTRL T), then more characters.	Punch turns off and does not punch any characters after DC4.	18B
11. If teletypewriter has sprocket feed printer, request DTC send, in rapid succession, some graphic characters, FF (Form Feed, CTRL L), EOT (End of Transmission, CTRL D), one DELETE (RUBOUT), and more graphic characters.	Teletypewriter prints (and punches if ASR with punch ON button depressed) the graphic characters, forms out (and carriage returns if "New Line" feature is enabled), and disconnects from data transmission line, but motor does not turn off until form-out (and carriage return) is completed.	14,15,2C
12. If teletypewriter has friction feed printer, request DTC send some graphic characters, EOT (End of Transmission, CTRL D), one DELETE (RUBOUT), and more graphic characters.	Teletypewriter prints (and punches if ASR with punch ON button depressed) the graphic characters, then disconnects from line without printing additional graphic characters.	2C

4.05 ON-LINE TESTS — GENERAL PURPOSE, POINT-TO-POINT PRIVATE LINE SERVICE (TP186680 Logic Assembly)

NOTE: Refer to 8.05 (c) for lighting of lamps and operation of keys of the logic assembly.

On-line tests are performed according to the type of data set and terminal station arrangement as follows:

DATA SET TYPE USING DAS 8200 TYPE (Except 1A Data Station)	REFERENCE BSP SECTIONS: STATION TESTS WITH PRIVATE LINE SERVICE BOARD (PLS) AND 904 TYPE DATA TEST CENTER (DTC)	REFERENCE BSP SECTIONS: DATA SET TEST PROCEDURES	TERMINAL STATION SERVICE ARRANGEMENTS	TEST PROCEDURES TO FOLLOW
108A-, C-	668-100-500 668-101-610	591-023-501	Station-to-Hub Telegraph Channel Service (PLS) Voiceband Data Circuit (DTC)	Par. 4.05 A.
108D-, E- (Full Duplex)		591-028-501	Station-to-Station	Par. 4.05 A.
109A-		591-024-501	Station-to-Station Station-to-Hub	Par. 4.05 B.
109E- (Full Duplex)		591-036-502	Station-to-Hub Station-to-Station	Par. 4.05 B.
1A Data Station (Single Channel Arrangement, Binary)		591-813-501	Station-to-Hub Telegraph Channel Service (PLS) Voiceband Data Circuit (DTC)	Par. 4.05 C.
			Station-to-Station 1A Data Station at Far End	Par. 4.05 C.
			Station-to-Station 42A1 Terminal (VFCT) at Far End	Par. 4.05 C.

A. DATA SET 108A-, C-, D-, E- TYPE WITH DATA AUXILIARY SET 820D- TYPE

TROUBLE ANALYSIS

(1) Teletypewriter set motor not running.

(2) OUT OF SERVICE lamp (and all other lamps) on TP186680 Logic Assembly should not be lit. If lit, use 1013- Type Hand Test Set to check for presence of carrier signal (audio frequency or tone) on telephone data transmission line as follows:

(a) Remove ac power from Data Auxiliary Set 820D- Type, then remove the plastic housing, if present.

(b) Set 1013 handset TALK/MON switch to MON position.

(c) Connect 1013 handset leads to TB1 terminals 1 and 2 of Data Auxiliary Set 820D- Type.
- Carrier signal tone from far-end (remote) data set should be heard in 1013 handset. 29A

(d) Reconnect ac power to Data Auxiliary Set 820D- Type.
- Two signal tones should be heard in 1013 handset. Louder of two tones is from near-end (local) data set. 29B
- Carrier signals present, but OUT OF SERVICE lamp should not be lit. 29C

(3) Proceed with tests according to the type of service (Station-to-Hub or Station-to-Station).

STATION-TO-HUB ARRANGEMENT

(1) On nearby telephone, call a Private Line Serviceboard (PLS) if a Telegraph Channel, or a 904- Type Data Test Center (DTC) if Voiceband Data Circuit, and request Data Set 108A-, C-, D-, E- Type Loop-Back Test per Sections 668-100-500 and 668-101-510. 29E

(2) When instructed by PLS or DTC, depress TEST key on TP186680 Logic Assembly.
- TEST and OUT OF SERVICE lamps light. 1,29D
- Teletypewriter does not turn on. 29D
- Data set is in Test mode. 29E
- PLS or DTC performs Loop-Back Test.

(3) When instructed by PLS or DTC after completion of Loop-Back Test, depress ON key on TP186680 Logic Assembly.
- TEST and OUT OF SERVICE lamps turn off. 29C
- PLS or DTC will give results of test. 29E

(4) If PLS or DTC is equipped with a Test Sentence Generator (TSG) capable of sending distorted signals of various types and amounts to the teletypewriter station, perform the Receiving Distorted Signals tests in Table H. If PLS or DTC is not equipped with TSG, refer to the distortion tests of Table N.

(5) For ASR and KSR teletypewriter stations only, if PLS or DTC is equipped with a Distortion Measuring Set (DMS) capable of measuring distorted signals of various types and amounts from the teletypewriter station, perform the Sending Distorted Signals tests in Table I. If PLS or DTC is not equipped with DMS, refer to sending distortion tests of Table N.

(6) If PLS or DTC is equipped with Stress Test Repeater (STR), request the Stress Test for Model 33 Teletypewriter Station.

NOTE: If Stress Test Repeater is not available, disregard this test.

- From the data transmission facilities, this tests the maximum mechanical capabilities of the teletypewriter set as well as checking the capabilities of the data set to receive without distorting the received data. 28
- During this test, ON and PROCEED lamps are lit. 1,2,5,29C

(7) For ASR and KSR teletypewriter stations only, perform Break Test according to Table J.

(8) Perform Other On-Line Control Tests according to Table K.

STATION-TO-STATION OPERATION

(1) Perform Carrier Frequency Measurements according to Table L.

(2) Perform Loop-Loss Check of Telephone Data Transmission Line Facilities according to Table M.

(3) Perform Loop-Back Test — Data Set and Transmission Facilities Distortion Tests according to Table N.

(4) For ASR and KSR teletypewriters only, perform Break Test according to Table J.

(5) Perform Other On-Line Control Tests according to Table K.

(6) Check ability of station to go into Test mode according to Table O.

B. DATA SET 109A-, E- TYPE WITH DATA AUXILIARY SET 820D- TYPE

(1) Teletypewriter set motor not running.

(2) OUT OF SERVICE lamp (and all other lamps) on TP186680 Logic Assembly should not be lit. If lit, check for presence of signal current on telephone transmission data line as follows:

(a) Set function selector of KS-20538-L1 VOM, or equivalent, to measure 12 mA dc.

(b) Remove ac power from Data Auxiliary Set, then remove the plastic housing, if present.

(c) Disconnect telephone transmission lead from terminal board TB1 terminal 1 of Data Auxiliary Set and connect to positive (+) lead of VOM.

(d) Connect negative (-) lead of VOM to TB1 terminal 1.

(e) Reconnect ac power to Data Auxiliary Set.
- VOM indicates 3.0 to 3.2 mA dc (marking). 30A

(f) Remove ac power, disconnect VOM, and reconnect telephone transmission lead to TB1 terminal 1. Replace plastic housing on Data Auxiliary Set, and restore ac power.
- Signal current present on transmission data line, but OUT OF SERVICE lamp should not be lit. 30B

(3) Proceed with tests according to the type of data set (109A- or 109E-) and type of service (Station-to-Hub or Station-to-Station).

DATA SET 109E- TYPE STATION-TO-HUB ARRANGEMENT, DATA AUXILIARY SET 820D- TYPE IN FULL DUPLEX (FDX) MODE

(1) For Station-to-Hub Arrangement, on nearby telephone, call the hub or call a Private Line Serviceboard (PLS) if a Telegraph Channel, or a 904- Type Data Test Center (DTC) if a Voiceband Data Circuit, and request Data Set 109E- Type Loop-Back Test.

(2) When instructed by Hub/PLS/DTC, depress TEST key on TP186680 Logic Assembly.
- TEST and OUT OF SERVICE lamps light. 1,30C
- Teletypewriter does not turn on.
- Data set in Test mode. 30C
- Hub/PLS/DTC performs Loop-Back Tests. 30D

(3) As instructed by Hub/PLS/DTC after completion of Loop-Back Test, depress TEST key on TP186680 Logic Assembly.
- TEST and OUT OF SERVICE lamps turn off. 30B
- Hub/PLS/DTC will give results of tests. 30D

(4) If Hub/PLS/DTC is equipped with a Test Sentence Generator (TSG) capable of sending distorted signals of various types and amounts to the teletypewriter station, perform the Receiving Distorted Signals tests in Table H. If not, refer to loop-back and receiving distortion tests of Table N.

(5) For ASR and KSR teletypewriter stations only, if Hub/PLS/DTC is equipped with a Distortion Measuring Set (DMS) capable of measuring distorted signals of various types and amounts from the teletypewriter station, perform the Sending Distorted Signals Tests in Table I. If not, refer to sending distortion test of Table N.

(6) If Hub/PLS/DTC is equipped with a Stress Test Repeater (STR), request the Stress Test for Model 33 Teletypewriter Station.

NOTE: If STR is not available, disregard this test.

- From the data transmission facilities, this tests the maximum mechanical capabilities of the teletypewriter set as well as checking the capabilities of the data set to receive without distorting the received data. 28
- During this test, ON and PROCEED lamps are lit. 1,2,5,30B

(7) For ASR and KSR teletypewriter stations only, perform Break Test according to Table J.

(8) Perform Other On-Line Control Tests according to Table K.

DATA SET 109E- TYPE, STATION-TO-STATION ARRANGEMENTS, DATA AUXILIARY SET 820D- TYPE IN FULL DUPLEX (FDX) MODE

(1) Perform Loop-Back Test — Data Set and Transmission Facilities Distortion Tests according to Table N.

(2) For ASR and KSR teletypewriters only, perform Break Test according to Table J.

(3) Perform Other On-Line Control Tests according to Table K.

(4) Check ability of station to go into Test mode according to Table O.

DATA SET 109A-TYPE, STATION-TO-HUB AND STATION-TO-STATION ARRANGEMENTS

(1) Check Sending Signal Distortion of Data Facilities as follows:

(a) At both near-end (local) and far-end (remote) stations: Remove ac power from 820D-Type Data Auxiliary Sets and teletypewriter sets. Remove connector P2 of cable to TP186680 Logic Assembly from 25-pin connector J3 of Data Auxiliary Set. Connect W2A cord of J79901B-L3 Interface Test Adapter (ITA) (cover of 901B Data Test Set) to connector J3 of Data Auxiliary Set. Make sure all shorting bars are closed on 901B cover.

(b) At near-end station: Interconnect 901B cover and 911B Test Sentence Generator (TSG of J79911A Data Test Set) as in Figure 16.

(c) At far-end station: Interconnect 901B cover and 911C Distortion Measuring Set (DMS of J79911A Data Test Set) as in Figure 17.

(d) At near-end station: Apply ac power to Data Auxiliary Set and TSG. On TSG, operate RESET switch, then operate AUTO./MAN./STEP switch to AUTO. position.

(e) At far-end station: On DMS, operate PIP/PK switch to PIP, then back to PK, then operate RESET switch.
- At far-end station, DMS indicates amount of distortion. 30E

(f) At near-end station, operate AUTO./MAN./STEP switch of TSG to MAN. position.

(2) Check Sending Signal Distortion of Teletypewriter Station as follows:

(a) At far-end (remote) station: Do not disconnect 901B cover from DMS. Connect plug P2 of TP186689 Logic Assembly cable to 25-pin connector of 901B cover. Apply ac power to teletypewriter set.

(b) At near-end (local) station:
Remove connector of W25A cord of 901B cover from 25-pin connector J3 of Data Auxiliary Set, and connect plug P2 of cable of TP186680 Set Logic Assembly to connector J3 of Data Auxiliary Set. Apply ac power to teletypewriter set.

(c) At far-end station, operate RESET switch on DMS.

(d) At near-end station:
Inform far-end station that a series of U* will be sent from keyboard.
- Far-end station to report back amount of distortion measured on DMS, and whether or not printing is ungarbled and error-free. 30F

(e) Inform far-end station that Answer-Back will be sent several times.

(f) Depress HERE IS key several times. Each time wait for answer-back drum to complete its cycle before again depressing key.
- Far-end station to report back amount of distortion measured on DMS, and whether or not answer-back message is printed ungarbled and error-free. 30F,16

(g) If teletypewriter is ASR, inform far-end station that a message will be sent from tape reader.

(h) Place stability test tape (TP326743 or equivalent) in tape reader and operate control lever to MANUAL START position.
- Far-end station to report back amount of distortion measured on DMS, and whether or not message is printed ungarbled and error-free. 30F,19
- During this test, ON and PROCEED lamps are lit. 1,2,5,30B

(3) Check Receiving Signal Distortion of Data Facilities as follows:

(a) At near-end (local) station:
Remove ac power from Data Auxiliary Set, teletypewriter set, and TSG. Disconnect TSG from 901B cover. Disconnect plug P2 of TP186680 Logic Assembly cable from connector J3 of Data Auxiliary Set. Connect W25A cord of 901B cover to connector J3 of Data Auxiliary Set. Connect DMS to 901B cover and set DMS switches as in Figure 17.

(b) At far-end (remote) station:
Remove ac power from Data Auxiliary Set, teletypewriter set, and DMS. Disconnect DMS and plug P2 of TP186680 Logic Assembly cable from 901B cover. Connect TSG to 901B cover and set TSG switches as in Figure 16. Apply ac power to Data Auxiliary Set and TSG. On TSG, operate RESET switch, then operate AUTO./MAN./STEP switch to AUTO. position.

(c) At near-end station:
Apply ac power to Data Auxiliary Set and DMS. Operate RESET switch.
- At near-end (local) station, DMS indicates amount of distortion. 30E

(d) At far-end station, operate AUTO./MAN./STEP switch on TSG to MAN. position.

(4) Check Receiving Signal Distortion of Teletypewriter Station as follows:

(a) At near-end (local) station:
Do not disconnect 901B cover and DMS. Connect plug P2 of TP186680 Logic Assembly to 25-pin connector on face of 901B cover.
Apply ac power to teletypewriter set.

(b) At far-end (remote) station:
Set TSG switches: Bias to SWC (Switched Combination Distortion), DIST 5% and DIST 1% to value of 33% MINUS the value of distortion measured in Step 3 (c).
Operate AUTO./MAN./STEP switch to AUTO. position.

(c) At near-end station:
Operate RESET switch on DMS. If teletypewriter is ASR, depress tape punch ON button.
- ON and PROCEED lamps light. 1,2,5,30B
- Teletypewriter set turns on and prints ungarbled and error-free.
- Amount of distortion indicated on DMS. 30G
- Test message punches error-free (ASR only). 18

(d) At far-end station:
Operate AUTO./MAN./STEP switch on TSG to MAN. position.

(5) At near-end station, remove connector P2 of cable of TP186680 Logic Assembly from connector of 901B cover. At both near-end and far-end stations:

Remove connector of W25A cord of 901B cover from 25-pin connector J9 of Data Auxiliary Set. Connect plug P2 of cable from TP186680 Logic Assembly to connector J3 of Data Auxiliary Set.

(6) For ASR and KSR teletypewriters only, perform Break Test according to Table J.

(7) Perform Other On-Line Control Tests according to Table K.

C. 1A DATA STATION, SINGLE CHANNEL ARRANGEMENTS (SCA), BINARY MODE

(1) Teletypewriter set motor not running.

(2) OUT OF SERVICE lamp (and all other lamps) on TP186680 Logic Assembly should not be lit. If lit, use 1013- Type Hand Test Set to check for presence of carrier signal (audio frequency or tone) on data line as follows:

(a) Remove ac power from 1A Data Station.

(b) Set 1013 handset TALK/MON switch to MON position.

(c) Connect 1013 handset leads to terminals 2 and 5 of 1A Data Station terminal board TS(A) (2-wire) on 31A2 data mounting.
- Carrier signal tone from far-end (remote) data station should be heard in 1013 handset. 31B, 31C

(d) Reconnect ac power to 1A Data Station.
- Two signal tones should be heard in 1013 handset. The louder of the two tones is from transmitter of data station under test. 31B,31D
- Carrier signals present, but OUT OF SERVICE lamp should not be lit. 31E,31I 31J, 31K

(3) Proceed with tests according to the type of service (Station-to-Hub, Telegraph Channel Service, Voiceband Data Circuit, Station-to-Station with 1A Data Station at far-end, or Station-to-Station with 43A1 Terminal Station at far-end).

STATION-TO-HUB ARRANGEMENT, TELEGRAPH CHANNEL SERVICE, OR VOICEBAND DATA CIRCUIT SERVICE

(1) On nearby telephone, call a Private Line Serviceboard (PLS) if a Telegraph Channel, or a 904- Type Data Test Center (DTC) if Voiceband Data Circuit, and request 1A Data Station (SCA) Binary Mode Loop-Back Tests. 31G

(2) On nearby telephone, tell PLS/DTC the Circuit Pack DP numbers and frequencies as stamped on TRMTR and on the DEM circuit packs.

(3) When instructed by PLS/DTC, depress TEST key on TP186680 Logic Assembly.
- TEST and OUT OF SERVICE lamps light. 1,31F
- Teletypewriter does not turn on.
- 1A Data Station is in Test mode.
- PLS/DTC performs Loop-Back Test. 31F

(4) As instructed by PLS/DTC after completion of Loop-Back Tests, depress TEST key on TP186680 Logic Assembly.
- TEST and OUT OF SERVICE lamps turn off. 31E
- PLS/DTC will give results of tests. 31G

(5) Receive Bias Equalization Check.

(a) If PLS/DTC is equipped with a Test Sentence Generator (TSG) capable of sending distorted signals of various types and amounts, and if telephone that is connected to PLS/DTC for test coordinating is near the teletypewriter station, connect 911C Distortion Measuring Set (DMS) (J79911A DTS), or equivalent, as in Figure 17 and set PIP/PK switch of DMS to PIP.

(b) Request a 150 baud signal, predistorted alternately with 25% Marking bias and 25% Spacing bias.
- On DMS, equal Marking bias and Spacing bias is received. 31H

(c) Remove DMS and adapters from 1A Data Station, reconnect teletypewriter set, and resume testing with PLS/DTC.

(6) If PLS/DTC is equipped with a Test Sentence Generator (TSG) capable of sending distorted signals of various types and amounts to the teletypewriter station, continue this test according to Table H. If not, refer to loop-back and receiving distortion tests of Table N.

(7) For ASR and KSR teletypewriters only, if PLS/DTC is equipped with a Distortion Measuring Set (DMS) capable of measuring distorted signals of various types and amounts from teletypewriter station, continue this test according to Table I. If not, refer to sending distortion test of Table N.

(8) If PLS/DTC is equipped with Stress Test Repeater (STR), request the Stress Test for Model 33 Teletypewriter Station.

NOTE: If STR is not available, disregard this test.

- From the data transmission facilities, this tests the maximum mechanical capabilities of the teletypewriter set as well as checking the capabilities of the 1A Data Station to receive data without distortion. 28
- During the test, ON and PROCEED lamps are lit. 1,2,5,31E

(9) For ASR and KSR teletypewriters only, perform Break Test according to Table J.

(10) Perform Other On-Line Control Tests according to Table K.

STATION-TO-STATION ARRANGEMENT WITH 1A DATA STATION (SCA), BINARY MODE AT FAR END

(1) Check signal levels on data transmission line:

(a) Receive Signal Level is described in Trouble Analysis 311.

(b) Carrier Fail Level is described in Trouble Analysis 31J.

(c) Transmit Signal Level is described in Trouble Analysis 31K.

(2) Perform Loop-Back Test for Facilities Distortion according to Table N.

(3) Check Receive Bias Equalization as follows:

(a) Remove ac power from 1A Data Station and teletypewriter set.

(b) Remove plug P2 of cable of TP186680 Logic Assembly from 901B cover.

(c) 911B TSG, and 911C DMS with 901B cover to be connected to 1A Data Station, as in Figures 16 and 17.

(d) Set TSG switches as follows:

BIAS — SWC	CODE — 8/11
DIST 5% — 25	OUTPUT — EIA
DIST 1% — 0	AUTO./MAN./STEP — AUTO.
BAUDS — 110	All other switches OFF

(e) Set DMS switches as follows:

INPUT — ELA	PIP/PK — PIP
DISCR% — 0	PARITY — OFF
BAUDS — 110	POLARITY — +
CODE — 8/11	FILTER — OUT

- On DMS, equal Marking bias and Spacing bias is received. 31H

(4) Remove W25A cord of 901B cover from 25-pin connector J5 of 31A2 Data Mounting (DM) on 1A Data Station.

(5) Connect plug P2 of cable from TP186680 Logic Assembly to connector J5 of DM.

(6) Apply ac power to 1A Data Station and teletypewriter set.

(7) Request far-end (remote) station to switch out of Test mode.

(8) For ASR and KSR teletypewriters only, perform Break Test according to Table J.

(9) Perform Other On-Line Control Tests according to Table K.

(10) Check ability of near-end station to go into Test mode according to Table O.

(11) If teletypewriter terminal is in 4-wire service, depress VBLA pushbutton while terminal is on-line.
- VBLA and OUT OF SERVICE lamps light. 31Q,1
- ON and PROCEED lamps turn off.
- Teletypewriter set turns off.
- On 1A Data Station RCV INTF DD51 Circuit Pack, red CF lamp lights.

(12) Request far-end station to send graphic and control characters.
- If far-end station is in FDX (full duplex) mode (not strapped for Local Copy option on LINE EIA INTF DP66/DP60 Circuit Pack), it will print error-free the characters it sent.
- Near-end station does not respond.

(13) Depress VBLA pushbutton switch.
- VBLA and OUT OF SERVICE lamps turn off. 31Q

(14) Depress ON key on TP186680 Logic Assembly.
- ON lamp lights. 1
- Teletypewriter set turns on and runs closed. 2,4
- About one second later, PROCEED lamp lights. 5
- Near-end teletypewriter station can send and receive data on-line.

STATION-TO-STATION ARRANGEMENT WITH 43A1
TERMINAL STATION (VFCT SYSTEM) AT FAR END

(1) Check Signal levels on transmission data line:

(a) Receive Signal Level as described in Trouble Analysis 31I.

(b) Carrier Fail Level as described in Trouble Analysis 31J.

(c) Transmit Signal Level as described in Trouble Analysis 31K.

(2) Check Sending Signal Distortion of Data Facilities as follows:

(a) At near-end (local) station:
Remove ac power from 1A Data Station and teletypewriter set.
Disconnect teletypewriter set from 1A Data Station, and connect J79901B-L3 Interface Test Adapter (ITA) (cover of 901B Data Test Set), as in Figure 16.
Interconnect 901B cover and 911B Test Sentence Generator (TSG of J79911A Data Test Set), and set 911B TSG switches, all as in Figure 16.

(b) At far-end (remote) station:
43A1 Terminal Station to be connected to a hub and toll room test equipment.

(c) At near-end station:
Apply ac power to 1A Data Station and 911B TSG.
On 911B TSG, operate RESET switch, then operate AUTO./MAN./STEP switch to AUTO. position.
- At far-end station test facility, 911C DMS indicates amount of distortion. 31M

(d) Operate 911B TSG AUTO./MAN./STEP switch to MAN. position.

(3) Check Sending Signal Distortion of Teletypewriter Station as follows:

(a) At near-end station:
Remove W25A cord of 901B cover from 25-pin connector J5 of 31A2 Data Mounting (DM) on 1A Data Station. Connect plug P2 of cable of TP18680 Logic Assembly to connector J5 of 31A2 DM. Inform far-end station test facility that a series of U* will be sent from teletypewriter keyboard.

- Far-end station test facility to report back amount of distortion measured on 911C DMS, and whether or not printing is garbled and error-free when monitored on local teletypewriter set. 31N

(b) Inform far-end station test facility that Answer-Back will be sent several times. Depress HERE IS key several times. Each time wait for answer-back drum to complete its cycle before again depressing key.
- Far-end station test facility to report back amount of distortion measured on 911C DMS, and whether or not answer-back message is printed ungarbled when monitored on local teletypewriter set. 31N,16

(c) If teletypewriter station is ASR, inform far-end station test facility that a message will be sent from the tape reader. Place stability test tape (TP326743 or equivalent) in tape reader and operate control lever to MANUAL START position.
- Far-end station test facility to report back amount of distortion measured on 911C DMS, and whether or not message is printed ungarbled and error-free when monitored on local teletypewriter set. 31N,19
- During this test, ON and PROCEED lamps are lit. 1,2,5,31E

(4) Check Receiving Signal Distortion of Data Facilities as follows:

(a) At near-end station:
Remove ac power from 1A Data Station and teletypewriter set.
Disconnect teletypewriter set from 1A Data Station, and reconnect W25A cord of 901B cover, as in Figure 16.
Interconnect 901B cover and 911C Distortion Measuring Set (DMS of J79911A Data Set), and set 911C DMS switches, all as in Figure 17.

(b) Apply ac power to 1A Data Station and 911C DMS. Request far-end station toll room test facility to send test message signal with following characteristics: no bias, zero distortion, 150 baud code.

(c) On 911C DMS, operate RESET switch, then operate PIP/PK switch to PIP, then back to PK position.
- 911C DMS indicates amount of distortion. 31M

(5) Check Receiving Signal Distortion of Teletypewriter Station as follows:

(a) Do not disconnect 901B cover and 911C DMS. Connect plug P2 of TP186680 Logic Assembly to 25-pin connector on face of 901B cover.

(b) Request far-end station toll room test facility to send test message signal with following characteristics: BIAS of SWC (Switched Combination Distortion), DIST 5% and DIST 1% to value of 33% MINUS the value of distortion measured in Step 4 (c).

(c) Operate RESET switch on 911C DMS. If teletypewriter station is ASR, depress tape punch ON button.
- ON and PROCEED lamps light. 1,2,5,31E
- Teletypewriter set turns on, and prints ungarbled and error-free.
- Amount of distortion is indicated on 911C DMS. 31P
- Test message is punched error-free (ASR only). 18

(6) Check Receive Bias Equalization as follows: Request far-end station test facility to send a test message of: 150 bauds, distorted alternately with 25% Marking bias and 25% Spacing bias.
- Equal Marking bias and Spacing bias is received on 911C DMS. 31H

(7) Remove W25A cord of 901B ITA cover from 25-pin connector J5 of 31A2 Data Mounting (DM) on 1A Data Station. Remove plug P2 of cable of TP186680 Logic Assembly from 901B cover and connect plug P2 to 31A2 DM connector J5.

(8) For ASR and KSR teletypewriter only, perform Break Test according to Table J.

(9) Perform Other On-Line Control Tests according to Table K.

(10) Check ability of near-end station to go into Test mode according to Table O.

NOTES

TABLE H

RECEIVING DISTORTED SIGNALS FROM PRIVATE LINE SERVICE
BOARD/DATA TEST CENTER/HUB

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	On voice-connected telephone, request PLS, DTC, or Hub to send a distorted signal to be received at the teletypewriter station with 33% Switched Combination Distortion.* (If teletypewriter is ASR, depress tape punch ON button.)		
2.	On voice-connected telephone, request test message to start.	ON and PROCEED lamps are lit. Test message is printed (and punched, if ASR) ungarbled and error-free.	1,2,5, and 29C,30B or 31E 26,8,9,11,12 13,14,18

*PLS, DTC, or Hub must set Test Sentence Generator (TSG) controls as follows: BIAS to SWC, DIST 5% and DIST 1% to a value of 33% MINUS 1/2 the value measured in Loop-Back Test plus 1-1/2%.

Example:

Distortion measured in Loop-Back Test — 18% (max)
One-half this amount of distortion — 9%
33 - 9 + 1-1/2 = 25-1/2%

The DIST 5% control should be set to 5, and the DIST 1% control to 0.

TABLE I

MEASURE STATION SIGNAL DISTORTION FROM TELETYPEWRITER STATION TO PRIVATE LINE SERVICE BOARD/ DATA TEST CENTER/HUB

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	On voice-connected telephone, inform PLS, DTC, or Hub you are going to keyboard a series of U*.	ON and PROCEED lamps are lit. Amount of distortion received at PLS, DTC, or Hub is reported back on voice-connected telephone.	1,2,5, and 29C 30B, or 31E 27
2.	Inform PLS, DTC, or Hub you are going to operate HERE IS key several times. Each time HERE IS key is depressed, wait for answer-back drum to complete cycle before again depressing key.	ON and PROCEED lamps are lit. Amount of distortion received at PLS, DTC, or Hub is reported back on voice-connected telephone.	1,2,5, and 29C 30B, or 31E 27,16
3.	For ASR only, inform PLS, DTC, or Hub you are going to send a message from tape reader. Place stability test tape (TP326743 or equivalent) in tape reader and operate control lever to MANUAL START position.	ON and PROCEED lamps are lit. Amount of distortion received at PLS, DTC, or Hub is reported back on voice-connected telephone.	1,2,5, and 29C 30B, or 31E 27,19

TABLE J

CHECK ABILITY OF STATION TO SEND AND RECEIVE A TIMED BREAK

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	Teletypewriter station connected on-line with PLS, DTC, Hub, or other teletypewriter station.	ON and PROCEED lamps lit. Teletypewriter on and running closed.	
2.	On voice-connected telephone, inform far-end station you are going to keyboard a continuous series of graphic characters, and request far-end station send a Break (interrupt) signal during this series of characters.	Characters are sent on-line, and if station is in HDX mode, are printed out locally until Break signal is received. Upon receipt of Break signal, keyboard is blinded and no characters are sent to far-end station. If in HDX, printer runs open. PROCEED lamp turns off, and BREAK RELEASE lamp lights, when Break is received.	17
3.	Depress BREAK RELEASE button. Send characters from keyboard.	BREAK RELEASE lamp turns off, and PROCEED lamp lights. Far-end station receives subsequent characters.	17
4.	If teletypewriter is ASR, place test tape in tape reader. Operate control lever to MANUAL START position. Request far-end station to send Break (interrupt) signal during tape transmission.	Far-end station receives test message until Break signal is received. Upon receipt of Break signal, tape reader turns off. Printer runs open, then closed. PROCEED lamp turns off, and BREAK RELEASE lamp lights.	

TABLE J (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
5. Depress BREAK RELEASE button. Operate reader control lever to MANUAL START position.	BREAK RELEASE lamp goes out, and PROCEED lamp lights. Reader turns on and far-end station receives subsequent message.	17
6. Operate tape reader control lever to MANUAL STOP position.	Reader turns off.	
7. Have far-end station send message to local station. If teletypewriter is ASR, depress punch ON button.	Printer prints and tape is punched with incoming message.	
8. During receipt of incoming message, depress BREAK button.	Far-end teletypewriter station keyboard (and tape reader, if ASR) are blinded. Near-end teletypewriter stops printing (and punching, if ASR).	17

TABLE K

OTHER ON-LINE CONTROL TESTS

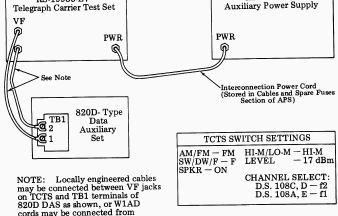
	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	Teletypewriter station connected on-line with PLS, DTC, or other teletypewriter station. (If teletypewriter is ASR, place a punched tape in tape reader but do not start reader.)	ON and PROCEED lamps lit. Teletypewriter on and running closed.	
2.	On voice-connected telephone, request far-end station to send ENQ (or WRU, CTRL E).	Answer-back mechanism operates and answer-back message is printed out at far-end station, and if in HDX mode, at near-end station. PROCEED lamp turns off.	16
3.	Request far-end station to send DC1 (or X-ON, CTRL Q).	Printer does not print. If teletypewriter is ASR, tape reader does not start. PROCEED lamp remains unlit.	2C
4.	If teletypewriter is ASR, operate tape reader control lever to MANUAL START position.	Tape reader does not turn on.	19
5.	If teletypewriter is ASR, place tape reader control lever in MANUAL STOP position.		
6.	Request far-end station to send ACK (CTRL F).	PROCEED lamp lights. If teletypewriter is ASR, tape reader turns on. Message is printed at far-end station, and if in HDX mode, at near-end station.	2C 19

TABLE K (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
7. If teletypewriter is ASR, operate tape reader control lever to MANUAL STOP position.	Tape reader stops operating.	
8. If teletypewriter is ASR, depress punch OFF button. Request far-end station to send DC2 (or TAPE, CTRL R), then send a test message.	Punch turns on and punches all characters received from transmission line and from keyboard.	18
9. If teletypewriter is ASR, request far-end station to send DC4 (or ~~TAPE~~, CTRL T), then send more characters.	Punch turns off and does not punch any subsequent characters from data transmission line or keyboard.	18
10. If teletypewriter has sprocket feed printer, request far-end station to send in rapid succession some graphic characters, FF (Form Feed, CTRL L), EOT (End of Transmission, CTRL D), one DELETE (RUBOUT), and some more graphic characters.	Teletypewriter prints (and punches, if ASR and punch ON button depressed) the graphic characters, forms out (and carriage returns if "new line" feature is enabled), and disconnects from data transmission line, but motor does not turn off until form-out (and carriage return) is completed.	14,15,2C
11. If teletypewriter has friction feed printer, request far-end station to send some graphic characters, EOT (End of Transmission, CTRL D), one DELETE (RUBOUT), and some more graphic characters.	Teletypewriter prints (and punches, if ASR and punch ON button depressed) the graphic characters, and disconnects from data transmission line without printing additional characters.	2C
12. Request far-end station to send a graphic character.	ON lamp lights. Teletypewriter turns on and runs closed. About one second later, PROCEED lamp lights.	1 2,4 5

TABLE K (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
13. Remove paper from teletypewriter printer (from reservoir if friction feed, or platen if sprocket feed).	ALARM lamp lights. Teletypewriter continues to run closed.	21
14. Depress OFF button.	ON and PROCEED lamps turn off. Teletypewriter turns off.	2,5 2C
15. Request far-end station to send a graphic character.	Teletypewriter does not turn on.	2
16. Replace paper in teletypewriter printer reservoir or platen.	ALARM lamp turns off.	21
17. Depress ON button.	ON lamp lights. Teletypewriter turns on and runs closed. About one second later, PROCEED lamp turns on.	1 2,4 5
18. Depress OUT OF SERVICE button.	ON and PROCEED lamps turn off. OUT OF SERVICE lamp lights, and button stays down. Teletypewriter turns off.	2,5 1,2 1,2 2
19. Request far-end station send a graphic character.	Teletypewriter does not turn on.	2
20. Depress OFF button.	OUT OF SERVICE lamp turns off, and button comes up.	



NOTE: Locally engineered cables may be connected between VF jacks on TCTS and TB1 terminals of 820D DAS as shown, or W1AD cords may be connected from TB1 terminals of 820D DAS to terminals VF-1 and VF-2 on terminal board TB1 at rear of TCTS.

TCTS SWITCH SETTINGS	
AM/FM – FM	HI-M/LO-M – HI-M
SW/DW/F – F	LEVEL – 17 dBm
SPKR – ON	
	CHANNEL SELECT:
	D.S. 108C, D – f2
	D.S. 108A, E – f1

Figure 15 - Connections for Carrier Frequency Measurements

TABLE L

CARRIER FREQUENCY MEASUREMENTS

Local Equipment Required:
KS-19935-L7 Telegraph Carrier Test Set (TCTS)
KS-19935-L8 Auxiliary Power Supply (APS)
W1AD Test Cords

Preliminary Procedures:
1. Make sure neither station is in Test mode.
2. Remove ac power from 820D- Type DAS and teletypewriter set, and interconnect TCTS, APS, and 820D- Type DAS as shown in Figure 15.
3. Disable the Carrier Squelch on Carrier Fail option (open screw switch A7 on Circuit Pack AR17 of 820D- Type DAS) if enabled at either station.

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
	FAR-END (REMOTE) CARRIER FREQUENCY MEASUREMENT		
1.	Connect ac power to 820D-Type DAS and Auxiliary Power Supply (APS) of TCTS.		
2.	Turn on PWR switch of APS.	Incoming carrier signal (receive frequency) is heard from speaker. SIGS M-ON lamp on TCTS lights if far-end station is sending a mark; does not light if it is sending a space; blinks if it is sending a modulated carrier signal. FREQUENCY DEVIATION meter on TCTS indicates deviation of no more than 6 Hz above and below f2 (2225 Hz Mark; 2025 Hz Space) for Data Set 108C-, D-, or 6 Hz above and below f1 (1270 Hz Mark; 1070 Hz Space) for Data Set 108A-, E- carrier signals received from far-end station.	29F

TABLE L (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
NEAR-END (LOCAL) CARRIER FREQUENCY MEASUREMENT		
3. Pull Circuit Pack AR17 out about 2 inches from mounting in 820D- Type DAS. (This disconnects the circuit pack and prevents it from interfering with the subsequent tests.)	Transmitted carrier signal (send frequency) is heard from speaker. SIGS M-ON lamp on TCTS lights if near-end station is sending a mark; does not light if it is sending a space. FREQUENCY DEVIATION meter on TCTS indicates deviation of no more than 6 Hz above and below f1 (1270 Hz Mark; 1070 Hz Space) for Data Set 108C-, D-, or 6 Hz above and below f2 (2225 Hz Mark; 2025 Hz Space) for Data Set 108A-, E- carrier signal frequencies sent on-line by near-end station.	29F
NEAR-END (LOCAL) CARRIER FREQUENCY SHIFT MEASUREMENT		
4. Connect the alligator clip of another W1BB or W1AD cord to terminal 2 of connector J3 on 820D- Type DAS. While listening to the tone from the speaker, touch the other end of this cord to terminal 9 of J3.	Continuous tone from speaker is lower than in Step 3. SIGS M-ON lamp on TCTS lights if near-end station is sending a Mark; does not light if it is sending a Space. FREQUENCY DEVIATION meter on TCTS indicates deviation of no more than 6 Hz above and below f1 (1270 Hz Mark; 1070 Hz Space) for Data Set 108C-, D-, or 6 Hz above and below f2 (2225 Hz Mark; 2025 Hz Space) for Data Set 108A-, E- carrier signal frequencies sent on-line by near-end station.	29F

TABLE L (Continued)

5.	Turn off PWR switch on APS and remove ac power from 820D-Type DAS. Disconnect all test cords. Restore Carrier Squelch on Carrier Fail option if previously disabled, and restore Circuit Pack AR17 to its mounting in 820D-Type DAS.

TABLE M

LOOP-LOSS CHECK OF TELEPHONE DATA TRANSMISSION LINE FACILITIES

Local Equipment Required:
TTS-28 Portable Station Test Set

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1. Remove ac power from 820D-Type DAS.		
2. Remove cover from 820D-Type DAS, and disconnect telephone line from TB1 terminals 1 and 2.		
3. With FUNCTION switch of TTS-28 Test Set at DBM 900Ω TERM 0 position, connect + and - terminals of TTS-28 to telephone line.		
4. Request far-end station or Test Center to send a signal of 1000 Hz at 0 dBm.		
5. Request far-end station or Test Center to send a signal of 2300 Hz at 0 dBm.	TTS-28 meter indicates loop-loss. NOTE: It may be necessary to set FUNCTION switch of TTS-28 to DBM 900Ω TERM -10 position to obtain reading.	29G
6. Disconnect TTS-28 from telephone line, and reconnect telephone line to TB1 terminals 1 and 2 of 820D-Type DAS. Replace cover and restore power to 820D-Type DAS.		

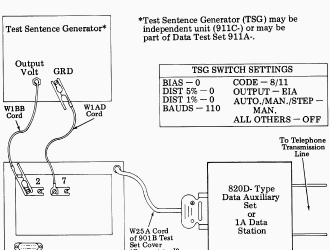


Figure 16 - Connections for Distortion Generating Setup

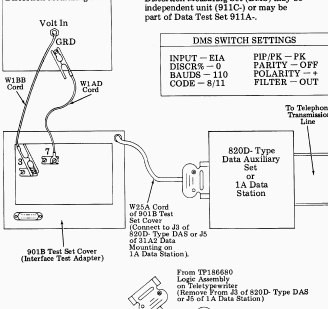


Figure 17 - Connections for Distortion Measuring Setup

TABLE N

LOOP-BACK TEST – DATA SET AND TRANSMISSION FACILITIES DISTORTION TESTS

Local Equipment Required:
901B- Type Data Set (DTS)
911B- Type Test Sentence Generator (TSG) } May be part of 911A-
911C- Type Distortion Measuring Set (DMS) } Type Data Test Set
W1AD and W1BB Cords

Preliminary Procedures:
1. Remove ac power from teletypewriter set and 820D- Type Data Auxiliary Set or 1A Data Station, and connect TSG and DMS through Interface Test Adapter (cover of 901B DTS) to 820D- Type DAS or 1A Data Station as shown in Figures 16 and 17.
2. Make sure all shorting bars on 901B cover are closed.

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
LOOP-BACK TEST		
1. Request far-end (remote) station be placed in Test mode.		
2. Apply ac power to 820D- Type DAS or 1A Data Station, TSG, and DMS.		
3. Operate RESET switches on TSG and DMS.		
4. On DMS, operate PIP/PK switch to PIP, then back to PK, then operate RESET switch.		
5. On TSG, operate AUTO./ MAN./STEP switch to AUTO. position.	DMS indicates amount of distortion. (Make note of this value for later reference.)	29H or 30D or 31L
6. On TSG, operate AUTO./ MAN./STEP switch to MAN. position.		

TABLE N (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
SENDING SIGNAL DISTORTION OF TELETYPEWRITER STATION		
7. With ac power removed from all equipment, disconnect TSG from 901B cover but leave all other connections as in Figure 16.		
8. Connect plug P2 of cable from TP186680 Logic Assembly on teletypewriter to 25-pin connector on 901B cover.		
9. Apply ac power to 820D-Type DAS or 1A Data Station and DMS.		
10. Depress ON key on teletypewriter.	ON lamp lights. OUT OF SERVICE lamp goes out. Motor turns on and teletypewriter runs closed. About one second later, PROCEED lamp lights.	
11. Operate RESET switch on DMS.		
12. Send a series of U* from teletypewriter keyboard.	Amount of distortion is indicated on DMS.	29I or 30F or 31N
13. Depress HERE IS key several times. Each time wait for answer-back drum to complete its cycle before again depressing key.	Answer-back message is printed ungarbled and error-free. Amount of distortion is indicated on DMS.	16 29I or 30F or 31N

TABLE N (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
14. If teletypewriter is ASR, place stability test tape (TP326743 or equivalent) in tape reader and operate control lever to MANUAL START position.	Teletypewriter operates and prints ungarbled and error-free. Amount of distortion is indicated on DMS.	19 29I or 30F or 31N
15. Depress OFF key on teletypewriter set.	ON and PROCEED lamps go out. Motor turns off.	
RECEIVING SIGNAL DISTORTION OF TELETYPEWRITER STATION		
16. With ac power removed from all equipment, reconnect TSG to 901B cover as in Figure 16.		
17. Set BIAS switch of TSG to SWC, and set DIST 5% and DIST 1% switches to a value of 33% MINUS the amount of distortion measured in Step 5.		
18. Apply ac power to 820D-Type DAS or 1A Data Station, DMS, and TSG.		
19. Operate AUTO./MAN./STEP switch of TSG to AUTO. position.	ON and PROCEED lamps light. Teletypewriter turns on and prints ungarbled and error-free. Amount of distortion is indicated on DMS.	29J or 30G or 31P
20. If teletypewriter is ASR, depress punch ON button.	Test message punches error-free.	18C and 29J or 30G or 31P

TABLE N (Continued)

PROCEDURE	RESPONSE	TROUBLE ANALYSIS
21. On TSG, operate AUTO./MAN./STEP switch to MAN. position.		
22. With ac power removed from all equipment, remove connector W25A cord of 901B cover from 25-pin connector J3 of 820D-Type DAS. Remove plug P2 of cable of TP186680 Logic Assembly from connector of 901B cover, and connect plug P2 to connector J3 of 820D-Type DAS. Request far-end (remote) station to switch out of Test mode.		

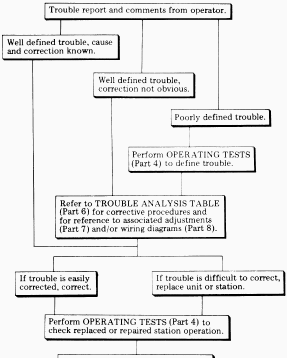
TABLE O

CHECK ABILITY OF STATION TO ENTER TEST MODE

	PROCEDURE	RESPONSE	TROUBLE ANALYSIS
1.	Inform far-end (remote) station that near-end (local) station will be checked for Test mode.		
2.	Depress TEST key on TP186680 Logic Assembly.	TEST and OUT OF SERVICE lamps light.	1, 29D or 30C or 31F
		If teletypewriter station was running, ON and PROCEED lamps go out and teletype-writer turns off.	2
		820D- Type DAS or 1A Data Station is in Test mode (on 820D- Type DAS, TST lamp lights).	29D or 30C or 31F
3.	Request far-end station to send graphic and control characters.	Far-end station prints error-free the characters it sent.	
4.	Depress TEST key on TP186680 Logic Assembly.	TEST and OUT OF SERVICE lamps go out. (On 820D- Type DAS, TST lamp goes out.)	29C, 29D or 30B, 30C or 31E
5.	Depress ON key on TP186680 Logic Assembly.	ON lamp lights.	1
		Teletypewriter turns on and runs closed.	2,4
		About one second later, PROCEED lamp lights.	5
		Near-end station can send and receive data on-line.	

5. TROUBLE CALL PROCEDURE

5.01 The chart below illustrates the procedure normally followed during a trouble call.



6. TROUBLE ANALYSIS

6.01 The following table contains analysis and corrective measures for troubles most frequently encountered during the Operating Tests (Part 4) or during Trouble Call Procedure (Part 5). Some Corrective Procedures are given directly in this table (Part 6), some are referred to specific Adjustments (Part 7), some are referred to specific Wiring Diagrams (Part 8).

6.02 If a trouble is not covered in this table, or cannot be corrected within a reasonable amount of time,

(a) Use associated BSP, W-Plans, or Wiring Diagrams.

(b) Use locally specified procedures (assistance, call supervisor, etc).

(c) Repair or replace defective apparatus or component.

NOTE: If the typing unit is replaced, record and attach to the unit its accumulated operating hours. Record the station timer hours in the permanent station record, if available, or reset timer to zero (remove indicator and rotate its gear).

(d) Cover removal procedure is described and illustrated in 3.03.

NOTE 1: Check of mechanical adjustments also includes checking for worn, bent, broken, and loosened parts; lack of required lubrication; loose, stretched, or missing springs; as well as for maladjustment and misalignment of mechanisms.

NOTE 2: Check of circuits and wiring diagrams means check of proper operation of the circuit and its components, including: circuit continuity, shorts, and opens, including loose or broken wires, connectors, and circuit cards; frayed insulation; proper voltages and circuit commons; proper operation (or malfunction) of circuit components such as relays, switches, etc.

6.03 TROUBLE ANALYSIS TABLE

No.	Trouble	Corrective Procedures
1	LOCAL, OUT OF SERVICE, TEST lamps fail to light. Individual lamps fail to light at right time — see 8.05(c). (OFF lamp does not light.)	Check main fuse CT and power supply fuse CS (8.05(a) and 8.07).
		Check voltage at convenience outlet CQ (8.05(a)) for presence of required ac power (power cord plugged into main power source).
		Check individual lamps and replace as required.
		Check lamp circuits (8.10(a), (b), 8.11(a), (b), (c), (d)).

No.	Trouble	Corrective Procedures
2	TELETYPEWRITER SET TURN-ON AND TURN-OFF	
2A	Motor does not start.	Check motor fuse MF (8.08), and fuses CT, CS (8.07).
		If motor hums, check start relay MB (8.08).
		Check for main shaft bind.
2B	Teletypewriter set does not turn on or off locally.	Check interface circuit voltages for conditions of Not Turned On and LOCAL Key Depressed (8.06(a)).
		Check Motor Control Relay (CV) and its Circuit (8.09), and Motor Circuit (8.08).
		Check Local Turn-On Control Circuit (8.10(a) or 8.11(a)) and Logic Assembly Relay Functions (8.05(d)).
2C	Teletypewriter set does not turn on or off from data line signals.	Check Interface Circuit Voltages for On-Line Connected Conditions (8.06(a)).
		Check Line Interface Control Circuits (8.10(b) or 8.11(b), (c)).
		Check Motor Control Relay (CV) and its Circuit (8.09), and Motor Circuit (8.08).
3	SELECTOR MECHANSIM	
	Selector armature remains in unattracted position.	Check SMD fuse CR (8.07).
		Check range scale — normally set between 60 and 75.
		Check (and substitute) SMD card (8.12(a)).
		Check push-on connectors of wire leads to Power Transistor (CY) on heat-sink of UCC29 (8.12(b)).
	Selector armature remains in unattracted position.	Check (and substitute) SMD card (8.12(a)).

No.	Trouble	Corrective Procedures
3 (Cont)	Selector clutch (and mechanism) not functioning.	Check Selector Clutch Stop and Release adjustment (7.06).
		Check range scale.
4	Local dc signal circuit open.	Check (and substitute) SMD card (8.12(a)).
		Check SMD circuits (8.12(b)).
		Check logic assembly dc signal circuit into SMD circuit (8.13).
5	PROCEED circuit fails to operate (Private Line only).	Check Proceed Circuit (8.11(c)).
		Check Activity Circuit (8.11(a)).
6	ALARM/PAPER ALARM failure.	Check Paper Alarm Circuit (8.14). Check Paper Alarm switch for proper operation.
7	KEYBOARD	
	Keys bind.	Check for broken keytop guideplate or displaced keylever return spring.
	Keyboard fails to trip.	Check Distributor Clutch Release (7.03) and Distributor Clutch Stop (7.04).
	Keyboard trips more than once, or runs continuously.	Check Distributor Clutch Release (7.03), Distributor Clutch Stop (7.04), Distributor Mechanism Trip (7.05).
8	PRINTED COPY ERROR	
8A	Isolate trouble to Printer (ASR and KSR).	Place station on-line and receive a message from another station, Data Test Center, Serving Test Center, etc. Erroneous copy may be an indication of printer trouble.

No.	Trouble	Corrective Procedures
8B	Printed copy error — isolated to keyboard.	Check that contact wires are properly located in their T-levers (both ends of keyboard).
		Contact wire gap should be 0.012 inch to 0.032 inch, as gauged by eye. For parity operation, check BSP Shift and Control contact wire adjustments.
8C	Printed copy error — isolated to Printer.	Check range scale setting — normally set between 60 and 75.
		Depress LOCAL button and then the keytop of a consistently misprinted character. With station motor off, manually trip codebar clutch and rotate main shaft. Observe component operation — isolate failure to: Selector (7.06), Blocking Levers (7.07), Codebars (7.08), or Carriage (7.11).
9	Function failure.	Units without function lever retainer: Check that function lever and pawl are not out of their respective casting slots.
		If function failure is general, check Left and Right Rocker Drive adjustments in BSP.
10	No CARRIAGE RETURN.	Check Carriage Return Lever Position (7.11).
11	Left hand margin irregular.	Check Dashpot Orifice (7.12).
		Check that dashpot mounting screws are tight.
12	Incorrect space between printed characters.	Check Spacing Ratchet Position (7.13).
13	Printed character density not uniform.	All characters shaded to one side: loosen typewheel mounting nut; refine typewheel position.
		Some characters off shaded: Check Stop Plate Position (7.14).

No.	Trouble	Corrective Procedures
14	NEW LINE (and Line Feed) Function	NOTE: NEW LINE feature (carriage return on-line feed) disabled; at rear of Function Box Assembly, TP181325 Auto Carriage Return Pawl in Slot A is engaged and prevented from operating by TP186557 Disabling Bracket.
14A	Friction Feed Printer	No line feed, and drive link not operating: Check Line Feed Blocking Lever (7.15).
		Irregular line feed, with or without drive link operating: Check Line Feed Control (7.16).
14B	Sprocket Feed Printer	Check Line Feed Selection (7.17), Line Feed Strip (7.18), and Line Feed Detent (7.19).
15	FORM-OUT Failure (Sprocket Feed Printer)	
15A	Fails to form-out.	Check Form-Out Lever Overtravel (7.20).
15B	Fails to stop form-feeding once started.	Check Form-Out Contact (7.21).
15C	Form feed incomplete after receipt of EOT before teletype-writer turns off.	Check Reader Distributor Trip Magnet Circuit (8.16(a)).
16	ANSWER-BACK	
16A	Does not respond, cycle or operate.	Check Answer-Back Control (7.22) and Drum Advance (7.23).
16B	Repeatedly cycles.	Check Trip Lever (7.24).
16C	Does not respond to ENQ when received on-line (not supposed to respond to ENQ from keyboard).	Check Answer-Back Conirol (7.22) for both DATA-PHONE and Private Line. For DATA-PHONE only, also check Answer-Back Trip Lever Advance adjustment (7.24) and Answer-Back Magnet Circuit (8.15).

No.	Trouble	Corrective Procedures
16D	Does not print correct coded characters.	Check coding of Answer-Back drum.
		Check that Answer-Back drum starts from "home" position.
		Check that Answer-Back contact wires are in their contact block V slots, and not crossed.
17	BREAK Function — ASR and KSR only.	
17A	Key depressed, no response (Private Line station Local mode does not respond).	Check BREAK contacts for correct operation.
		Check Signal Line, Send-Receive, and Break Circuit (8.13).
		Check TP303833 Break Detector Circuit Card.
17B	No response from Break signal received from line.	Check TP303833 Break Detector Circuit Card.
		Check Selector Magnet Driver, and Break Detection and Indication Circuits (8.12(b)).
		Check SMD Circuit (including TP182630 SMD Driver card, output transistor CY).
17C	Alarm lamp fails to light. Release fails to function.	Check for lamp bulb failure — replace.
		Check Selector Magnet Driver, and Break Detection and Indication Circuits (8.12(b)).
		Check for proper operation of release switch.
18	Automatic PUNCH	
18A	Does not turn on.	Check Automatic Punch On (7.25).
18B	Does not turn off.	Check Automatic Punch Off (7.26).

No.	Trouble	Corrective Procedures
18C	Incorrect perforations in tape.	Punch code holes missing, check Punch Pawl Upstop Assembly (7.27).
		Too many punch code holes, check Punch Stripper Bail Upstop (7.28).
		For 10 holes-per-inch, check Punched Tape Code Hole Spacing (7.29).
19	READER	
19A	Does not turn on	Check for tight-tape condition, or that control lever is not in AUTO position.
		If Distributor Clutch does not trip, check Distributor Clutch Release (7.03).
		Check fuse F1 in Reader Power Pack (8.05(a) and 8.16 (b)).
		Check Reader Trip Lever and Armature (7.30).
		Check Reader Distributor Trip Magnet Circuit (8.16(a)).
		Check Reader Automatic Start and Function Box Circuits (8.16(c)).
19B	Garble or no copy from reader, good copy from keyboard.	Check for correctly punched characters on tape.
		Check that sensing pins are not stuck under sensing pin guide.
		Check for worn sensing pins.
20	"DATA-PHONE" DATA SET/ DATA AUXILIARY SET — GENERAL	
	Incorrect operation of: dialer (including TOUCH-TONE® frequencies and rotary impulses), ringer, handset (receiver and transmitter), switchhook, no dial-tone, failure to connect on voice-call.	Incorrect operation or failure of operation to be corrected in accordance with accepted Telephone Company procedures.

No.	Trouble	Corrective Procedures
20 (Cont)	Key/Pushbutton and Lamp (incorrect operation or failure).	Check for correct operation (8.05(c)).
	Incorrect switching of operational modes (Voice, Data, Test, On-Line, Off-Line, etc).	Check Key/Pushbutton functions and switching (8.05(c)).
		Check Interface Circuits Voltages between Data Set and Teletypewriter Set Logic Assembly for station operating condition or mode (8.06(a)), and Logic Assembly Relay Functions (8.05(d)).
21	(PAPER) ALARM	
	No paper in reservoir (friction feed) or platen (sprocket feed):	
	(PAPER) ALARM fails to light.	Replace lamp.
		Check Paper Alarm Circuit (8.14).
	Teletypewriter set turns on On-Line (DATA-PHONE only).	If TP186627 Logic Assembly has Option C (187 strapped to TB18, operation is correct. If this option is not installed, check Paper Alarm Circuit (8.14).
		Check Interface Circuits Voltages (8.06, Note 1).
	With paper in reservoir (friction feed) or platen (sprocket feed); Teletypewriter set fails to turn on.	Check Paper Alarm Circuit (8.14) and Paper Alarm Switch.
22	DATA SET 113A-TYPE	
	Loop-Back Tests per Section 668-400-300 Test H_1 and Section 668-101-511.	These tests check Originate Frequencies (Mark, Space, and Slice), Transmit Signal Level, Receive (Demodulator) Sensitivity.
	Originate frequencies out of tolerance.	Replace data set.
	Transmit signal level out of tolerance.	Adjust R31 on circuit pack ER1.
		Replace data set.

No.	Trouble	Corrective Procedures
22 (Cont)	Transmit Level, Receive Sensitivity, or Distortion fail to meet requirements according to transmission facilities.	Data Test Center to verify loop loss, and that overall transmission facilities meet requirements (Section 314-205-501).
		Additional data set tests may be performed per Section 591-033-500.
23	DATA SETS 103G- AND 103A3- TYPES	
	Loop-Back Tests per Section 668-400-300 Test H, and Section 668-101-503.	These tests check Originate and Answer Frequencies (Mark, Space, and Slice), Transmit and Receive Signal Levels, Receive (Demodulation) Sensitivity.
	Originate or Answer Frequencies out of tolerance.	Replace data set.
	Transmit Signal level out of tolerance.	Adjust R34 on Circuit Pack CJ11 or CJ15 Modem.
		Replace data set.
	Receive Signal level out of tolerance.	Replace data set.
	Transmit Level, Receive Sensitivity, or Distortion fail to meet requirements according to transmission facilities.	Data Test Center to verify loop loss, and that overall transmission facilities meet requirements (Section 314-205-501).
		Additional data set tests may be performed per Section 591-026-500 (Data Set 103G- Type) and Section 591-014-501 (Data Set 103A3- Type).
24	DATA SET 103A2- TYPE	
	Loop-Back Tests per Section 668-400-300 Test H, and Section 668-101-500.	These tests check Originate and Answer Frequencies (Mark, Space, and Slice), Originate and Answer Signal Levels, Receive Sensitivity.
	Originate or Answer Frequencies out of tolerance.	Replace data set.

No.	Trouble	Corrective Procedures
24 (Cont)	Originate or Answer signal levels out of tolerance.	Replace data set.
	Transmit Signal Level, Receive Sensitivity, or Distortion fail to meet requirements according to transmission facilities.	Data Test Center to verify loop loss, and that overall transmission facilities meet requirements (Section 314-205-501).
		Additional data set tests may be performed per Section 591-014-500.
25	DATA SET 403E4/E7- TYPES	
25A	Loop-Back Tests per Section 668-104-532.	These tests check Answer Frequencies, Signal Level, Receiver Sensitivity, Bandwidth of each of seven data channel detectors, translation of codes, release from Test mode, time-out interval, and time-out disconnect.
25B	Answer Frequencies out of tolerance.	Replace Line Control Circuit Pack AR422-AR251.
		Replace data set.
25C	Transmit Signal level out of tolerance.	Replace Circuit Pack AR290, and/or Circuit Pack AR422/AR251.
		Replace data set.
25D	Receiver Sensitivity out of tolerance.	Replace Circuit Pack AR249.
		Replace data set.
25E	Data channel detector bandwidth out of tolerance.	Replace Circuit Pack AR246 (Group A, low frequencies) or Circuit Pack AR247 (Group B, high frequencies).
		Replace data set.
25F	Answer Frequencies, Signal Level, Receiver Sensitivity, Distortion, Code Translation, or Timing-Out fail to meet requirements according to transmission facilities.	Data Test Center to verify loop loss, and that overall transmission facilities meet requirements (Section 314-205-500).

No.	Trouble	Corrective Procedures
25G	Data set fails to operate in TEST mode.	Replace Circuit Pack AR290 and/or AR429/AR253. Refer to Trouble Analysis 20, check Circuit Pack AR291. Replace data set.
25H	Data set fails to switch in or out of various modes of operation, or respond to data auxiliary set control switches.	Replace Circuit Pack AR429/AR253 and/or AR422/AR251. Refer to Trouble Analysis 20, check Circuit Pack AR291.
25I	Teletypewriter fails to print correct characters — normal operation of teletypewriter has been established before this time.	Replace Circuit Pack AR289, and/or AR287, and/or AR286, and/or AR291. Replace Circuit Pack AR246 (Group A, low frequencies) or AR247 (high frequencies), and/or AR245, and/or AR248.
25J	Teletypewriter fails to respond to any of the special controls or characters, as option strapped on Circuit Pack AR288 — normal operation of teletypewriter has been established before this time.	Replace Circuit Pack AR288, and/or AR287, and/or AR286. Replace data set.
	Above data set malfunctions unable to be corrected as indicated, and/or other data set failures.	Additional data set tests may be performed per Section 594-026-500. Replace data set.
26	RECEIVING DISTORTION DATA-PHONE Service: TEST E, Section 668-400-300, Sending Distorted Signals To Station (from Data Test Center).	Maximum distorted signal to be received at teletypewriter station is 32% SWC (Switched Combined Distortion), sent from Data Test Center/Private Line Servicebeard and determined as 33% SWC MINUS 1/2 the value of distortion Data Test Center measured for that type data set in Loop-Back Test H PLUS 1-1/2%.

No.	Trouble	Corrective Procedures
26 (Cont)	Private Line Service:	Maximum distorted signal to be received at teletypewriter station is 35% SWC (Switched Combined Distortion), sent from DTC or other source at far end of telephone facilities and determined at Private Line Serviceboard/Data Test Center or other far-end source as 35% SWC MINUS 1/2 the value of distortion measured by PLS/Data Test Center or by Loop-Back Distortion Test (Section 591-023-501) at teletypewriter station PLUS 1-1/2%
	Distortion errors printed (and punched, if ASR) on teletypewriter set.	Check that the three selector mounting screws are tight.
		Reorient selector range to midpoint setting.
		Check Selector (7,06).
		Adjust selector armature spring tension.
		Replace data set and or Circuit Pack AR17.
		Check Telephone Facilities.
27	SENDING DISTORTION	
	DATA-PHONE Service: Test F, Section 668-400-300, Measure Station Signal Distortion.	Maximum distorted signal received at Data Test Center/Private Line Serviceboard 911C DMS to be 8% PLUS 1/2 the value of distortion measured by Data Test Center/ Private Line Serviceboard in Loop-Back Test H PLUS 1-1/2%.
	Private Line Service:	Maximum distorted signal received at Private Line Serviceboard/Data Test Center 911C DMS or other measuring device at far-end of telephone facilities to be 8% PLUS 1/2 the value of distortion measured by PLS/Data Test Center in Loop-Back Test H or by Loop-Back Distortion Test (Section 591-023-501) at teletypewriter station PLUS 1-1/2%.

No.	Trouble	Corrective Procedures
27 (Cont)	Distortion received by Data Test Center or other indicating device at far-end of telephone facilities exceeds calculated amount.	Check for dirty distributor discs.
		Check for worn distributor brushes.
		Replace data set and/or Circuit Pack AR17.
		Check Telephone Facilities.
28	STRESS TEST FROM DATA TEST CENTER Per Section 668-400-300 tests:	
	1. Horizontal Position and Type Alignment. 2. Vertical Position and Type Alignment.	Refer to Trouble Analyses 12 and 13.
	3. Selector and Codebar Test. 4. Oscillating Shift Bracket Test.	Refer to Trouble Analysis 8C.
	5. Dashpot and Line Length Test.	Refer to Trouble Analyses 10 and 11.
	6. Line Feed Spacing Test.	Refer to Trouble Analysis 14.
29	DATA SETS 108A-, C-, D-, AND E- TYPES USING DATA AUXILIARY SET 820D-TYPE	Additional data set and data auxiliary set tests may be performed per Section 591-023-501 (Data Sets 108A-, C- Types) and Section 591-028-501 (Data Sets 108D-, E-Types).
	No carrier signal (audio frequency tone) on telephone transmission data line.	This test may be performed using 1013- Type Dial Hand Test Set, or more completely using a KS-19935-L7 Telegraph Carrier Test Set (TCTS), per above BSP Sections.

No.	Trouble	Corrective Procedures
29A	No carrier signal from far-end.	Check that far-end data set is operating.
		Verify that telephone data transmission lines and circuits meet requirements (per Section 314-410-500).
29B	No carrier signal from near-end data set.	Replace data set.
29C	Teletypewriter OUT OF SERVICE lamp fails to turn off. Station fails to connect on line.	Check Interface Circuits Voltages between Data Auxiliary Set and TP186680 Set Logic Assembly (8.06(b)) and Logic Assembly Relay Functions (8.05(d)).
		Check Line Interface Control Circuits (8.11(b)).
		Check Proceed Circuit (8.11(c)).
		Check Signal Line, Send-Receive Circuit (8.13).
		Check for presence of carrier signal on data transmission line (Trouble Analysis 29A).
		Replace Circuit Pack AR17 in Data Auxiliary Set 820D- Type.
29D	Failure of Data Set/Data Auxiliary Set to switch into Test mode.	Check wiring circuit between TP186680 Logic Assembly Key/Lamp Strip and Data Auxiliary Set 820D-Type terminal board TB1 terminals 5 and 6 (8.11(a)).
		If TEST circuit is good between TP186680 Logic Key/Lamp Strip and Data Auxiliary Set 820D- Type, depress TEST button (lamp lights) on Data Auxiliary Set to place Data Auxiliary Set in Test mode.
		Replace Circuit Pack AR17.

No.	Trouble	Corrective Procedures
29E	Loop-Back Tests – performed by Private Line Serviceboard or 904-Type Data Test Center, per Sections 668-100-500 and 668-101-510. Data Set/Data Auxiliary Set must be in Full Duplex (FDX) mode.	These tests check Transmit Frequency (Mark, Space, and Slice), Transmit and Receive Signal Levels, Carrier Fail and Squelch Circuit Tests.
		See Loop-Loss Checks, Trouble Analysis 29G, to check telephone data transmission lines and circuits.
	Transmit frequencies out of tolerance. Demodulator fails to respond to receive frequencies.	See Loop-Loss Checks, Trouble Analysis 29G.
		Replace data set.
	Transmit Signal Level out of tolerance.	Adjust R18 on data set through hole in front panel.
		See Loop-Loss Checks, Trouble Analysis 29G.
		Replace data set.
	Receive Signal Level Sensitivity, and Carrier Fail and Squelch Level out of tolerance.	Adjust R37 (R61 to be about mid-range) inside data set.
		See Loop-Loss Checks, Trouble Analysis 29G.
		Replace data set.
29F	Carrier Frequency Deviation	Carrier signal frequency deviation shall not be less than ±6 Hz and not more than ±6 Hz from sending frequencies f1 for Data Sets 109C-, D- (Mark 1270 Hz; Space 1070 Hz), or f2 for Data Sets 108A-, E- (Mark 2225 Hz; Space 2025 Hz).
29G	Loop-Loss Measurement Checks	At station location, with Portable Station Test Set TTS-28, check Actual Measured Loss (AML) against Expected Measured Loss (EML) recorded on station layout card when station was installed (per Section 591-023-501).

No.	Trouble	Corrective Procedures
29G (Cont)		Loop limits should be: Type of Loop — AML Limits Without repeaters or carriers. — EML ±1dB With E7 repeaters only. — EML ±1dB With all other repeaters and/or carriers. — EML ±2dB Station-to-station. — -24 dB max Station-to-hub. — -16 dB max
29H	Loop-Back Test Data Sets 108A-, C-, D-, E-Types/Data Auxiliary Set 820D- Tyne combination in FDX mode: Station-To-Station service.	This checks transmission facilities and data set distortion level and ability of data sets to transmit and receive data in the FDX (full duplex) mode.
		Loop-back distortion measured to be 15% or less.
		See Loop-Loss Checks, Trouble Analysis 29G.
		See Carrier Frequency Deviation, Trouble Analysis 29F.
29I	Sending Distorted Signal (Signal sent by teletypewriter station on telephone data transmission facilities.)	Maximum distorted signal received at teletypewriter set measuring device through near-end (local) and far-end (remote) data sets to be 8% PLUS the value of the distortion measured in Loop-Back Test (for Data Sets 108A-, C-, D-, E- Types Station-To-Station) Trouble Analysis 29H.
	Distortion received on indicating device not to exceed above determined amount.	Check for dirty distributor discs.
		Check for worn distributor brushes.
		Replace data set and/or Circuit Pack AR17.
		Check Telephone Transmission Facilities.

No.	Trouble	Corrective Procedures
29J	Receiving Distorted Signal (signal received by teletype-writer station from telephone data transmission facilities.)	Maximum distorted signal to be received at teletypewriter set to be 33% SWC (Switched Combination Distortion), sent from signal source and determined at the source as 33% MINUS the value of distortion measured in Loop-Back Test (for Data Sets 108A-, C-, D-, E- Types, Station-To-Station) Trouble Analysis 29H.
	Distortion errors printed (and punched, if ASR) on teletype-writer set.	Check that the three selector mounting screws are tight.
		Reorient selector range to midpoint setting.
		Check Selector (7.06).
		Adjust selector armature spring tension.
		Replace data set and/or Circuit Pack AR17.
		Check Telephone Transmission Facilities.
30	DATA SET 109A-, E- TYPE USING DATA AUXILIARY SET 820D- TYPE	Additional tests may be made per Sections 591-024-301 and 591-024-501 (Data Set 109A- Type), 591-036-302 and 591-036-502 (Data Set 109E- Type).
30A	Incorrect loop current or no loop current on telephone data transmission line.	Telephone transmission data line loop current to be +3.0 to +3.2 mA dc marking at Data Auxiliary Set 820D terminal board TB1 terminal 1 lead.
		Check that data set line pads are adjusted to compensate for line loop resistance shown on transmission facilities circuit layout record card. If necessary, measure resistance of loop to be sure it is not shorted, open, or greater than 2000 ohms.

No.	Trouble	Corrective Procedures
30A (Cont)		Check that far-end data set is operating properly.
		Verify that telephone data transmission lines and circuits meet requirements (per Section 314-410-500).
		Replace data set.
30B	Teletypewriter OUT OF SERVICE lamp fails to turn off.	Check Interface Circuits Voltages Between Data Auxiliary Set and TP186680 Set Logic Assembly (8.06(b)) and Logic Assembly Relay Functions (8.05(d)).
		Check Line Interface Control Circuits (8.11(b)).
		Check Proceed Circuit (8.11(e)).
		Check Signal Line, Send-Receive Circuit (8.13).
		Check for transmission line loop-current (Trouble Analysis 30A).
		Replace Circuit Pack AR17 in Data Auxiliary Set 820D- Type.
30C	Failure of Data Set/Data Auxiliary Set to switch into Test mode.	Check wiring circuit between TP186680 Logic Assembly Key/Lamp Strip and Data Auxiliary Set 820D- Type terminal board TB1 terminals 5 and 6 (8.11(a)).
		If Test circuit is good between TP186680 Logic Key/Lamp Strip and Data Auxiliary Set 820D- Type, depress TEST button (lamp lights) on data auxiliary set to place in Test mode.
		Replace Circuit Pack AR17.

No.	Trouble	Corrective Procedures
30D	Loop-Back Test Data Set 109E-Type, in FDX mode: Station-To-Hub arrangement, measurements made at Hub/PLS/DTC. Station-To-Station arrangement, measurements made at near-end (local) station.	This checks transmission facilities and data sets distortion level and ability of data sets to transmit and receive data in the FDX (full duplex) mode.
		Loop-back distortion measured to be 15% or less.
		See Incorrect or No Loop Current, Trouble Analysis 30A.
		Check Telephone Transmission Facilities.
30E	Transmission Facilities and Data Sets Distortion Test. Data Set 109A-Type.	This checks transmission facilities and data sets distortion level and ability of data sets to transmit and receive data.
		Distortion measured at 911C-DMS (Distortion Measuring Set) to be 10% or less.
		See Incorrect or No Loop Current, Trouble Analysis 30A.
		Check Telephone Transmission Facilities.
30F	Sending Distorted Signal. (Signal sent by teletypewriter station on telephone data transmission facilities.)	Maximum distorted signal received at teletypewriter set measuring device through near-end (local) and far-end (remote) data sets to be 8% PLUS the value of distortion measured in Loop-Back Test (for Data Set 109E-Type, Station-To-Station) Trouble Analysis 30D, or Transmission Facilities and Data Set Distortion Test (for Data Set 109A-Type) Trouble Analysis 30E.
	Distortion received on indicating device not to exceed above determined amount.	Check for dirty distributor discs.
		Check for worn distributor brushes.
		Replace data set and/or Circuit Pack AR17.
		Check Telephone Transmission Facilities.

No.	Trouble	Corrective Procedures
30G	Receiving Distorted Signal. (Signal received by teletypewriter station from telephone data transmission facilities.)	Maximum distorted signal to be received at teletypewriter set to be 32% SWC (Switched Combination Distortion), sent from signal source and determined at the source as 33% MINUS the value of distortion measured in Loop-Back Test (for Data Set 109E Type, Station-To-Station) Trouble Analysis 30D, or Transmission Facilities and Data Set Distortion Test (for Data Set 100A Type) Trouble Analysis 30E.
	Distortion errors printed (and punched, if ASR) on teletypewriter set.	Check that the three selector mounting screws are tight.
		Reorient selector range to midpoint setting.
		Check Selector (7.06).
		Adjust selector armature spring tension.
		Replace data set and/or Circuit Pack AR17.
		Check Telephone Transmission Facilities.
31	1A DATA STATION (SCA), BINARY MODE	
31A	When performing tests, trouble may be indicated or isolated to a specific circuit pack.	Replace circuit pack — verify that correct options and no others are installed on new circuit pack for this particular 1A Data Station.
	If trouble cannot be isolated to a specific circuit pack:	Replace circuit packs, one at a time, until trouble is corrected. Note which circuit pack corrected the trouble. Reinstall all original circuit packs except for the new one which corrected the trouble. Verify that correct options and no others are installed on new circuit pack.
		Additional 1A Data Station (SCA), Binary Mode, tests may be performed per Section 591-813-501.

No.	Trouble	Corrective Procedures
31B	No Carrier Signal (audio frequency tone) on telephone data transmission facilities (lines and circuits).	Verify that telephone transmission facilities meet requirements per Section 314-410-500 (Private Line Data Circuits, Voice Bandwidth Circuits for Miscellaneous Data, Overall Tests and Requirements), or Section 660-450-302 (Circuit Order or Trunk Order Tests for Carrier Telegraph Layouts).
		These tests may be made using 1013-Type Dial Hand Test Set, or more completely using a KS-11938-L7 Telegraph Carrier Test Set and J77901-L3 Interface Test Adapter (Cover of 901B Data Test Set) per Section 591-813-501, which includes additional, more complete tests.
31C	No carrier signal from far-end.	Check that far-end data station terminal is operating.
31D	No carrier signal from near-end.	Replace TRMTR DP1-DP25 Circuit Pack (Trouble Analysis 31A).
31E	Teletypewriter OUT OF SERVICE lamp fails to turn off.	Check for presence of carrier signal on telephone transmission line (Trouble Analysis 31B).
		Check Interface Circuits Voltages between 1A Data Station and TP186680 Set Logic Assembly (8.06(b)).
		Check Logic Assembly Relay Functions (8.05(d)).
		Check Line Interface Control Circuits (8.11(b)).
		Check PROCEED Circuit (8.11(c)).
		Check Signal Line, Send-Receive Circuit (8.13).
		Check Receive Signal Level and Gain (Trouble Analysis 311).

No.	Trouble	Corrective Procedures
31F	Failure of 1A Data Station to switch into Test mode. NOTE: LOCAL COPY feature must not be installed when performing this test.	Check on TP186680 Logic Assembly Key/Lamp Strip 507A plug that there is a jumper strap between terminals 1-1 and 1-6 under TEST key and a wire from terminal 1-5 to 1A Data Station terminal board TS(A) terminal 8 on 31A2 Data Mounting (8.11(a)).
		If TEST circuit between TP186680 Logic Assembly and terminal board TS(A) on 31A2 Data Mounting is good, replace LINE EIA INTF DP66/DP60 Circuit Pack (Trouble Analysis 31A).
31G	Loop-Back Tests Performed by Private Line Serviceboard or 904- Type Data Test Center. 1A Data Station must be in FDX (Full Duplex) mode.	These check Transmit Frequency (Mark, Space, and Slice), Transmit and Receive Signal Levels, Carrier Fail and Squelch Circuit Tests.
	Transmit frequency out of tolerance.	Replace TRMTR DP1-DP25 Circuit Pack (Trouble Analysis 31A).
		Verify that Telephone Transmission Facilities meet requirements (Trouble Analysis 31B).
	Transmit Signal Level out of tolerance.	Refer to Transmit Signal Level Trouble Analysis 31K.
		Verify that Telephone Transmission Facilities meet requirements (Trouble Analysis 31B).
	Receive frequency out of tolerance.	Replace DEM DP26-DP50 Circuit Pack (Trouble Analysis 31A).
		Verify that Telephone Transmission Facilities meet requirements (Trouble Analysis 31B).
	Receive Signal Level out of tolerance.	Refer to Receive Signal Levels (Trouble Analysis 31I) and Carrier Fail Level (Trouble Analysis 31J).
		Verify that Telephone Transmission Facilities meet requirements (Trouble Analysis 31B).

No.	Trouble	Corrective Procedures
31H	Receive Bias Equalizing. Required is to receive from data line a signal predistorted alternately with 25% Marking bias and 25% Spacing bias.	On RCV INTF DP51 Circuit Pack, adjust RCV BIAS potentiometer for equal Marking bias and Spacing bias as indicated on 911C- DMS (J7911A Data Test Set). Counterclockwise adjustment reduces Marking bias, clockwise adjustment reduces Spacing bias.
		Replace RCV INTF DP51 Circuit Pack (Trouble Analysis 31A).
31I	Receive Signal Level. Out of tolerance, as received from telephone data transmission facilities.	Received signal to be ±4 dBm of the value specified on the circuit service order work card. With KS-20538-L1 VOM, or equivalent, measure on 31A2 Data Mounting terminal board TS(A) terminals 2 and 5 for two-wire, or 4 and 5 for four-wire. (NOTE: Remove TRMTR DP1-DP23 Circuit Pack from 73 APP MTG during measurement.)
		No signal or low level signal, see Trouble Analysis 31B, C.
	Gain level out of tolerance.	On LINE EIA INTF DP66 (or DP60) Circuit Pack, adjust RCV GAIN potentiometer so that VOM positive lead to RCV test point, negative lead to GRD test point, indicates per Test Point Table 8.06(b).
		Replace LINE EIA INTF DP66/DP60 Circuit Pack (Trouble Analysis 31A).
		On RCV INTF DP51 Circuit Pack, measure LIM IN test point with VOM positive lead, negative lead to GRD test point on DP66/DP60 Circuit Pack, to indicate value per Test Points Table 8.06(b).
		Replace DEM DP26-50 Circuit Pack (Trouble Analysis 31A).

No.	Trouble	Corrective Procedures
31J	Carrier Fail Level.	These checks (and adjustments if necessary) to be performed only after check/adjustments for Receive Gain Level (above).
	On RCV INTF DP51 Circuit Pack, Carrier Fail lamp lighted.	On RCV INTF DP51 Circuit Pack, adjust CF ADJ potentiometer clockwise until lamp just turns off. Depress switch button (red lamp lens), lamp should light – if not, with pushbutton depressed, adjust so lamp just lights, and when pushbutton is released, lamp turns off.
	On RCV INTF DP51, Circuit Pack, Carrier Fail lamp not lighted.	On RCV INTF DP51 Circuit Pack, depress red lamp pushbutton switch. If lamp lights, CF ADJ potentiometer is properly set. If lamp does not light, adjust CF ADJ potentiometer counterclockwise until lamp just lights, release pushbutton and lamp turns off.
		Replace LINE EIA INTF DP66 (or DP60) Circuit Pack (Trouble Analysis 31A).
31K	Transmit Signal Level. Out of tolerance, as put out on telephone transmission facilities.	Transmit signal to be ±2 dBm of value specified on circuit service order work card. With KS-20538-L1 VOM, or equivalent, measure on 31A2 Data Mounting terminal board TS(A) terminals 2 and 5 for two-wire, or 2 and 3 for four-wire. If necessary, adjust SEND LEVEL potentiometer on LINE EIA INTF DP66 (or DP60) Circuit Pack.
		On LINE EIA INTF DP66 (or DP60) Circuit Pack, measure SEND test point (VOM positive lead, negative lead to GRD test point) to indicate per Test Points Table S.06(b). Adjust SEND LEVEL potentiometer, if necessary.
		Replace LINE EIA INTF DP66/DP60 Circuit Pack, or TRMTR DP1-DP25 Circuit Pack (Trouble Analysis 31A).

No.	Trouble	Corrective Procedures
31K (Cont)		On TRMTR DP1-DP25 Circuit Pack, measure TRMTR OUT test point (VOM positive lead, negative lead to GRD test point on DP66(DP60) to indicate per Test Points Table 8.06(b).
		Replace TRMTR DP1-DP25 Circuit Pack, or LINE 81A INTF DP66(DP60 Circuit Pack (Trouble Analysis 81A).
31L	Loop-Back Tests, Station-To-Station service, with 1A Data Station at far-end (remote) terminal station. 1A Data Station must be in FDX (Full Duplex) mode.	This checks transmission facilities and 1A Data Stations distortion level and ability of 1A Data Stations to transmit and receive data in FDX mode.
		See Receive Signal Level, Trouble Analysis 311, and Transmit Signal Level, Trouble Analysis 31K.
31M	Transmission Facilities and 1A Data Station Distortion Test.	This checks transmission facilities and far-end terminal interface and near-end 1A Data Station distortion level, and ability of near-end 1A Data Station to transmit and receive data.
		See Transmit Signal Level (Trouble Analysis 31K).
		Check Telephone Transmission Facilities (Trouble Analysis 31B).
31N	Sending Distorted Signal. (Signal sent by teletypewriter station out on telephone data transmission facilities.)	Maximum distorted signal received at teletypewriter set measuring device through own and far-end (remote) 1A Data Station to be 8% PLUS the value of distortion measured in Loop-Back Test (for 1A Data Station at far-end, Station-To-Station) Trouble Analysis 31L, or Transmission Facilities and 1A Data Station Distortion Test (for 43A1 Terminal at far-end, Station-To-Station) Trouble Analysis 31M.

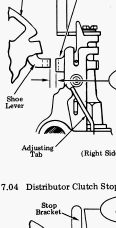
No.	Trouble	Corrective Procedures
31N (Cont)	Distortion received on indicating device not to exceed above determined amount.	Check for dirty distributor discs.
		Check for worn distributor brushes.
		Refer to Trouble Analysis 31A. Replace, one at a time, each of the circuit packs.
		Check Telephone Transmission Facilities (Trouble Analysis 31B).
31P	Receiving Distorted Signal. (Signal received by teletypewriter station from telephone data transmission facilities.)	Maximum distorted signal to be received at teletypewriter set to be 35% SWC (Switched Combination Distortion), sent from signal source and determined at the source as 53% MINUS the value of distortion measured in Loop-Back Test (for 1A Data Station at far-end, Station-To-Station) Trouble Analysis 31L, or (Transmission Facilities and 1A Data Station Distortion Test (for 43A1 Terminal at far-end, Station-To-Station) Trouble Analysis 31M.
	Distortion errors printed (and punched, if ASR) on teletypewriter set.	Check that the three selector mounting screws are tight.
		Reorient selector range to midpoint setting.
		Check Selector (7.06).
		Adjust selector armature spring tension.
		Replace data set and/or Circuit Pack AR17.
		Check Telephone Transmission Facilities (Trouble Analysis 31B).
31Q	Failure of 1A Data Station to switch into VBLA (Voice Band Loop Around) mode.	Check wiring circuit between VBLA lamp/switch and 1A Data Station terminal board TS(A) terminals 6 and 10 on 31A2 Data Mounting (8.11(d)).
	(VBLA function applicable in four-wire service only.)	Check operation of VBLA Relay on 31A2 Data Mounting when VBLA pushbutton switch is operated.

7. TELETYPEWRITER ADJUSTMENTS

7.01 Following are the adjustment paragraphs referred to in Trouble Analysis Table (6.03). After an adjustment is completed, check any other adjustment, as indicated, that may be affected.

7.02 After completing an adjustment, tighten all loosened screws and/or nuts.

7.03 Distributor Clutch Release (Keyboard, Reader, or Answer-Back)



Requirement
With distributor disengaged, depress any (nonfunction) key-top for keyboard, reader trip magnet armature for reader, or answer-back trip magnet armature for answer-back. Clearance between clutch shoe lever and trip lever should be
Min 0.016 inch
Max 0.035 inch

To Adjust
Remove answer-back drum. Use TP180993 bending tool to bend center trip ball adjusting tab for keyboard, left adjusting tab for reader, and right adjusting tab for answer-back.

7.04 Distributor Clutch Stop

To Check
Rotate distributor clutch to position shoe lever up to but not touching trip lever.

Requirement
Shoe lever should be
Min flush
Max 0.015 inch
behind rear surface of trip lever tip.

To Adjust
With screw friction tight, position stop bracket.

7.05 Distributor Mechanism Trip

To Check

Place typing unit in stop condition, depress DELETE keytop. Manually latch universal lever — pencil mark lever position or insert TP186308 gauge (if available) as illustrated. Rotate distributor clutch until lever is in lowermost position.

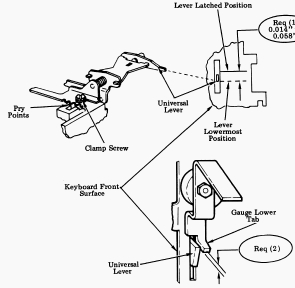
Requirement

(1) Min 0.014 inch — Max 0.058 inch movement of universal lever from its latched to its lowermost position, or

(2) Top edge of universal lever within thickness of TP186308 gauge lower tab.

To Adjust

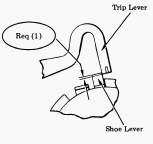
Loosen clamp screw, use pry points to position universal lever. Check 7.03 and 7.04.



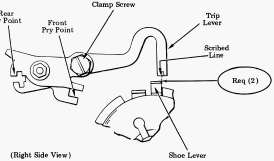
7.06 Selector Clutch Stop and Release

Requirement

(1) With selector clutch disengaged, trip lever should engage two-thirds to full thickness of shoe lever.



(2) With selector armature placed in its unattracted position (to trip clutch), released trip lever's scribed line should be aligned with front edge of shoe lever.



(Right Side View)

To Adjust

Loosen clamp screw. Use front pry point to meet Requirement (1). Use rear pry point to meet Requirement (2).

7.07 Blocking Lever Position

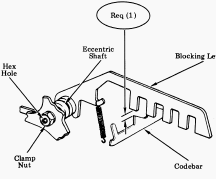
Requirement

(1) With range finder set at 80, selector in all-marking condition, and clutch in unlatched stop position, manually trip codebar clutch and rotate main shaft to position codebars flush with left edge of blocking levers.
Min 0.006 inch — Max 0.050 inch
between no. 1 (leftmost) blocking lever and codebar.
Min 0.003 inch
between remaining blocking levers and codebars.

(2) With all clutches latched, trip and rotate selector clutch (selector conditioned all-marking). As clutch shoe travels between 12 and 3 o'clock positions, there should be no vertical motion of no. 1 or no. 2 blocking lever.

To Adjust

Loosen clamp nut and use hex wrench to position eccentric shaft — keep shaft chamfered shoulder to rear. Check 7.08.



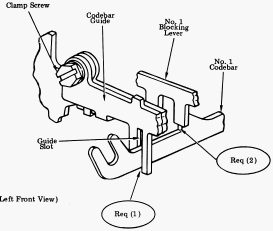
(Left Front View)

7.08 No. 1 Codebar Guide Position

Requirement
With typing unit in stop position and no. 1 blocking lever placed in its lowest (spacing) position
(1) No. 1 codebar should move freely in guide slot.

(2) No. 1 blocking lever should engage full thickness of no. 1 codebar.

To Adjust
Loosen clamp screw. Position codebar guide.



7.09 Print Suppression Latch Position

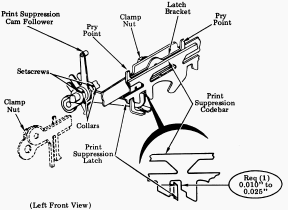
Requirement

(1) With typing unit in stop condition
Min 0.010 inch — Max 0.025 inch
between print suppression latch and print suppression codebar, as gauged by eye.

(2) Print suppression latch should return freely after being pushed downward and then released.

To Adjust

To meet Requirement (1), loosen clamp nuts and use pry points to position latch bracket. For Requirement (2), loosen setscrews and position collars.



7.10 Right and Left Slide Guideplates Position

Requirement

With typing unit in stop condition

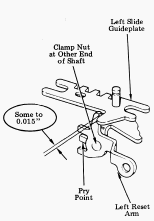
Min some -- Max 0.015 inch

between right slide guideplate and right reset arm and between left slide guideplate and left reset arm when play of slide guideplate is taken up toward front (by holding middle of rear slide forward) to make clearance maximum.

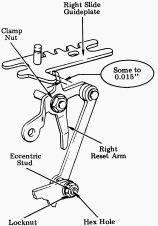
To Adjust

Right side guideplate: Loosen eccentric stud locknut and use hex wrench to rotate stud.

Left side guideplate: Loosen left reset arm clamp nut and use pry points to position arm.



(Left Side View)



(Right Side View)

7.11 Carriage Return Lever Position

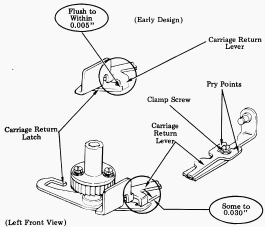
Requirement

With carriage return code in selector, rotate main shaft until function ball reaches lowest point of travel.
Early Design: Carriage return lever should be flush with carriage return latch within 0.005 inch.

Late Design:
Min some -- Max 0.030 inch
between carriage return lever and carriage return latch.

To Adjust

With clamp screw loosened, use pry points to position carriage return lever.



7.12 Dashpot Orifice

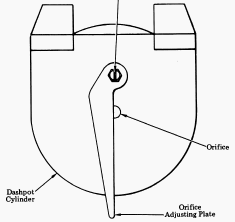
Requirement

No carriage bounce when carriage is returned from right hand margin by manually disengaging feed and check pawls from spacing ratchet.

To Adjust

Loosen clamp screw. Position orifice adjusting plate.

CAUTION: DO NOT FULLY UNCOVER ORIFICE. A FULLY UNCOVERED ORIFICE MAY RESULT IN BREAKAGE OF CARRIAGE RETURN LOBE PLATE.



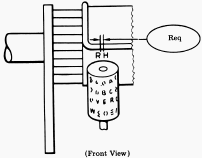
(Left Side View)

7.13 Spacing Ratchet Position

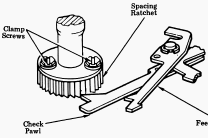
To Check
Print two or more characters such as RH at left margin and at center of line.

Requirement
Space between characters should be the same at left margin as at center of line.

To Adjust
With piston fully seated in dashpot and spacing ratchet clamp screws friction tight, pivot check pawl forward. Position spacing ratchet so check pawl, when released, rests on tip of a spacing ratchet tooth.



(Front View)



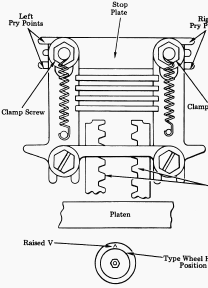
(Top View)

7.14 Stop Plate Position

Requirement
Printed characters should be of uniform density.

To Adjust
With clamp screw friction tight:
(1) If printing is light on left (WUT), move left pry points rearward. Refine, if necessary, by moving right pry points forward.

(2) If printing is light on right (MNH), move left pry points forward. Refine, if necessary, by moving right pry points rearward.



(Top View)

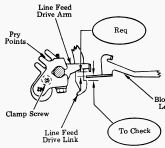
7.15 Line Feed Blocking Lever (Friction Feed)

Requirement
With line feed code in selector, rotate main shaft to pivot line feed drive arm to its highest position. There should be a gap between drive arm and blocking lever, and blocking lever should engage drive link as illustrated.

To Adjust
(1) If no gap exists, loosen clamp screw (friction tight) and reposition drive arm. Check 7.16 Requirement (2) if unit is early design with drive link pry adjustment.

(2) If gap exists but drive link does not engage blocking lever, loosen mounting screws and lower upstop bracket.

To Check
Cycle unit as in Requirement. Push down lightly, then release blocking lever. Observe 0.010 to 0.040 inch movement of blocking lever. If necessary, refine To Adjust (2).



(Left Side Views)

7.16 Line Feed Control (Friction Feed)

NOTE: If drive link travel is complete, check Requirements (1a), (1b), (2), and (3). If drive link travel is incomplete, check Requirement (4). Requirement (2) does not apply to late design line feed mechanism with yield spring drive link.

Requirement

Late design mechanism with yield spring drive link:
Unit in double line feed position with unit in stop position (drive link against upstop bracket).

(1a) Line feed pawl should enter fully and cleanly into ratchet teeth.

Early design mechanism with drive link pry adjustment:
Unit in single line feed position and pawl placed in its lowest position.

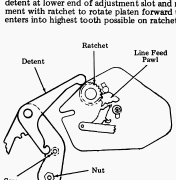
(1b) Pawl held forward should fully mesh with platen teeth.

(2) Platen should not rotate when detent is held outward then released against platen.

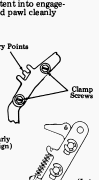
To Adjust

Early Design: To meet Requirement (1b), loosen nut and screw and position detent. For Requirement (2), loosen clamp screws and position drive link. If necessary, decrease gap of 7.15 Requirement.

Late Design: Loosen detent nut and screw friction tight. Position detent at lower end of adjustment slot and move detent into engagement with ratchet to rotate platen forward until feed pawl cleanly enters into highest tooth possible on ratchet.



(Right Side View)



(Left Side View)

7.16 Line Feed Control (Friction Feed) (continued)

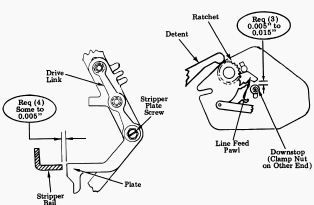
Requirement

(3) With unit in single line feed position and line feed code in selector, rotate main shaft slowly until line feed pawl advances ratchet to point where detent just falls into ratchet tooth. On late design mechanism, line feed drive link should not be extended when checking or making requirement.
Min 0.005 inch — Max 0.015 inch
between pawl and downstop.

(4) With line feed code in selector and main shaft rotated to place pawl in lowest position,
Min some — Max 0.005 inch
between stripper bail and plate.

To Adjust

For Requirement (3), loosen downstop clamp nut and position downstop. For Requirement (4), loosen stripper plate screw and position plate.



(Right Side Views)

7.17 Line Feed Selection (Sprocket Feed)

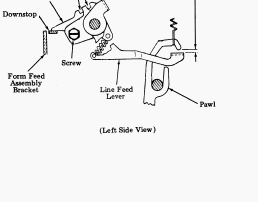
To Check
Place typing unit in stop condition.

Requirement
Single Line Feed:
Min 0.110 inch — Max 0.130 inch
between pawl and line feed lever.

Double Line Feed:
Min zero — Max 0.010 inch
between pawl and line feed lever.

To Adjust
Early Design: While holding rear part of arm against downstop, loosen screw friction tight. Position line feed lever using pry points.

Late Design: With screw friction tight, position line feed lever using pry points.



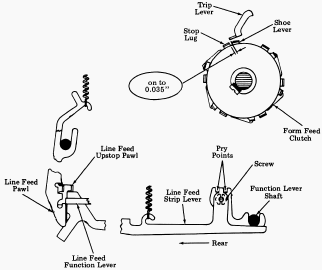
(Left Side View)

7.18 Line Feed Strip (Sprocket Feed)

To Check
With line feed selection adjusted for single line feed and line feed strip lever pushed down to seat line feed upstop pawl against line feed strip lever, set up line feed code in selector.

Requirement
Rotate main shaft until line feed pawl just strips off line feed function lever. Trip lever should fall
Min on — Max 0.035 inch
before stop lug.

To Adjust
Position adjustment pry point to approximately 3/4 of its full adjusting range toward rear of unit as a starting point. Cycle unit to set up requirement and carefully adjust pry point so line feed function pawl just strips. Check 7.17.



(Left Side Views)

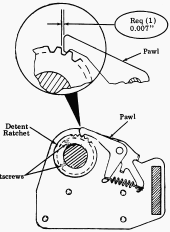
7.19 Line Feed Detent (Sprocket Feed)

To Check
Operate line feed selection through keyboard or set up line feed combination in selector by means of TP185832 armature clip and trip codebar clutch with unit under power.

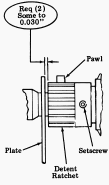
Requirement
(1) Pawl should be fully seated with
Max 0.007 inch
between pawl and detent ratchet tooth.

(2) There should be
Min some — Max 0.030 inch
between plate and detent ratchet.

To Adjust
Loosen both setscrews. Use finger pressure to engage and hold pawl firmly in detent ratchet. Depress line feed key.



(Right Side View)



(Front View)

7.20 Form-Out Lever Overtravel

Requirement

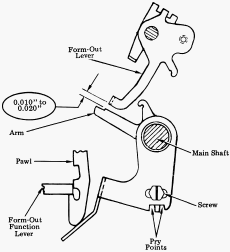
With form-out code combination in selector, and main shaft rotated to place form-out function lever in its lowermost position,

Min 0.010 inch -- Max 0.020 inch

between form-out lever and arm.

To Adjust

Loosen screw. Hold function lever against pawl. Use pry points to position arm.



(Right Side View)

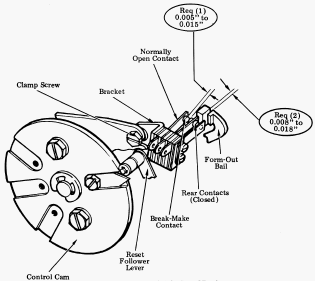
7.21 Form-Out Contact

Requirement
With typing unit in stop condition and reset follower lever on low part of control cam

(1) Min 0.005 inch – Max 0.015 inch
between form-out ball and insulator.

(2) Min 0.008 inch – Max 0.018 inch
between break-make and normally open contacts, with rear contacts closed.

To Adjust
To meet Requirement (1), loosen clamp screw and position bracket.
For Requirement (2), bend normally open contact.

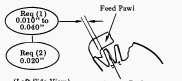


7.22 Answer-Back Control

NOTE: If answer-back drum fails to begin cycle, check this adjustment. If drum advances, but erratically, check 7.23.

Requirement

(1) For HERE IS failure: Trip distributor clutch and rotate main shaft until feed lever cam roller is directly over top of distributor shaft. Depress HERE IS key with 20 oz to 24 oz force.
Min 0.010 inch
Max 0.040 inch
between feed pawl and face of answer-back drum tooth of row 17.



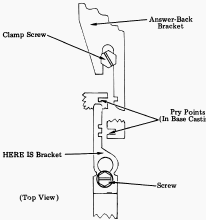
(Left Side View)

(2) For automatic answer-back failure: With automatic answer-back magnet armature attracted and feed pawl placed in its rearmost position
Min 0.020 inch
between feed pawl and no. 17 drum tooth.

To Adjust

HERE IS failure: Loosen screw. Position HERE IS bracket.

ENQ failure: Loosen clamp screw. Position answer-back bracket.



(Top View)

7.23 Answer-Back Drum Advance

NOTE: If answer-back drum advance is erratic, check this adjustment. If drum fails to begin its first cycle, check 7.22.

Requirement

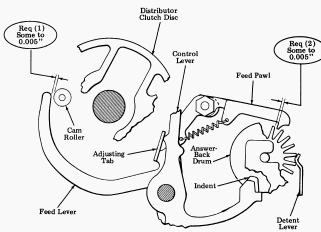
Answer-back drum fully detented in its home position and distributor clutch rotated until cam roller is adjacent to high part of feed lever. Feed pawl held clear of answer-back drum.

(1) Min some -- Max 0.005 inch between feed lever and cam roller.

(2) Min some -- Max 0.005 inch between feed pawl and rear face of no. 16 drum tooth.

To Adjust

To meet Requirement (1), bend feed lever adjusting tab. For Requirement (2), loosen screw and nut, position feed pawl.



7.24 Answer-Back Trip Lever

Requirement

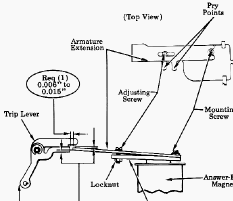
Trip distributor clutch and rotate main shaft to position trip lever fully forward. With armature held in its attracted position

(1) Min 0.006 inch -- Max 0.015 inch between end of armature extension and end of blocking latch.

(2) Front of armature extension vertically centered between top and bottom surfaces of blocking latch, as gauged by eye.

To Adjust

To meet Requirement (1), loosen mounting screw and use pry points to position armature extension. For Requirement (2), loosen locknut and reposition adjusting screw.



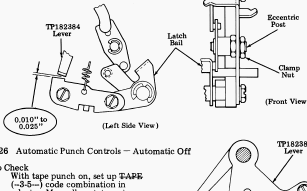
(Right Side View)

7.25 Automatic Punch Controls — Automatic On

To Check
With tape punch on, depress UNLOCK pushbutton (if present). Set up TAPE (-2-5--) code combination in selector. Manually rotate main shaft until drive link is in its most forward position.

Requirement
Min 0.010 inch — Max 0.025 inch between latch bail and TP182384 lever.

To Adjust
Loosen clamp nut and rotate eccentric post.

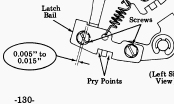


7.26 Automatic Punch Controls — Automatic Off

To Check
With tape punch on, set up ~~TAPE~~ (-3-5--) code combination in selector. Manually rotate main shaft until function rocker shaft is in its most forward position.

Requirement
Min 0.005 inch
Max 0.015 inch between latch bail and TP182384 lever.

To Adjust
Loosen screws and position latch bail using pry points.



7.27 Punch Pawl Upstop Assembly

NOTE: Following procedure is for manual punches. For automatic punches set up TAPE (--3.5--) instead of all-marking condition in selector to check Requirement (1). All other procedures are the same for both manual and automatic punches.

Requirement

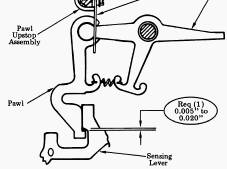
With tape punch on, typing unit selector in all-marking condition (see NOTE), and main shaft rotated to place stripper ball in rearmost position,

(1) Min 0.005 inch -- Max 0.020 inch between leftmost sensing lever and pawl.

(2) Some clearance between remaining pawls and associated sensing levers and feed pawl.

To Adjust

Loosen screw. Rotate pawl upstop assembly in clockwise direction. If absolutely necessary, assembly may be rotated counterclockwise. Check that plate guides both the pawls and levers without binding. Check 7.28.

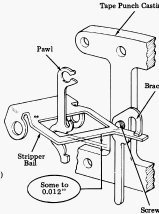


(Left Side View)

7.28 Punch Stripper Bail Upstop

Requirement
With tape punch in off position and all pawls in their uppermost position,
Min some -- Max 0.012 inch between stripper bail and closest pawl.

To Adjust
Loosen screw. Rotate bracket to position stripper bail.



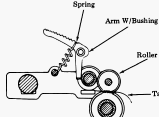
(Left Front View)

7.29 Punched Tape Code Hole Spacing

To Check
Place an 8-inch length of punched tape on a TP156011 tape gauge. Align a tape code hole with the first hole in the gauge.

Requirement
Remaining four gauge holes should be visible through corresponding tape holes of same code level.

To Adjust
Reposition spring on arm with bushing until requirement is met.

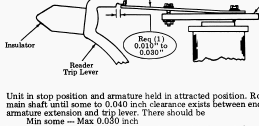


(Side View)

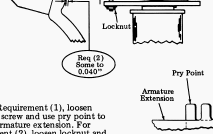
7.30 Reader Trip Lever and Armature

Requirement

(1) Trip distributor clutch by depressing armature. Rotate main shaft to position trip lever fully forward. With armature in unattracted position
Min 0.010 inch -- Max 0.030 inch
between end of armature extension and latching surface of reader trip lever.

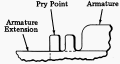


(2) Unit in stop position and armature held in attracted position. Rotate main shaft until some to 0.040 inch clearance exists between end of armature extension and trip lever. There should be
Min some -- Max 0.030 inch
between top of armature extension and reader trip lever at closest point.



To Adjust

To meet Requirement (1), loosen mounting screw and use pry point to position armature extension. For Requirement (2), loosen locknut and reposition adjusting screw.



NOTES

8. WIRING DIAGRAMS

8.01 Wiring Diagrams to which Trouble Analysis Table (6.03) refers are in this section.

8.02 Following lists the designations used in these diagrams and the BSTSEA W-Plans and other Wiring Diagrams.

Designation	Component
	UCC 29 Call Control Unit
CM	AC Power Cord
CN	Break Detector Card Connector
CP	Elapsed Time Indicator
CQ	Convenience Outlet
CR	Fuse Holder, SMD, 8/10A, SL-BL
CS	Fuse Holder, Power Supply
CT	Fuse Holder, Set, 2A, SL-BL
CU	Transformer, Power, 3-2/10A, SL-BL
CV	Motor Control Relay
CW	SMD Card Connector
CX	Power Supply Circuit Card
CY	Power Transistor
CZ	Power Terminal Block
# 1	Connector, CAH/RTD
# 2	Connector, CAJ/FC
# 3	Connector, CAS/FA
# 4	Connector, CAA/PB
# 5	Connector, CAG/DK
# 6	Connector, CAF/DB
# 7	Connector, CAE/KQ
# 8	Connector, CAD/PC
SMD	Selector Magnet Driver Circuit Card
	Printer
PA	Connector #3, CAB
PB	Connector #4, CAA
PC	Connector #8, CAD
PE	Answer-Back Contact Block
PF	Answer-Back Magnet
PG	TD Trip Magnet
PH	Selector Coil
PJ	TD Stop, Motor Hold, Form Out Switch Assy
PK	TD Feed Contact Assy (DE)
PL	Paper Alarm Switch
PN	ROT, DC3/DC1, ENQ/EOT Function Contact Assy
PR	ACK, DC1 Function Contact Assy

Designation	Component
	Keyboard
KP	Contact Block, Left
KQ	Connector #7, CAE
KS	Contact Block, Right
	Motor
MA	Motor
MB	Motor Start Relay
MC	Motor Start Capacitor
MD	Connector
ME	Connector
MF	Fuse Holder, Motor
	TD Reader
DA	TD Contact Block
DB	Connector #6, CAF
DC	TD Feed Magnet
DD	Connector, Reader Power Pack
DE	TD Feed Contact (PK)
DF	Power Pack Card
DK	Connector #5, CAG
	TP186627 Logic Assembly, DATA-PHONE
J1	Receptacle, receives P1 of cable to Data Set.
J3	Plug on circuit board to connect with P3.
J4	Receptacle, receives FA plug from cable to UCC29.
J5	Plug, receives FB receptacle from cable to UCC29.
P1	Plug, connects with J1, part of cable to Data Set.
P2	Plug, connects to Data Set function receptacle.
P3	Receptacle on circuit board to connect with J3.
	TP186680 Logic Assembly, Private Line
HEA	Connector, receives P1 of cable to Data Set.
P1	Plug, connects to HEA, part of cable to Data Set.
HAH	Receives connector FB from cable to UCC29.
HAJ	Receives connector FA from cable to UCC29.
HA/HK	Keyswitch/Lamp assembly connectors.
HB/HL	Lamp assembly connectors.
JA/KA JB/KB JC/KC JD/KD JE/KE JF/KF JH/KH JJ/KJ	Circuit Board to Circuit Board pin connector groups.

8.03 Wire color designations used in the diagrams are:

Letter Designation	Color
BK	Black
BL	Blue
BR	Brown
G	Green
O	Orange
P	Purple
R	Red
S	Slate
W	White
Y	Yellow

8.04 Circuit common and ground functions in the diagrams are as follows, and may or may not be connected together, depending on the data set.

Teletypewriter UCC29 Call Control Unit:

Common return to -20 v dc supply.

Common return to +24 v dc supply.

TP186627 Logic Assembly, D.-P.:

Physical ground on TP186637 Circuit Card

Physical ground on TP303826 Circuit Card

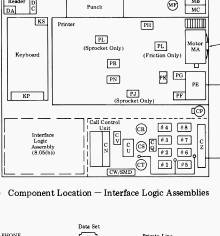
Common Lead in TP336601 Interface Cable

TP186680 Logic Assembly, P.L.:

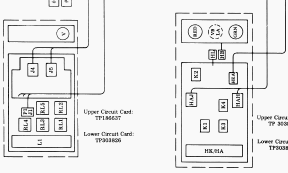
Physical ground on TP303831 Circuit Card

Physical ground on TP303832 Circuit Card

8.05 (a) Component Location — Teletypewriter Set



8.05 (b) Component Location — Interface Logic Assemblies



8.05 (c) Key/Lamp Strip and Characteristics

(1) Legend

L — Locking, remains down when depressed.
NL — Nonlocking, raises back up to normal position after depressing.
UL — Locks and unlocks on successive depressions.
R — Releasing, releases any depressed locked key.
NR — Nonreleasing, does not release locking keys.
I — With lamp, illuminates when key is depressed or when switched on by circuitry, depending on circuit operation.
NI — Non illuminating.

(2) Teletypewriter Set Interface Logic Assemblies

Key Designation	DATA-PHONE (TP186627)	Private Line (TP186680)
OFF	NL R NI	NL R NI
ON	NL R I*	NL R I
LOCAL	L R I	L R I
OUT OF SERVICE	L R I	L R I
TEST	L R I	L R I
ALARM	NL NR I	—
BREAK RELEASE	—	NL NR I
Located on Bezel Face Plate:		
BRK RLS	NL I	—
PAPER ALARM		(Lamp only)
VBLA	—	NL I
PROCEED	—	(Lamp only)

*Only when teletypewriter is operated On-Line.

8.05 (c) Key/Lamp Strip and Characteristics (Continued)

(3) Data Sets (DS)/Data Auxiliary Sets (DAS)

Key Designation	*113A-L1/2 Type DS	103G-Type DS	804B1 DAS (103A2 DS)	804G-Type DAS (402E4/7 DS)	565HK Set 2565HK Set 602A1 Set 2602A1 Set (103AS DS)
TALK	(TALK CLEAR) L R NI	(CLEAR TALK) NL R NI	(TALK) L R NI	(TALK) L R I	(CLEAR TALK) NL NR I
DATA	NL R I	NL R I	NL R I	NL R I	NL NR I
AUTO	—	UL R I	L R I	—	(AUTO ANS) L R I
TEST	L R NI	NL NR I	(TEST 1) NL NR I	NL NR I	NL NR I
TEST 2	—	—	NL NR NI	—	—
LOCAL	—	—	L L R NI	—	(MANUAL ANS) L R NI

*113A-L1- Type DS, none of the keys illuminate.

8.05 (d) Relay Designation and Function

TP166627 Logic Assembly, DATA-PHONE

RL1	Data Set Ready Relay
RL2	ON Relay
RL3	Data Terminal Ready Relay
RL4	OFF Relay
RL5	LOCAL Relay

TP166680 Logic Assembly, Private Line

K1	Activated by K3, released by ACK and LOCAL key.
K2	Controls TD Reader Magnet
K3	Activated by Activity, Send, and Receive circuits.
K4	Activated when on-line.

8.06 Voltages for Interface Circuits Between Teletypewriter Set Interface Logic Assemblies and Data Set/Data Auxiliary Set.

Circuit voltages (dc) on terminals (with reference to terminal 7, Signal/Circuit Ground) of 25-pin EIA connector on DS/DAS (usually at rear) into which P2 (of Logic Assembly Cable) connects.

NOTE 1: In paper-out condition before on-line turn-on, CD circuit (pin 6) is -5 to -25 volts. After paper runs out during on-line operation, CD circuit remains +5 to +25 volts.

NOTE 2: Voltages shown are for the condition when DS/DAS is not ringing.

Procedure for monitoring voltage signals at 25-pin EIA data terminal connector:

(1) Remove primary ac power from DS/DAS and from teletypewriter set.

(2) Disconnect from 25-pin EIA connector on DS/DAS the P2 connector which is part of the cable of the Set Logic Assembly on the teletypewriter set.

(3) Connect Set Logic Assembly connector P2 to 25-pin connector on face of J79901B-L3 Interface Test Adapter (cover of 901B Data Test Set).

(4) Connect W25A Connector Cord (part of J79901B-L3 ITA) to 25-pin EIA connector on DS/DAS.

(5) J79901B-L3 ITA terminal 7 is Signal (Circuit) Ground. If voltage to be measured is positive, place KS-20538-L1 Volt-Ohm-Milliameter (VOM), or equivalent, negative or ground lead on terminal 7 — if voltage to be measured is negative, place VOM positive lead on terminal 7.

(6) Other lead of VOM to be connected to terminal of J79901B-L3 to be measured.

(7) Reconnect primary ac power to DS/DAS and teletypewriter set.

DATA SET TYPE	TELETYPE-WRITER OPERATING MODE	PIN NO. / CIRCUIT / DESCRIPTION	7 AB SIG GND	1 AA PROT GND	2 BA XMIT DATA	3 BB REC DATA
113A-L1-	Not turned on.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	0 to -4
	LOCAL key depressed.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	0 to -4
	ON key depressed.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	0 to -4
	On-Line connected.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	-5 to -25 (Mark)
103G- and 103A3	Not turned on.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
	LOCAL key depressed.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
	ON key depressed.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
	On-Line connected.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
103A2	Not turned on.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	-5 to -25 (Mark)
	LOCAL key depressed.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	-5 to -25 (Mark)
	ON key depressed.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	-5 to -25 (Mark)
	On-Line connected.		0 (Ref)	-0.3 to +0.3	-3 to -25 (Mark)	-5 to -25 (Mark)
403A4/7	Not turned on.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
	LOCAL key depressed.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
	ON key depressed.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)
	On-Line connected.		0 (Ref)	-0.3 to +0.3	-5 to -25 (Mark)	-5 to -25 (Mark)

5 CB CTS	6 CC DSR	8 CF DCD	20 CD DTR (Note 1)	22 CE RI (Note 2)	9 +P	10 -P
*	-0.3 to +0.3	-0.3 to +0.3	+3 to +25	*	*	*
*	-0.3 to +0.3	-0.3 to +0.3	-3 to -25	*	*	*
*	-0.3 to +0.3	-0.3 to +0.3	+3 to +25	*	*	*
*	+5 to +25	-0.3 to +0.3	+3 to +25	*	*	*
-5 to -25	-5 to -25	-5 to -25	+5 to +25	-5 to -25	+10 to +25	-10 to -25
-5 to -25	-5 to -25	-5 to -25	-5 to -25	-5 to -25	+10 to +25	-10 to -25
-5 to -25	-5 to -25	-5 to -25	+5 to +25	-5 to -25	+10 to +25	-10 to -25
+5 to +25	+5 to +25	+5 to +25	+5 to +25	+5 to +25	+10 to +25	-10 to -25
-5 to -25	-5 to -25	-5 to -25	+3 to +25	-5 to -25	+15 to +25	-15 to -25
-5 to -25	-5 to -25	-5 to -25	-3 to -25	-5 to -25	+15 to +25	-15 to -25
-5 to -25	-5 to -25	-5 to -25	+3 to +25	-5 to -25	+15 to +25	-15 to -25
+5 to +25	+5 to +25	+5 to +25	+3 to +25	-5 to -25	+15 to +25	-15 to -25
-5 to -25	-5 to -25	*	+5 to +25	*	*	*
-5 to -25	-5 to -25	*	-5 to -25	*	*	*
-5 to -25	+5 to +25	*	+5 to +25	*	*	*
-5 to -25	+5 to +25	*	+5 to +25	*	*	*

*These circuits are not used, and any voltages that may be present are of no significance.

8.06 (b) Private Line Service

DATA INTERFACE	TELETYPEWRITER OPERATING MODE	PIN NO. CIRCUIT DESCRIPTION	1 AA PROT GND
108A-,C-, D-,E- 109A-,E-	Power on Teletypewriter Set and DAS 820D- Type Teletypewriter Set Running or Not Running.		-0.3 to +0.3
1A DATA STATION (SCA) BINARY	Power on Teletypewriter Set and 1A Data Station (SCA), Teletypewriter Set Running or Not Running.		-0.3 to +0.3

2 BA XMIT DATA	3 BB REC DATA	4 CA RTS	5 CB CTS	6 CC DSR	7 AB SIGNAL GND	8 CF DCD
-3 to -25 (Mark) +3 to +25 (Space)	-3 to -25 (Mark) +3 to +25 (Space)	*	*	+5 to +25	0 (Reference)	+5 to +25
-5 to -25 (Mark) +5 to +25 (Space)	-3 to -25 (Mark) +3 to +25 (Space)	*	*	+5 to +25	0 (Reference)	+5 to +25

*NOTE: These circuits are not used, any voltages that may be present are of no significance.

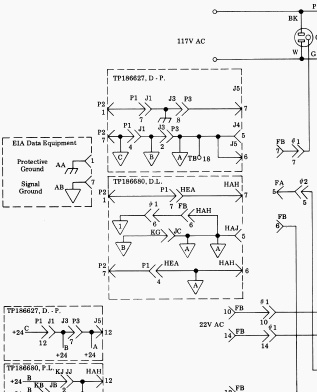
1A Data Station (SCA), Binary

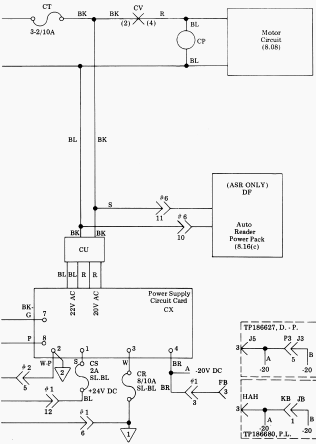
TEST POINTS ON CIRCUIT PACKS

CIRCUIT PACK	TEST POINT	NORMAL CONDITION (NOTE 1) MARK	SPACE	PROBABLE TROUBLE AREA (Replace C.D.)
RCV INTF (DP51)	LIM IN	-32 dBm +2 dB	-32 dBm +2 dB	DP26-DP50
	EIA OUT	-16 Volts +3 Volts	+16 Volts +3 Volts	DP51 and DP26-DP50
TRMTR (DP1-DP25)	TRMTR OUT	-13 dBm +0.6 dB	-13 dBm -0.5 dB	DP1-DP25, or DP66 (DP60)
	EIA IN	+0.2 Volt +0.2 Volt	+5.5 Volt +1.5 Volts	DP66 (DP60)
LINE EIA INTF (DP66/DP60)	SEND	NOTE 2		DP1-DP25, or DP66 (DP60)
	RCV	-12 dBm +2 dB	-12 dBm +2 dB	DP66 (DP60)
	RD	-16 Volts +3 Volts	+16 Volts +3 Volts	DP66 (DP60) and DP26-DP50

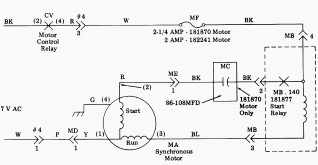
NOTE 1: Test meter KS-20538-L1 VOM, or equivalent, calibrated for 600-ohm termination to be used.

NOTE 2: 600-ohm facility: 4 dB higher than that delivered to facility. 900-ohm facility: 2 dB higher than that delivered to facility.

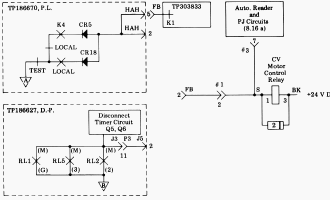

P
BK
CQ
W
G
117V AC
TP186627, D - P.
J5
P2
P1 J1
J3 P3
EIA Data Equipment
Protective Ground
Signal Ground
AA
AB
TP186680, D.L.
P1 HEA
HAH
FB
HAH
KC
HAJ
KG
P2
HEA
HAH
TP186627, D - P.
+24
+24
+24
TP186680, P.L.
KJ J2
KB J6
HAH
22V AC
FB
FA
FB
FB
FB
FB
FB
FB
#1
#2
#1
F1


CT
BK
BK
CV
R
3-2/10A
(2)
(4)
BL
CP
Motor Circuit (8.08)
BL
BL
BK
(ASR ONLY) DF
S
#6
11
#6
10
Auto Reader Power Pack (8.16(c)
BK
BK
CU
BL
BL
R
R
Power Supply Circuit Card CX
BK-G
7
22V AC
20V AC
P
8
2
1
3
4
W
P
S
CS 2A SL.BL
W
BR
A
-20V DC
#2
5
#1
12
+24V DC BL
CR 8/10A SL.BL
BR
#1
3
FB
3
#1
6
1
TP186627, D - P
J5
J3
3
A
B
5
-20
-20
HAH
KB
JB
3
A
B
1
-20
-20
TP186680, P.L.

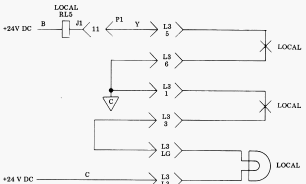
8.08 Motor Circuit

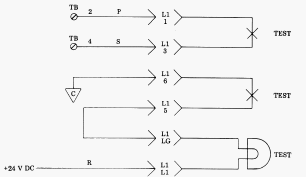


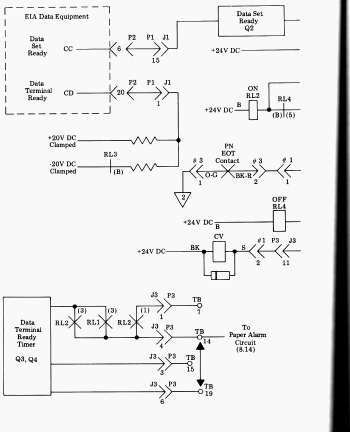
8.09 Motor Control Circuit

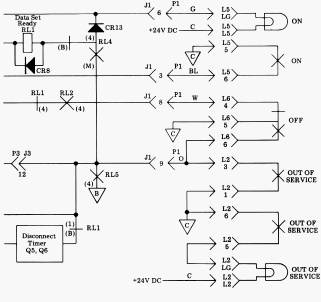


8.10 (a) TP186627, D-P – Local Turn-On Control Circuits

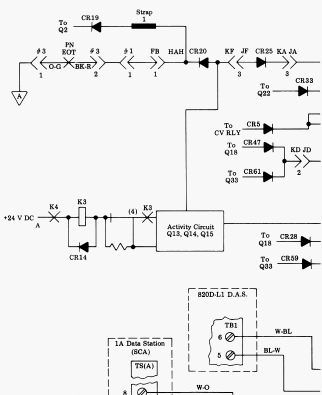


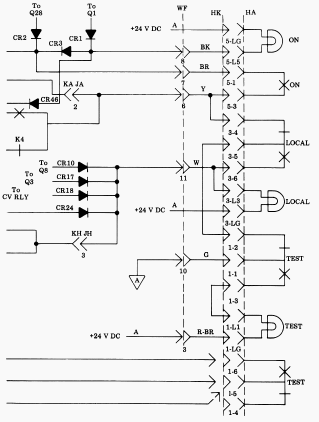


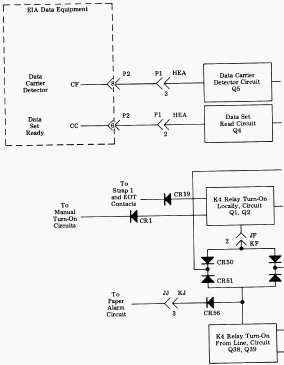

EIA Data Equipment
Data Set Ready
CC
6
P2
P1
J1
15
Data Set Ready Q2
+24V DC
Data Terminal Ready
CD
20
P2
P1
J1
1
ON RL2
+24V DC
B
RL4
(B) (6)
+20V DC Clamped
-20V DC Clamped
RL3
(B)
PN EOT Contact
3
C-G
2
BK-R
1
1
2
7
OFF RL4
+24V DC
B
CV
+24V DC
BK
S
#1
P3
J3
2
11
Data Terminal Ready Timer
Q3, Q4
(3)
(3)
(1)
RL2
RL1
RL2
J3
P3
TB
7
1
To Paper Alarm Circuit (8.14)
TB
14
TB
15
TB
19
6

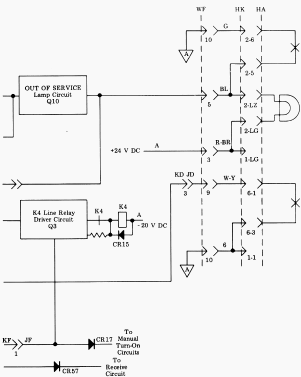

Data Set Ready RL1
CR13
RL4
CR8
(4)
(B)
(M)
J1
6
P1
G
C
+24V DC
L5
LG
L6
ON
L6
5
ON
J1
3
P1
BL
L6
6
RL1
RL2
(4)
(4)
J1
8
P1
W
L6
4
OFF
L6
5
L6
6
F9 J3
12
RL5
(4)
B
J1
9
P1
O
L2
3
OUT OF SERVICE
L2
1
L2
6
OUT OF SERVICE
L2
5
L2
LG
L2
OUT OF SERVICE
Disconnect Timer Q5, Q6
(1)
(B)
RL1
C
+24V DC

8.11 (a) TP186680 PL — Local Turn-On Control and Activity Circuits

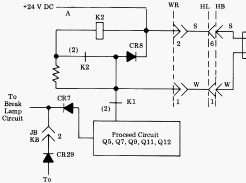



To Q28
To Q1
CR2
CR3
CR1
KA JA
CR46
2
K4
To Q5
To Q3
To CV RLY
CR10
CR17
CR18
CR24
KH JH
3
WF
HK
HA
+24 V DC
A
5-LG
ON
BK
8
5-L5
BR
7
5-1
ON
Y
6
5-3
3-4
LOCAL
3-5
W
11
3-6
5-L5
LOCAL
+24 V DC
A
3-LG
1-2
G
10
TEST
A
1-1
1-3
1-L1
TEST
+24 V DC
A
R-BR
3
1-LG
1-6
TEST
1-5
1-4

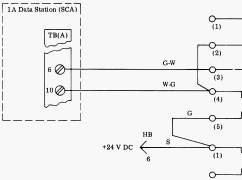

EIA Data Equipment
Data Carrier Detector
CF
P2
P1
HEA
3
Data Carrier Detector Circuit Q5
Data Set Ready
CC
P2
P1
HEA
2
Data Set Read Circuit Q4
To Strap 1 and EOT Contacts
CR19
To Manual Turn-On Circuits
CR1
K4 Relay Turn-On Locally, Circuit Q1, Q2
2
JF
KF
CR50
CR48
CR51
CR49
To Paper Alarm Circuit
JJ
KJ
3
CR56
K4 Relay Turn-On From Line, Circuit Q38, Q39


WF
HK
HA
G
1-9
2-4
OUT OF SERVICE
2-5
BL
OUT OF SERVICE Lamp Circuit Q10
5
3-LG
OUT OF SERVICE
2-LG
B-BR
+24 V DC
A
3
1-LG
KD JD
W-Y
2
9
6-1
OFF
K4 Line Relay Driver Circuit Q3
K4
K4
A
-20 V DC
CR15
6-3
6
10
1-1
KF
2
2F
1
CR17
To Manual Turn-On Circuits
To Receive Circuit
CR57

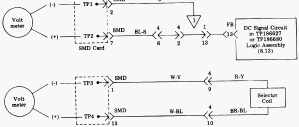
8.11 (c) TP186680, PL — Proceed Circuit



8.11 (d) TP186680, PL, W/1A Data Station (SCA) Only — Voice Band Loop Around (VBLA) Circuit



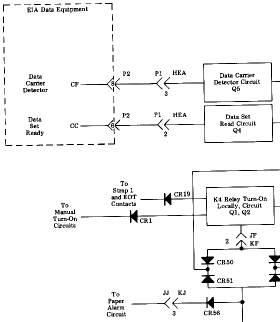
8.12 (a) Selector Circuit

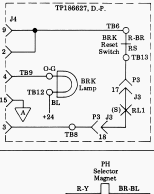


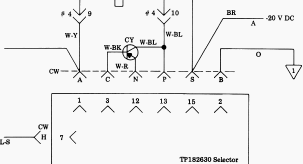
Nominal voltmeter readings across test points indicated:

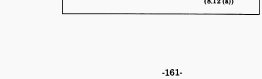
	TP186627 Logic Assembly (DATA-PHONE)	TP186680 Logic Assembly (Private Line)
TP1 (-) and TP2 (+)	-0.1 ±0.06	+0.25 ±0.05
TP3 (-) and TP4 (+)	+3.3 ±0.5	+3.3 ±0.5

Except during reception of data characters and Break signals, for voltages other than these, trouble is in SMD card or in respective logic assembly.

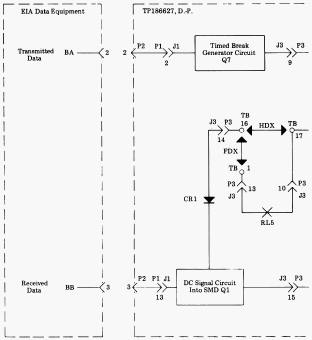

EIA Data Equipment
Data Carrier Detector
CF
P2
P1
HEA
3
Data Carrier Detector Circuit Q5
Data Set Ready
CC
P3
P1
HEA
2
Data Set Read Circuit Q4
To Step 1 and KOT Contacts
CR19
To Manual Turn-On Circuits
CR1
K4 Relay Turn-On Locally, Circuit Q1, Q2
2
JF
KF
CR50
CR49
CR51
CR49
To Paper Alarm Circuit
JJ
KJ
3
CR56
K4 Relay Turn-On From Line, Circuit Q38, Q39

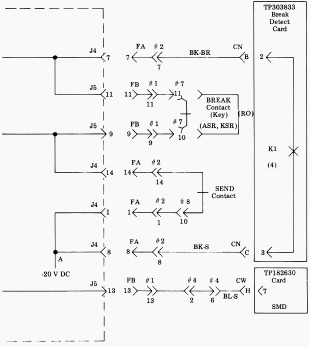

TP186637, D.F.
J4
9
2
TB6
BRK Reset Switch
R-BR
Rn
TB13
TB9
O-G
4
15
TB12
BRK Lamp
BL
P3
17
J3
RL1
(S)
J3
+24
3
P3
TB8
18
TP186680, P.L.
HAJ
WF
HA
HK
P
9
1
4-1
Break Release
2
WF
HK
HA
R-S
4-2
R-S
4
WF
HK
HA
R
4
4-L4
R
Break Release
HK
HA
15
4-LG
+24
3

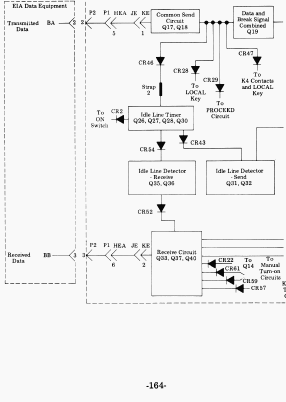

PH Selector Magnet
R-Y
BR-BL
BK-BL
4
9
4
10
BR
A
-20 V DC
W-Y
CY
W-BL
W-BK
W-BL
W-R
O
CW
A
C
N
P
B
B

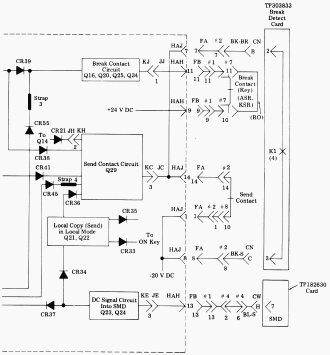

1
3
12
13
15
2
CW
H
7
BL-S
TP185830 Selector Magnet Driver (8.12 (a))

8.13 (a) Signal Line, Send-Receive, and Break Circuitry — DATA-PHONE Service

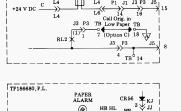



TP303833
Break
Detect
Card
J4
7
FA
#2
7
BK-BR
CN
B
2
J5
11
FB
#3
11
#7
1
BREAK
Contact
(Key)
(ASR, KSR)
(RO)
J5
9
FB
#1
9
#7
7
10
K1
(4)
J4
14
FA
#2
14
SEND
Contact
J4
1
FA
#2
1
#8
10
J4
8
FA
#2
8
BK-S
CN
C
3
A
-20 V DC
J5
13
FB
#1
13
#4
2
#4
6
CW
H
BL-S
TP182630
Card
7
SMD

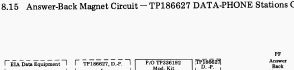

TP186680, P.L.
EIA Data Equipment
Transmitted Data
BA
P5 P1 HKA JK KE
2
3
1
Common Send Circuit Q17, Q18
Data and Break Signal Combined Q19
CR46
CR47
CR48
CR20
To K4 Contacts and LOCAL Key
Strap 2
To LOCAL Key
To PROCEDED Circuit
To ON Switch
CR2
Idle Line Timer Q26, Q27, Q28, Q30
CR43
CR44
Idle Line Detector Receive Q35, Q36
Idle Line Detector Send Q31, Q32
CR52
Received Data
BB
P2 P1 HKA JS KE
3
6
2
Receive Circuit Q33, Q37, Q45
CR22
To Q14
To Manual Turn-on Circuits
CR61
CR55
CR57
K4 Relay Turn-on Circuit


TP303833
Break
Detect
Card
CR39
Break Contact
Circuit
Q16, Q20, Q25, Q24
KJ
JJ
HAH
HAJ
FA
#2
BK-BR
CN
FB
#1
#7
Break
Contact
(Key)
(ASR,
KSR)
(BO)
Strap
3
+24 V DC
CR55
CR21 JH KH
To
Q14
CR36
Send Contact Circuit
Q29
KC
JC
#8
Send
Contact
CR41
Strap 4
CR45
CR38
CR35
Local Copy (Send)
or Local Mode
Q21, Q22
To
ON Key
CR33
#4
CW
BK-S
-20 V DC
CR34
TP182630
Card
CR37
DC Signal Circuit
Into SMD
Q23, Q24
KE
JE
SMD
K1
(4)

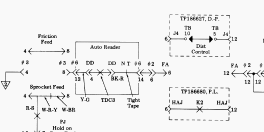
8.14 Paper Alarm Circuits



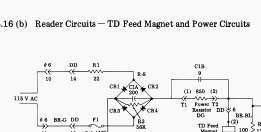
8.15 Answer-Back Magnet Circuit — TP186627 DATA-PHONE Stations Only

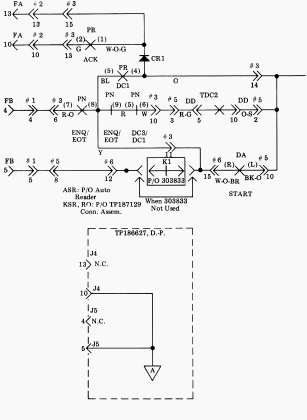


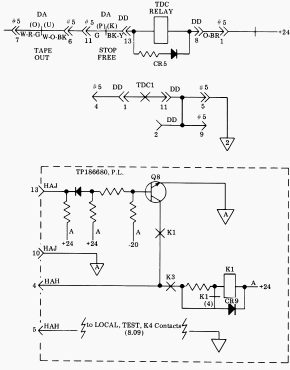
8.16 (a) Reader Circuit — Distributor Trip Magnet



8.16 (b) Reader Circuits — TD Feed Magnet and Power Circuits




FA
#2
13
13
#3
15
PR
FA
#2
10
10
#3
(2)
G
(1)
W-O-G
18
ACK
CR1
FB
(4)
(5)
BL
DC1
O
#3
14
FB
#1
4
4
#3
(7)
R-G
PN
(8)
6
PN
(9)
R
PN
(6)
W
#3
10
#5
3
DD
R-G
TDC2
5
DD
#5
10
O-S
2
ENQ/
EOT
ENQ/
EOT
DC3/
DC1
#3
Y
FB
#1
#5
9
5
8
#6
12
K1
P/O 303853
#6
(R)
(L)
18
W-O-BR
BK-O
10
DA
#5
START
ASR: P/O Auto
Reader
KSR, RO: P/O TP187129
Conn. Assem.
When 303833
Not Used
TP186627, D-P.
J4
12
N.C.
J4
10
J5
4
N.C.
J5
8
A


TDC
RELAY
DA
(O)1 (U)
W-R-G
W-O-BK
TAPE
OUT
DA
(P)(K)
BK-Y
STOP
FREE
DD
DD
O-BR
+24 V DC
CR5
TDC1
TP186680, P.L.
HAJ
HAJ
HAH
HAH
to LOCAL, TEST, K4 Contacts
(8.09)
Q8
K1
K3
CR9
+24
-20