"DATASPEED*" TAPE-TO-TAPE SYSTEM

TAPE SENDERS 5A AND 5C

TROUBLESHOOTING

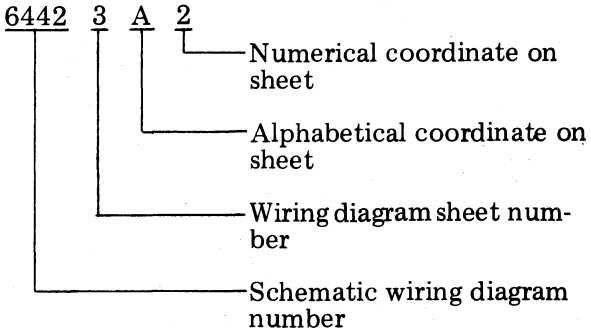
CONTENTS

1. GENERAL

1.01 This section provides troubleshooting procedures for DATASPEED Tape Senders 5A and 5C. It is reissued to update the text and add to the troubleshooting table. The following TCNs have been included in this issue, 928 and 1120. Since this is a general revision, marginal arrows ordinarily used to indicate changes and additions are omitted. This section was formerly 592-807-300.

1.02 General description and operation information, installation procedures, and adjustment and lubrication information are found in related sections.

1.03 The description of circuit operation in this section references schematic diagrams in another section. The circuit elements shown on these diagrams are referenced in the text and may be located according to the following system:



2. EQUIPMENT REQUIRED

2.01 Troubleshooting requires the usual tools (screwdrivers, wrenches, etc) found in Section 570-005-800.

2.02 A standard volt-ohm-milliammeter, some strapping wire, and test tapes are also required.

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3. TROUBLESHOOTING

GENERAL

CAUTION: DISCONNECT ALL AC POWER BEFORE REMOVING ASSEMBLIES OR COVERS FROM READER OR ANY APPARATUS UNIT.

3.01 Restoring the terminal for on-line service is the initial task of field repair. If spares are available, complete unit substitution is an effective way to restore normal operation. Repairs, adjustments, and replacement of component parts can then be done later at a location that is more suited to servicing and testing.

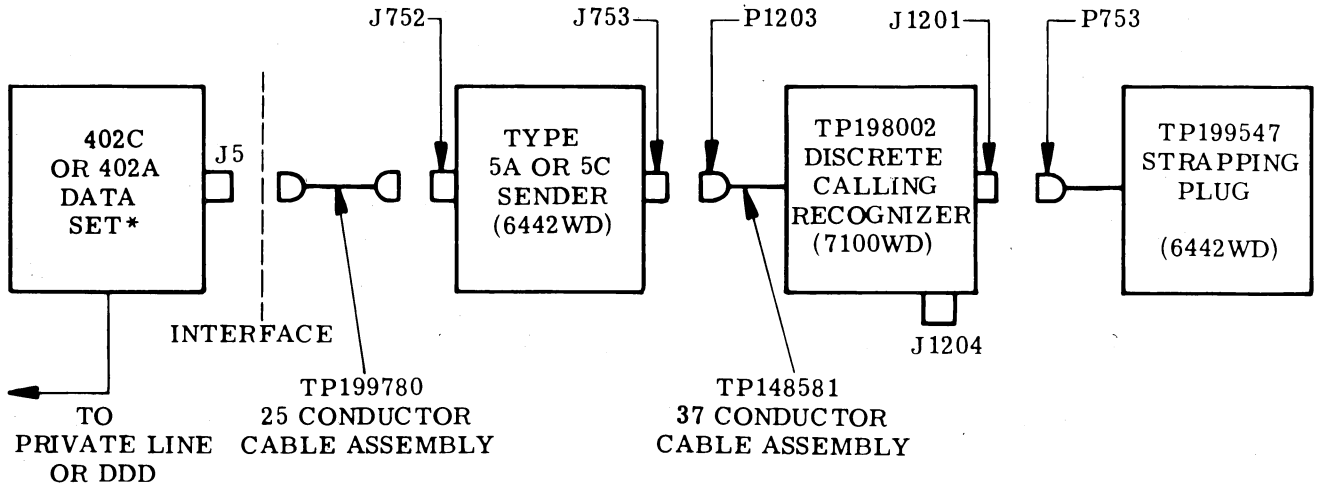
3.02 If the type and cause of a trouble are unknown, refer to 3.23 through 3.55, to the troubleshooting table (Table B), and to the following paragraphs to isolate the problem area and clear the trouble. Refer to the section covering installation for extra feature apparatus unit service arrangements and wiring option tables. To obtain information for troubleshooting extra feature apparatus units, refer to the related feature section.

CABINET CIRCUIT — 5C SENDER

3.03 The electrical circuits of the 5C Tape Sender cabinet are the tape spooling circuit and the TP148562 electrical service panel illustrated in Figure 5. A mercury switch on the tape tension arm turns on the winder motor when slack tape allows the arm to drop to a predetermined level. Improper tape spooling indicates maladjustment (refer to related adjustment, lubrication, and disassembly section). Complete failure to wind indicates a defective switch or winder motor.

TAPE READER

3.04 For more detailed information on the tape reader (CX type) units, refer to the related sections. This section pertains primarily to the electronic components of the Tape Senders 5A and 5C.



LEGEND:

J — Connector attached to equipment.
P — Strapping plug or connector attached to a cable.

*402A can be used with manual send station only.

*402C1 without reverse channel receiver.

*402C2 with reverse channel receiver (circuit assurance and line break feature).

Figure 1 - Interconnecting Diagram for Send-Only Terminal

TAPE SENDERS 5A AND 5C CIRCUITS

A. General

3.05 Circuits associated with the tape sender units can be divided into seven groups:

Data set interface
Control circuits
Motor operate circuit
Reader operate circuit
Data storage circuit
Timing pulse circuit
Power supply circuit

Unusual troubles that may not have been anticipated in this section can be cleared by reference to the theory of operation in the description and operation section where circuit details are discussed. An interconnecting block diagram and control circuit diagram are included here for the convenience of the craft person (Figures 1 and 2). Also included are trouble sources and general information that otherwise may be difficult to obtain (Figure 2 and Tables B and C). Refer also to the complete diagrams shipped with the equipment, if available.

B. Data Set Interface

3.06 For data set interface pins refer to Table A.

C. Control Circuits

3.07 The control circuits (Table A and Figures 1, 2, and 3) associated with the data set interface must function as follows (3.08 through 3.10) for proper operation of a manually operated sender when used as part of a send-only terminal. For other types of operations, refer to the sections covering the extra features to be used.

Data Mode Circuit

3.08 Data Send Mode (DM) lead pin 20 (Figure 2):

(a) The lead to this pin must be grounded by the sender to transmit data. It is permanently grounded through the TP199547 strapping plug to the sender module ground and to Control Common (CC) pin 24 of the data set.

(b) If an extra feature unit, such as a recognizer (Figure 1), is used for discrete calling or unattended answering, the lead to pin 20 must be opened to receive answer-back signals.

(c) The data set does not transmit data if the pin 20 lead is open. The data set does not respond to an answer-back signal by grounding its affected interface terminal (pin 18 for Answer-Back A) when the pin 20 lead is grounded. For answer-back circuit information, refer to the section covering the recognizer.

Remote Release Circuit

3.09 Remote Release (RR) lead pin 14 (Figure 2):

(a) The lead to this pin must be grounded by the sender to keep the data set on the line during a call. It is permanently grounded through the TP199547 strapping plug to the sender ground and to Data Common (DC) pin 11 of the data set.

(b) If a recognizer is used, the lead to pin 14 becomes part of an automatic disconnect feature.

(c) The data set will immediately disconnect (go on-hook) if this lead is opened. For disconnect circuit information, refer to the section covering the recognizer. If the sender is used as part of an unattended send-receive terminal, refer also to the section covering the unattended send-receive apparatus unit.

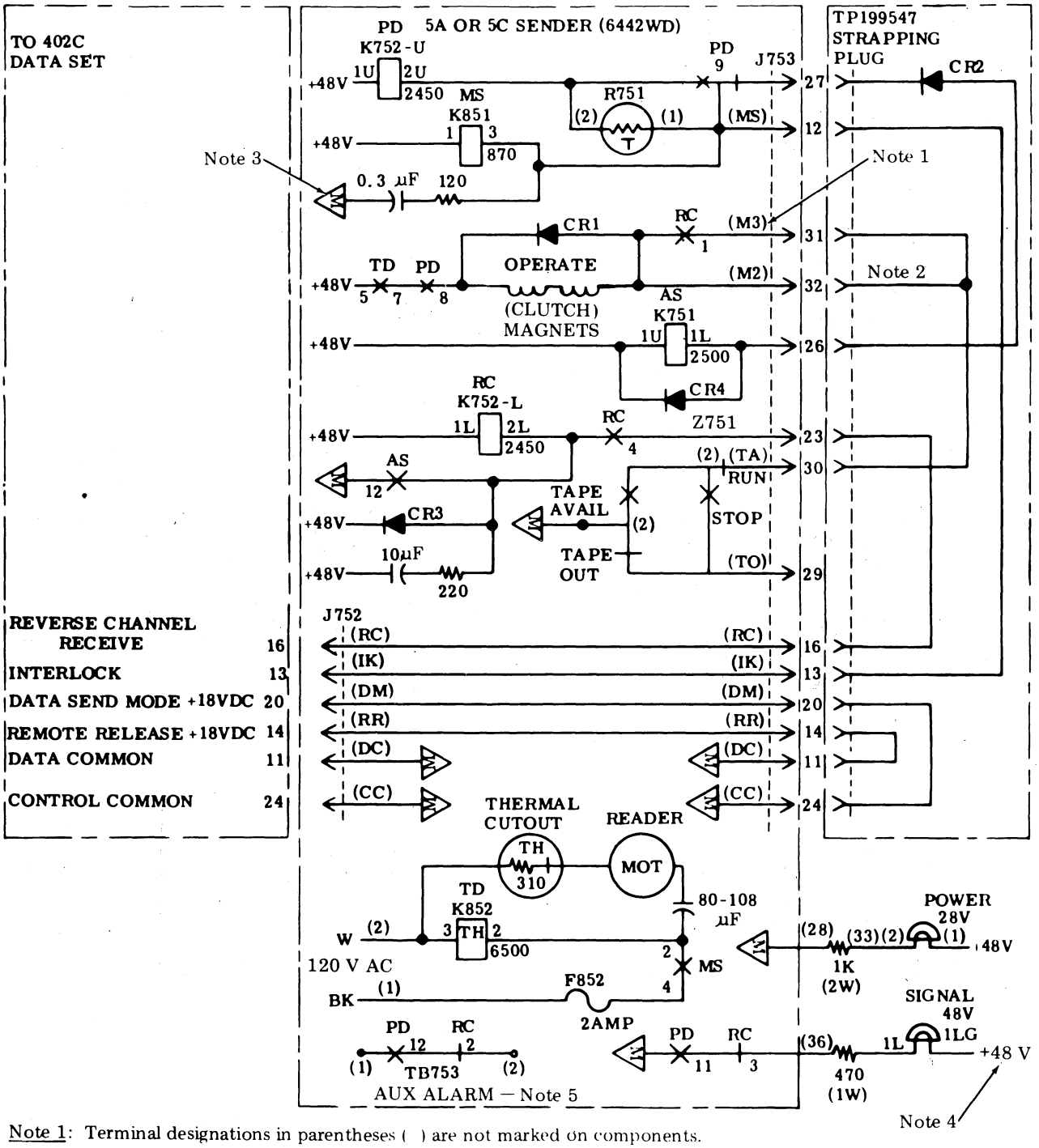
Reverse Channel Receive Circuit (Circuit Assurance and Break)

3.10 Reverse Channel Receive (RC) lead pin 16 (Figure 2):

(a) This lead must be grounded by the data set, if the TP199547 strapping plug is wired for reverse channel (circuit assurance and break feature) (Figure 2, Note 2), to energize the reader (clutch) operate magnets.

(b) If wired for reverse channel, the sender must be used with a 402C2 data set and with a reverse channel equipped receiver.

(c) The reader neither feeds tape nor transmits data if the sender ground path to the clutch magnets is opened.



Note 1: Terminal designations in parentheses ( ) are not marked on components.

Note 2: Remove strapping plug pin 32 for reverse channel, (circuit assurance and break) operation

Note 3: Indicates module signal ground.

Note 4: All +48 v leads are fused by F951 (1.5 amp) in the TP198000 Power Supply.

Note 5: Contacts close when the SIGNAL lamp is on.

Figure 2 - Tape Sender 5A and 5C Control Circuits

TABLE A

INTERFACE OF 402C TRANSMITTING DATA SET

PIN NO.	LEAD	FUNCTION
1	Frame Ground	Common to data set ground and ac power service ground.
2 3 4 5	Data 1 Data 2 Data 3 Data 4	Conditioned to mark (closure) or space (open) by 5A or 5C Sender.
6	Timing	Alternately conditioned to mark or space by 5A or 5C Sender.
7 8 9 10	Data 5 Data 6 Data 7 Data 8	Conditioned to mark (closure) or space (open) by 5A or 5C Sender.
11	Data Ground	Common to frame ground and ac power service ground.
13	Interlock	When closed to control common, signals 5A or 5C Sender that data set is in data mode.
14	Remote Release	Opened from data ground to terminate call.
15	Remote Operate	Closed to data ground, by 5A or 5C Sender with recognizer feature, for unattended answer feature (data set option N).
16	Reverse Channel Receive	Closed to control common when 387 Hz is received.
17 18 19	Answer-Back AB Answer-Back A Answer-Back B	Closed to control common when corresponding answer-back tone is received (used by recognizer equipped sender only).
20	Data Send	Closed by 5A or 5C Sender to data ground to send data, open to receive answer-back.
22	Ring Indicator	When closed to control common, indicates presence of ringing current to 5A or 5C Sender on incoming calls.
24	Control Common	Common for all control functions.
25	-18 volts	Power supply (data set option M) — for Telephone Company test purposes only.

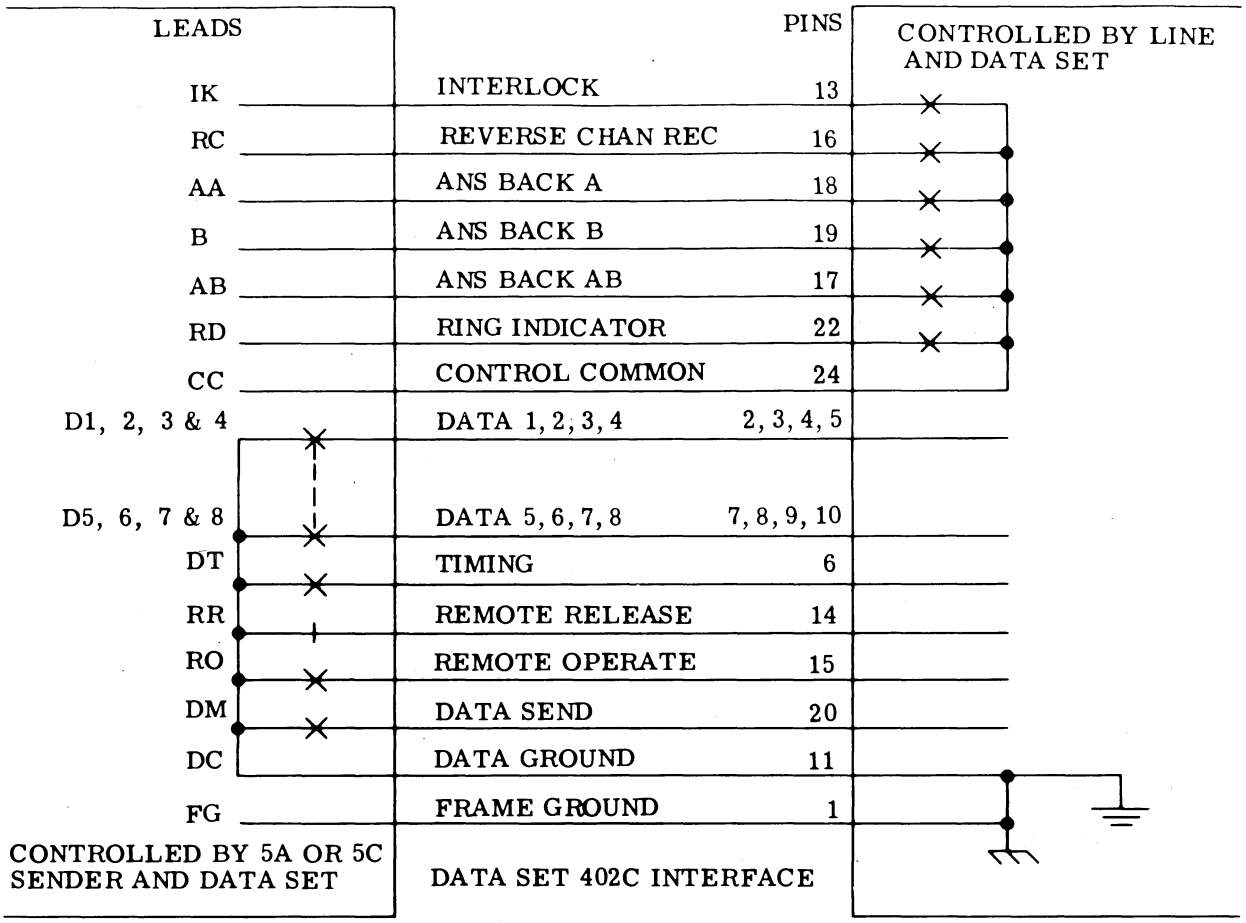


Figure 3 - Typical Interface — Contact Control Arrangement at Data Set

Interlock Circuit

3.11 Interlock (IK) lead pin 13 (Figure 2):

(a) This lead must be grounded by the data set immediately after it transmits a 2025 Hz tone signal, and while the data set is in the data mode ready to transmit data or in the answer-back mode ready to receive answer-back signals. The ground is required to operate the motor-start (MS) and all-space (AS) relays, and to energize the pulse-delay (PD) and transmit-delay (TD) relays in the sender. The PD relay terminates the all-space signal after approximately 300 milliseconds. The TD relay delays engagement of the reader clutch for approximately 2 seconds until the reader motor reaches operating speed and transmission of the all-space signal has been completed.

(b) In an unattended send-receive terminal the IK lead also becomes part of the unattended answer circuits of the recognizer and the unattended send-receive apparatus unit features. Its function in this type of service is explained in the sections covering these extra feature units.

(c) The reader motor will not start or run if the IK ground lead is open.

Note: The circuits associated with the Answer-Back A (AA) and Remote Operate (RO) leads, and unattended service (AUTO ANS) are described in the recognizer and unattended send-receive apparatus unit sections.

D. Motor Operate Circuit

3.12 If the tape reader motor does not run, plug the tape reader power cord (TP199542) into a convenience outlet. If the motor still does not run, remove the reader cover and press the red button located on the left side of the motor unit below the mounting rail. This

resets the thermal cutout. Check for abnormal motor loading by turning the reader shaft by hand. Operation of the thermal cutout in the type 5A Senders may indicate overheating of the unit as a result of obstructing the ventilating holes in the top cover.

3.13 If the tape reader motor runs with the reader power cord plugged into a convenience outlet but does not run with the normal operating connections, check fuse F851 on the motor control relay apparatus unit. Check whether the MS relay (K851) operates when the DATA key of the data set is pressed. Operate the MS relay manually; the motor should start if the fuse is good.

E. Reader Operate Circuit

3.14 Failure of the reader to read, with the motor operating normally, may indicate a defective TD relay (K852) (Figure 2). Check by removing the relay and placing a jumper between pins 5 and 7 of the relay socket. This should allow the reader to start. The pins are numbered, looking at the face of the socket, counterclockwise starting at the key of the large center hole.

3.15 If the PD relay (K752-U) does not operate to complete the 48 v dc path to reader clutch magnets and to release all-space (AS) relay, the cause may be an open thermistor (R751).

3.16 Failure of the reader to read may indicate dirty or maladjusted RUN-STOP or tape-out contacts in the reader. This trouble can also be caused by reverse channel failure in stations equipped with the circuit assurance and break feature. At such stations it is necessary to block the RC relay (K752-L) or rewire the strapping plug, with pin 32 inserted (Figure 2, Note 2), to make the reader operate when no reverse channel signal is being received.

3.17 The presence of defective or early type echo suppressors in the telephone plant may result in loss of reverse channel with a resulting failure of the RC relay (Figure 2) to remain energized, through its own contact 4 to data set pin 16, after it has been operated by contact 12 of the AS relay (K751). This causes the reader to stop when the AS relay releases and opens its contact 12 and RC relay contact 1. Sometimes, however, the echo suppressors allow the reverse channel signal to reach the sender but block the sender output.

F. Data Storage Circuit

3.18 Continuous or intermittent gain or loss of a code level may indicate tape reader contact trouble or a defective relay, circuit card connection, diode, resistor, or defective wiring in the transmitter circuit. (Refer to Table C — Z751, TB751, TB752, K751, K752, K753, and K754.) Press circuit card TP177582 firmly into socket, check, and establish good connections.

3.19 Failure to generate the all-space signal indicates failure of the AS relay to operate at the beginning of a transmission, resulting in a complete loss of data at the receiver.

G. Timing Pulse Circuit

3.20 Garbled data on all levels is likely to be caused by failure in the timing circuits. Complete loss of data might also result if the circuit is not operating properly. A more probable cause for loss of data is failure of the AS relay or the presence of defective or early style echo suppressors mentioned previously. Probable causes of failure within the timing pulse circuit are dirty universal contacts or a defective relay. Note that a defective transistor also affects the data storage circuit operation.

H. Power Supply Circuit

3.21 The TP198000 power supply assembly is a typical full wave bridge rectifier equipped with silicone diodes which are driven from the secondary of a step-down transformer. The circuit supplies 48 volts dc at output (terminal 4). In addition, circuit wiring is color coded to aid in identifying input/output terminals. Refer to 6441WD and 6444WD for actual and schematic wiring of the power supply. Terminal designations in parentheses ( ) are for references only and are not marked on components. A filter capacitor and bleeder resistor complete the circuit. All relays are dependent on the +48 v dc power supply for proper operation. The transmit-delay (TD) relay coil is operated by ac through a contact of the motor-start (MS) 48 v dc relay.

TROUBLE CHECKOUT

Note: Figures 3, 4, and 5 show, respectively, connections for 5A and 5C Tape Senders, additional wiring for the 5C Tape Sender, and test tape (Figure 6) for checking the sender. Sections covering installation indicate the wiring for every type of operation, both with and without extra feature units.

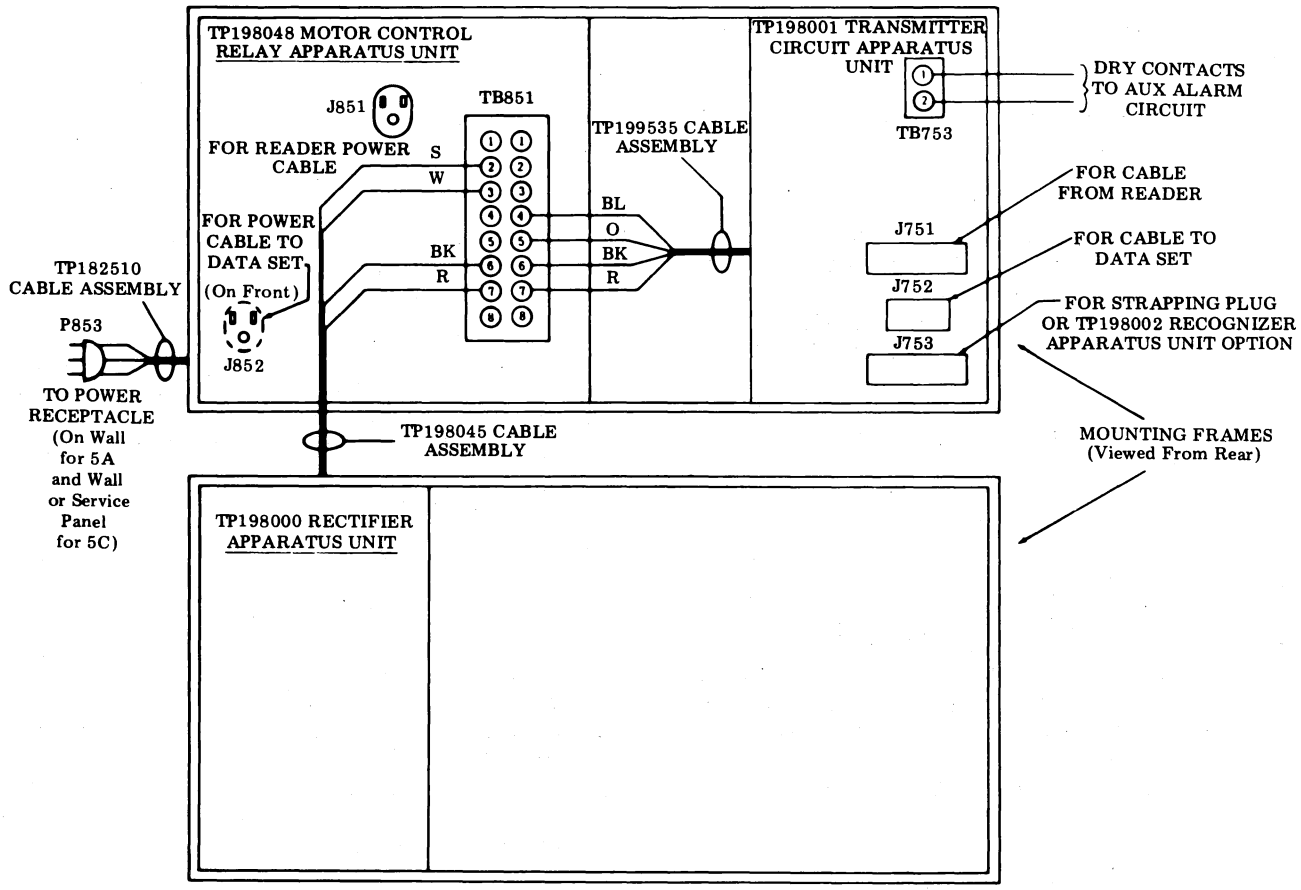


Figure 4 - 5A and 5C Tape Senders Apparatus Unit Connections

3.22 The following tests and connections may help to locate and classify unknown troubles. They do not require operation of the equipment on line. If a trouble or possible cause of trouble is known, refer to Table B to correct the condition. If required, refer also to the other related sections covering the sender and extra feature units.

A. Tape Sender 5A

3.23 Lift the left coverplate from the reader by pulling up on the outer edges of the plate. Loosen the two captive screws at the rear of the base. Lift the rear of the cover slightly, and push the cover toward the front of the unit. The cover may then be lifted off of the unit.

3.24 Check that the reader and motor mounting screws are tight. Turn the reader shaft by hand. A slight resistance to turning will be felt at one point, but there should otherwise be no binding or dragging.

3.25 Check that the motor and reader "float" freely in their rubber mountings. There should be only a perceptible amount of play in the gears. If necessary, move the reader to set the gear play to the required amount. (Refer to standard adjustment section pertinent to the reader).

3.26 Check that the 37-pin cable plug is securely connected to the mating receptacle at the reader base of the 5A Sender and check the 36-pin reader plug.

3.27 Replace the reader cover and plate. Plug the reader power cord on the rear of the unit to the ac power source. Note that the reader runs without excessive noise, vibration, or heating.

3.28 Connect the reader power cord into the tape reader outlet on the back of the motor control relay apparatus unit (Figure 4). Plug the multiple conductor cable from the tape

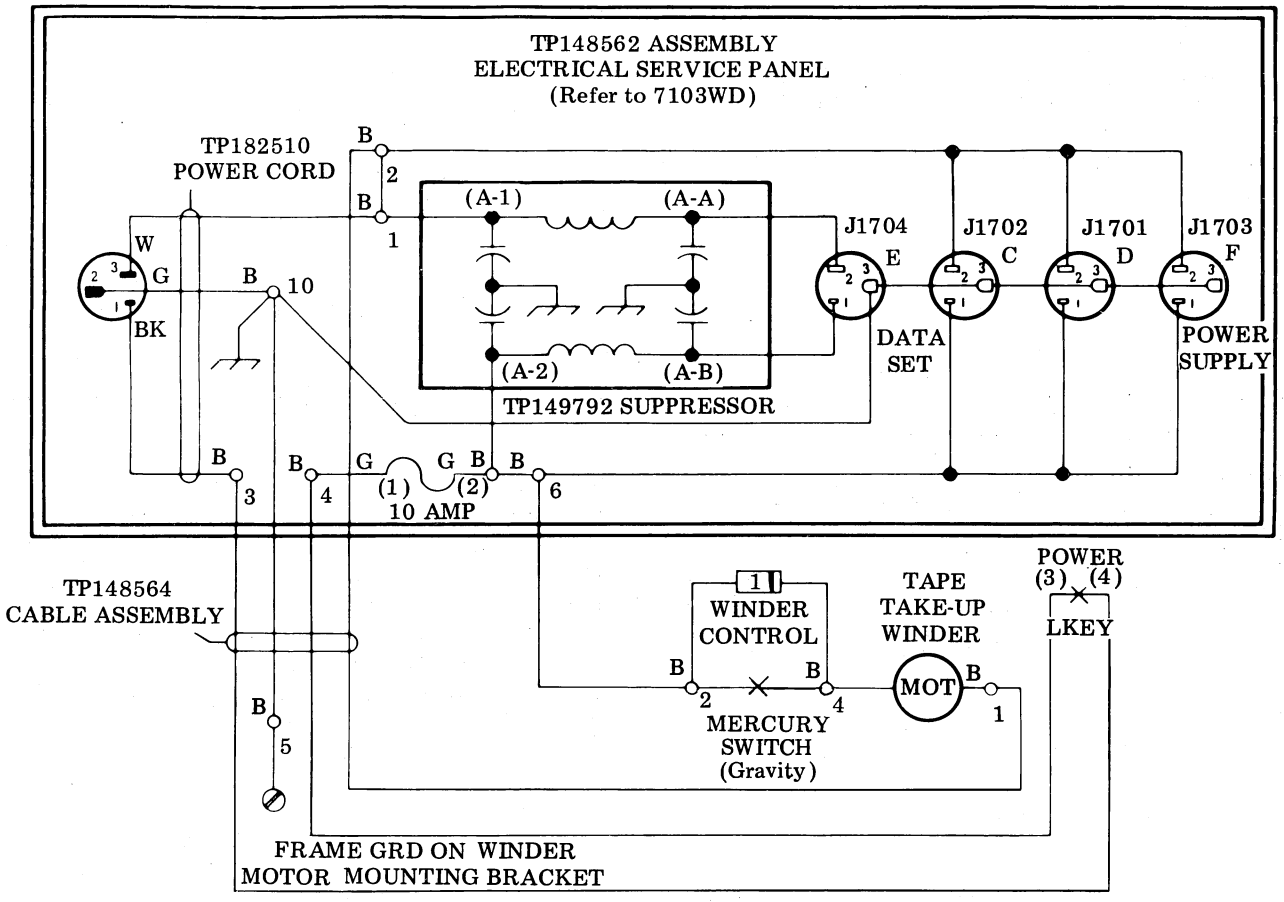


Figure 5 - Additional Wiring for 5C Sender

reader to the 37-pin receptacle (J751) on the transmitter apparatus unit (Figure 4). The plug is fitted with a slide latch locking device.

3.29 Make connection between the 25-pin receptacle J752 on the transmitter apparatus unit and the receptacle at the data set. Connect the power cord from the data set to the data set receptacle (J852) at the TP198048 motor control unit (Figure 4).

3.30 Plug the power cord from the apparatus box into the outlet supplied by the subscriber.

3.31 Place a test tape in the reader and place the reader control switch in the RUN position. Remove the handset on the data set and press the DATA button on the data set. Observe that the AS and RC relays in the transmitter circuit operate briefly, then release as the PD relay operates. The RC relay will remain operated only if sender is wired for reverse channel and is on the line with a 402C2 data set that is also wired for reverse channel and is receiving a reverse channel signal. Observe that the tape reader starts reading about 10 seconds after the DATA button is pressed (if not, refer to Troubles 2, 5, 6, and 7 of Table B). Place the data set on-hook, disconnect the apparatus box power cord.

Note: In those units arranged for reverse channel (circuit assurance and break) operation, release of the RC relay prevents the reader from starting (Figure 2, Note 2). To check the tape reader operation, hold down the RC relay armature manually.

3.32 Position the cover on the apparatus box and lock it in place by turning the quarter turn fasteners clockwise.

B. Tape Sender 5C

3.33 Lift the left coverplate from the tape reader by pulling up on the outer edge of the plate. Slide open the drawer assembly on which the reader is mounted. A hand hold is provided immediately beneath the reader.

3.34 Check that the reader and motor mounting screws are tight. Turn the reader shaft by hand. A slight resistance to turning will be felt at one point, but there should otherwise be no binding or dragging (refer to adjustment section for tape reader (CX type), if required).

3.35 Check that the reader and motor "float" freely in their rubber mountings.

3.36 There should be only a perceptible amount of play in the gears. If necessary, move the reader to set gear play to the required amount. (Refer to standard adjustment section pertinent to the reader.)

3.37 Check that the 36-pin cable plug is securely connected to the mating receptacle at the reader.

3.38 Replace the reader plate and remove the back of the cabinet. The entire back is held by a single screw near the top.

3.39 Disconnect the reader power cord from the reader power outlet (J851) (Figure 4) on the motor control relay unit and plug it into any convenient ac outlet. Plug the power cord from the electrical service panel into the outlet supplied by the subscriber.

3.40 Note that the reader runs without excessive noise or rattles.

3.41 Reconnect the reader power cord to J851.

3.42 Place a test tape (Figure 6) in the reader and place the reader control switch in the RUN position.

3.43 Lift the chad depressor arm and move tape-tension arm to the extreme left. Release the chad depressor to lock the tension arm in place.

3.44 Press the POWER switch if it is not already lighted. Remove the handset from its cradle and press the DATA button on the data set and observe that the AS and RC relays in the transmitter circuit apparatus unit operate briefly, then release as the PD relay operates. The RC relay will remain operated only if sender is wired for reverse channel operation and is on the line with a 402C2 data set that is also wired for reverse channel operation and is receiving a reverse channel signal. Observe that the tape reader starts reading about 10 seconds after the DATA button is pressed. Place the data set on-hook.

Note: In the senders that are strapped for circuit assurance and break operation, release of the RC relay prevents the reader from starting. To check the tape reader operation, manually hold down the RC relay armature.

3.45 If the trouble is not defined by the previous checks, operate the sender on-line to determine the frequency of occurance and type of trouble.

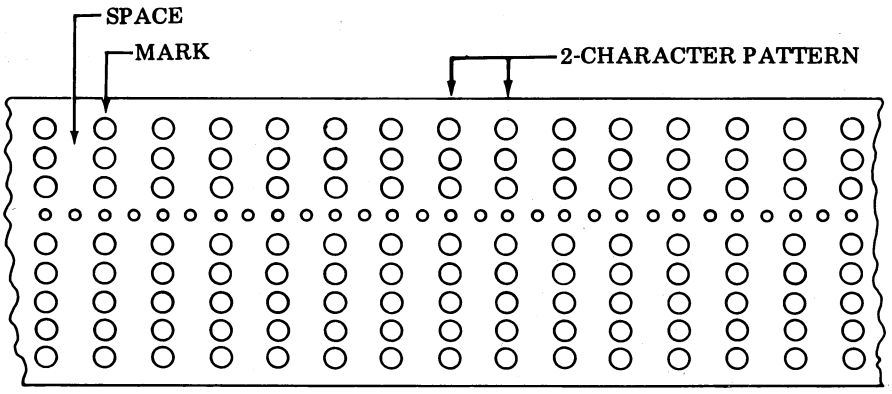


Figure 6 - TP148554 Test Tape (189 Repetitions of the 2-Character Pattern)

C. On-Line Test

3.46 Arrange for a test, of the attended sender, with the local Test Center. Inform Test Center operator if circuit assurance and break feature (reverse channel) is used on the terminal. With power on, place a test tape in the reader (TP148554 all mark-all space or TP343800 for 6-level with advanced-feed hole) and move reader level switch to proper setting — 8 or 6. Lift handset when Test Center calls back, move RUN-STOP-FREE switch to RUN, and listen to high-pitched tone sent by remote receiver. Press DATA key at end of tone. DATA key lamp will light; after 10 seconds reader motor comes on and after a short delay the reader reads the tape. If circuit assurance and break feature is a part of the test, wait for reader to stop and SIGNAL lamp to light, before depressing TALK key; if feature is not used, depress TALK key after 45 seconds of transmission. Check with Test Center operator about any errors in received message. If no errors are reported, hang up; if errors are reported, check troubleshooting procedures and corrective procedures in Table B. Rerun tests to confirm repairs.

TROUBLESHOOTING PROCEDURES

3.47 The following paragraphs outline preliminary checks and procedures to be followed in using Table B in troubleshooting the 5A and 5C Senders.

Note: Use a thoroughly pretested data set and line, if possible.

3.48 Arrange to run on-line tests with an available Test Center; otherwise, test with a pretested 5B Receiver and receiving data set. If neither a Test Center or remote receiver is available, or if the trouble cannot be cleared through use of this section alone, the trouble may be located and classified through use of Trouble Checkout 3.22 through 3.45, and cleared through additional reference to the description, operating procedure, and principles of operation section for the sender. Use the schematic and actual wiring diagrams shipped with the equipment, if available. If unusual difficulties are still encountered, check the equipment against all associated wiring diagrams and parts sections for previous emergency field modifications or other unrecorded changes.

3.49 Check that all cables and connectors are properly connected and that they appear to be in good condition.

Note: Also check internal connections; especially extra feature units.

3.50 Before starting to shoot trouble, check the wiring options (TP199547 strapping plug) and the extra feature units (such as recognizer) in use. If a sender that is wired for reverse channel operation is to be operated without a reverse channel signal, either the reverse channel (RC) relay must be manually blocked in its operated condition or the strapping plug must be rewired, with pin 32 inserted, for operation without reverse channel (Figure 2, Note 2). Wiring options related to an extra feature unit are given in the section covering installation of the sender. Troubleshooting an extra feature unit is explained in detail in the section covering that unit.

3.51 If trouble is in the standard sender tape handling equipment, refer to the adjustment, lubrication, and disassembly section covering the sender.

3.52 For the location of referenced circuit elements on schematic diagrams, refer to Table C of this section. For parts ordering information, refer to the tape sender cabinet (AC) and electrical components parts sections.

3.53 Use a good standard test tape (Figure 6), that has been checked with a tape gauge, for all on-line tests; recheck splice on test tape.

3.54 If the type of trouble and probable causes are not clear, check the following before starting a long series of troubleshooting tests.

(a) TP148562 electrical service panel of 5C Sender (Figure 5 and 6442WD, Sheet 4) — 10 amp fuse 120 v ac (103-127) outlet; and ground connections at J1704 for the data set and J1703 for the power supply, motor control circuit, and reader.

(b) TP198048 motor control circuit (6442WD, Sheet 3):

(1) One amp fuse F851 and 120 v ac at W and S wires of TP198045 cable assembly to power supply, and 2 amp fuse to reader and transmit delay (TD) relay through motor start (MS) relay contact.

(2) Continuous 120 v ac (103-127) and ground at J852 for the data set.

(3) 120 v ac (103-127) and ground at J851 for the reader and TD relay after the MS relay has been operated by application of ground to BL wire of TP199535 cable assembly from IK lead of data set (6442WD-1E6) and +48 v dc from power supply.

(4) +48 v dc or 0 wire of TP199535 for clutch magnets when TD relay operates 2 seconds after MS relay has operated.

(5) Continuous +48 v dc on R wire of TP199535 cable assembly for transmitter circuit relays.

(c) TP198000 power supply (6444WD and 6442WD, Sheet 4) — 1-1/2 amp fuse F951 and steady +48 v dc output (b) (4) and good ground (b) (3) at TP198045 cable assembly.

(d) Manually operate and visually check, or test, any relays and contacts that could be related to a trouble (Figure 2 and 6442WD). Contacts and slip-type connectors are more likely to cause trouble than most other circuit elements.

3.55 Check for proper voltage, ground, and open conditions at circuit element terminals before replacing elements. (Refer to the schematic and actual wiring diagrams section for the sender.)

CAUTION: BEFORE REMOVING OR REPLACING CARDS, COVERS OR, ANY OTHER COMPONENTS, REMOVE ELECTRICAL POWER. USE PRETESTED CARDS FOR ALL SUBSTITUTION CHECKS.

TROUBLESHOOTING TABLE USAGE

3.56 Table B contains corrective procedures for troubles found in Trouble Checkout (3.22 through 3.46). Corrective procedures are given directly or a specific adjustment (for cabinet refer to Section 582-102-715 and for reader refer to Section 582-100-710) is given. Paragraph callouts in the table refer to trouble-shooting information available in this section. Electrical system callouts refer to wiring diagrams in Section 582-102-415, see 1.03.

3.57 If a trouble is not covered in this table, or cannot be corrected within a reasonable amount of time, consider the following:

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

(b) Repair component using associated sections or wiring diagrams.

(c) Replace defective components. All components should be tested prior to replacement, if a test is available. Available field tests are included in Table B.

3.58 Replace cards or fuses only as directed in Table B.

Note: When part or unit replacement is suggested, repair may also be used as an alternative measure. Refer to Section 582-102-815 for parts.

3.59 If the corrective procedures given for any trouble symptom (Table B) do not clear the trouble, make a point-to-point check of all related voltages, wiring, connections, and circuit elements as shown in the schematic and actual wiring diagram section. Repair or, if necessary, replace defective parts and assemblies such as tape reader (CX type), reader motor, motor control unit, power supply, electrical service panel, data set, and test Telephone Company line to reestablish service (3.01).

INDEX FOR TABLE B

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS

NO.	TROUBLE	CORRECTIVE PROCEDURE
1	No power indication. POWER indicator fails to light when pressed.	Plug in, tighten, or replace TP182510 power cord (6442WD 4B2)or TP152510 for table mounted (6442WD 4E2). Check 28 v indicator lamp TP193179 (6442WD 1F7). Check fuses: 1 amp TP143306 (F851) rectifier, 2 amp TP138538 (F852) (6442WD 3C3) reader, 1 amp TP120139 (F853), 10 amp TP151418 (XF1701) rear panel (6442WD 4F3) and 1.5 amp TP171644 (F951) +48 v dc (6444WD). If ac input to power supply is present and all fuses are good, but +48 v dc output is missing or erratic, (3.21) replace TP198000 power supply (6444WD or 6442WD Sheets 3 and 4). With a VOM, trace back from point of failure to where proper voltage is obtained. Replace wiring and components as required to reestablish circuit (6442WD). Note: TD (Transmit Delay) relay TP198047 (K852) for clutch magnets, reader motor, and convenience outlets have ac voltage present. All other components have dc voltages.
2	DATA key on data set fails to remain lighted when depressed or (with discrete calling feature on sender) data set does not answer automatically.	Check power to data set. Check for defective connections or broken wire between pin 11 of J753 and module ground at solder lug 52 of relay (K754) (6442WD 1E5). Check permanent RR lead ground, from sender to data set remote release interface terminal 14 (3.09), and open between TP199547 strapping plug at J753 pins 11 and 14 (6442WD 1E5). Check that strap N is in and determine that strap ZC is out of 402C data set. Check operation of relay UA (operated by AUTO ANS key) and relay TA (operated by RUN-STOP switch). If inoperative, refer to Section 582-102-116 or replace entire TP198002 recognizer unit. Replace 402C data set.

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
3	Data set disconnects (goes on-hook).	If recognizer is not used, inspect TP199547 strapping plug at pins 11 and 14 (3.09). If recognizer is used, replace TP198002 or TP148558 recognizer unit, refer to Section 582-102-116. Consult Telephone Company for information on rewiring of terminal if disconnect is a problem in system synchronization.
4	Remote receiver drops call after connection has been established. Note: The remote data set must receive the all-space signal for at least 40 ms in order to ground its carrier-on (CN) pin and enable the receiver to receive data.	Check TP199547 strapping plug at pins 13 and 12 (3.11). Check diode between pin 27 and 26 of TP199547 strapping plug. Banded side of diode must be toward pin 27. Check for open ground path at contact 9 of PD relay. Replace thermistor TP199546 (R751) or if PD relay does not operate, replace relay or entire TP198001 transmitter circuit assembly (6442WD). Check one or more of the AS relay contacts to open the ground paths of the 8 data leads to the data set (may be checked with ohmmeter while relay is operated by hand). Operate AS relay (K751) by hand for 300 ms after data set grounds its IK lead and motor is running; if receiver does not stay on-line, clean relay contacts, replace relay, or entire TP198001 transmitter circuit assembly (6442WD).
5	Signal generator disc does not start after receiving answer-back signal.	Listen for answer-back signals from called station. Check connections between pin 18 of data set and pin 18 of P1203, and between pin 13 of data set and pin 13 of P1203. Replace card TP148597. If IK relay (K1201-U) operates, clean contacts 9 and 10. If IK relay does not operate, but reader motor will start in attended operation (AUTO ANS key released), replace TP198002 recognizer unit; if reader motor does not start in attended operation, replace 402C data set.

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
5 (cont)		If SP relay (K1202-U) operates, clean contact 9. If SP relay does not operate, verify that pin 1U of SP relay is wired to pin H of card connector XZ1201 (SO wiring); replace TP198002 recognizer unit if wiring is present. Replace 402C data set. Note: If a 914B, 914C or a 913A Data Test Set is available, perform End-to-DTC Interface Test, before replacement. Replace TP199570 signal generator assembly.
6	Signal generator disc overruns home position.	Replace TP199570 signal generator assembly.
7	MS relay fails to operate when DATA key is depressed.	Check for open ground path at pins 13 and 12 of TP199547 strapping plug (6442WD) (3.11). Check terminal 3 of MS relay TP198049 (K851), if defective, replace relay (6442WD 3C6) or entire TP198048 motor control relay assembly (3.11) (6442WD).
8	Reader motor does not run.	Unplug reader from controlled outlet and plug directly into convenience outlet or wall outlet. If motor runs, go to Trouble 9; if not, go to Trouble 10 (3.12 and 3.13).
9	Reader motor will only operate when reader power cord is plugged directly into convenience outlet or wall outlet.	Check 2 amp fuse TP138538 (F852) for reader motor (6442WD 3C3) (3.12). If new fuse blows, refer to Trouble 10. MS relay TP198049 (K851) must operate when DATA key is pressed. Operate MS relay manually; motor will start if fuse is good. If MS relay fails to operate, go to Trouble 7 (3.13). IK lead, pin 13, must be grounded by data set in data mode. If not, replace data set. With all power and reader disconnected, check associated wiring with a VOM for open or short circuit (3.11). Replace TP198048 motor control relay assembly or TP198000 48 v dc power supply, if defective (6444WD).

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
10	Reader motor will not operate when TP199542 reader power cord is plugged directly into convenience outlet.	Check motor thermal cutout and reset (3.12). Rotate reader shaft (by hand). If any binding occurs, replace CX803 reader (3.12 and 3.13). Check motor for overheating due to obstruction of ventilating holes or shock mount vibration (3.12). Replace reader power cord TP199542, if defective. Replace motor (MU43).
11	Reader fails to read tape (transmit), does not move tape approximately 2 seconds after motor starts.	If reader runs with manual operation but not with unattended operation, go to Trouble 12 or 13. If SIGNAL lamp is off, check Tight-Tape Arm, Feed Wheel Detent, Feed Pawl, and Inertia Stop Lever adjustments. Check Start-Stop Contact Assembly Bracket, Tape-Out Pin, and Magnet Assembly adjustments. Clean contacts if required. Note: Contact springs may have been weakened by leaving lever in FREE position. Test TD relay TP198047 (K852). To test: With PD (pulse delay) relay operated, place a jumper between pins 5 and 7 of TD relay socket. If clutch and reader operate, replace TD relay (3.15). Check ground path to clutch magnets (3.50) for open circuit (especially pins 30 to 32, without reverse channel; or pins 30 to 31 and RC relay contact 1M, with reverse channel). If PD relay (K752-U) fails to operate, check continuity of TP199547 strapping plug at pins 12 and 13. Replace thermistor TP199546 (R751) or entire TP198001 transmitter circuit assembly (3.15). If PD relay (K752-U) operates but clutch magnets do not operate, clean contact 8 of PD relay. If SIGNAL lamp is on, call customer's receiver and have operator go into data mode while you stay in talk mode. Listen for low-pitched (reverse channel) tone at end of short high-pitched tone. If reverse channel tone is heard, replace 402C data set (402C2, C4, C6 or C8 with "S" option required); if line goes silent, receiver is at fault.

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
11 (cont)		If reverse channel does not operate RC relay (K752-L), inspect TP199547 strapping plug at pins 16 to 23 (3.10) or replace entire TP198001 transmitter circuit assembly (3.17). Replace CX803 reader.
12	Signal generator disc completes cycle, transmission does not begin.	Remove ER relay TP199565 (K1204) from socket and manually release. Replace tightly in socket (unlatched) and retest. Replace ER relay, if defective. Observe operation of GO relay (K1202-L). If GO relay operates, contact 5 needs cleaning. If relay does not operate, check connections between GO and ER relays. If ER relay operates, check Coding TP199580 Disc adjustment, or clean disc and retest. If ER relay operates continually, check contact wires in signal generator. Adjacent groups should not touch each other. If they do, replace TP199570 signal generator assembly. Replace card TP148597. Replace 402C data set.
13	Transmission does not begin after call is answered (and motor starts), using TP148558 recognizer for unattended service w/o discrete calling.	Listen for answer-back signals from called station. If data set does not answer automatically, check relay UA (operated by AUTO ANS key) and relay TA (operated by RUN-STOP switch). Replace 402C data set. Note: If a 914B, 914C or 913A Data Test Set is available, perform End-to-DTC Interface Test, before replacement. Check operation of GO relay (K1202L) and SP relay (K1202U) by whistling (answer-back tone) into handset. If any relay is inoperative, replace entire TP148558 recognizer unit. Replace 402C data set.

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
14	Invalid discrete code causes sender to transmit.	Make sure ER relay TP199565 (K1204) is tightly inserted in socket. If not, push in and retest. Replace ER relay TP199565. Replace card TP148597.
15	Data transmission begins before signal generator disc completes cycle.	Replace TP199570 signal generator assembly.
16	Reader motor stops during transmission (5C reader only).	Check TP199542 power cord to J851 or TP182510 power cord or connectors. See **Trouble 1.** Check terminals 2 and 4 of MS (K851) relay (6442WD 3E4), replace MS relay if TD relay also drops out. Check connections at J752 (pin 13) and J753 (pin 12). See Trouble 7.
17	Data not received by remote receiver when reader feeds tape.	Call Test Center and arrange for loop-back test of data set. If test fails, replace 402C data set. Check that remote receiver is receiving an all-space signal. If so, refer to Trouble 4 or 13. If all-space signal is not received, proceed as follows: Check for loss of continuity at DM lead, pin 20 (3.08). Check ground at strapping plug TP199547 and control common pin 24 on data set (3.08). Replace card TP177582 (XZ751) (3.18). Clean contacts 10 and 11 of AS relay (K751), (6442WD 2F7) or replace relay (3.20). Check connections to K755 relay (6442WD Sheet 2) or replace relay TP198011. Clean universal contacts at reader; if defective, replace contacts or reader.
18	Garbled data — random, unclassified errors.	Call Test Center and arrange for loop-back test of data set. If test fails, replace 402C data set.

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
18 (cont)		Check Sensing Bail adjustment (3.02). Replace TP198000 48 v dc power supply if output voltages are too high, low, or fluctuating (3.21 or 3.54 (c)). Replace TP198001 transmitter circuit assembly (6442WD).
19	Garbled data — frequent or constant gain or loss of one or more code levels.	Check level selector switch positioning. Call Test Center and arrange for loop-back test of data set. If test fails, replace 402C data set. Check Universal Transfer Lever and Timing (Universal) Contact Actuator adjustments. Clean reader contacts if required. Note: Contact springs may have been weakened by leaving lever in FREE position. Check connections between reader and transmitter circuit assembly (6442WD). Replace card TP177582 (EC582) or defective element on the card. Check socket connection or a defective diode (2 diodes per level) on the card in the circuit of the affected level. Diode trouble is indicated, check relays, contacts, and resistors in the transmitter circuit that control voltage or current to that diode (3.18). Replace CX803 reader. Defective contacts or coil circuit in 1 of the 4 sections of the K753 relay or K754 relay, replace the K753 or K754 relay (6442WD). Clean and adjust the contact of the all-space (AS) relay K751 associated with the affected level — an open circuit or nonoperating relay section normally causes loss of the related mark-code (ground) signal to the data set (3.19). Replace TP198001 transmitter circuit assembly (6442WD).

TABLE B

TROUBLESHOOTING 5A AND 5C SENDERS (Continued)

NO.	TROUBLE	CORRECTIVE PROCEDURE
20	Winder motor does not run.	Check TP145976 winder motor and its circuitry, replace if defective (3.03). Replace MS relay TP198049 (K851) or entire TP198048 motor control relay assembly.
21	Improper tape spooling.	Check Chad Depressor Bracket, Winder Switch Mounting Clamp, Tape Unwinder Arm, and Tape Guide adjustments (3.03).
22	Complete failure of tape spooling.	Check Winder Switch Electrodes adjustment. Check TP145976 winder motor or TP162958 switch; replace if defective (3.03).
23	Feed holes burring.	Check for proper tape routing. Check Tape Lid and Feed Wheel Detent adjustments.
24	Control panel lamps do not light.	Replace TP199549 lamp (48 v). Verify voltage at lamp socket, check wiring and voltage supply (6442WD 1D3).

TABLE C

5A AND 5C TAPE SENDER SYMBOLS, ABBREVIATIONS, AND REFERENCES

CIRCUIT ELEMENT	WIRING DIAGRAM
1. Circuit Card EC582 (TP177582)	Actual and Schematic
Operating Diodes:	Wiring Diagrams Section
(a) Level 1, Z751A (Pins 31 & 29)	6442WD, 2B3
(b) Level 8, Z751B (Pins 30 & 28)	6442WD, 2E3
(c) Level 7, Z751C (Pins 20 & 26)	6442WD, 2D3
(d) Level 6, Z751D (Pins 19 & 25)	6442WD, 2D3
(e) Level 5, Z751E (Pins 18 & 24)	6442WD, 2C3
(f) Level 4, Z751F (Pins 17 & 23)	6442WD, 2C3
(g) Level 3, Z751H (Pins 16 & 22)	6442WD, 2E3
(h) Level 2, Z751J (Pins 15 & 21)	6442WD, 2B3
Holding Diodes:	6442WD, 2A5 thru 2F5
(i) Level 1, Z751K (Pin 13)	6442WD, 2A5
(j) Level 2, Z751K (Pin 6)	6442WD, 2B5
(k) Level 3, Z751K (Pin 7)	6442WD, 2E5
(l) Level 4, Z751K (Pin 8)	6442WD, 2C5
(m) Level 5, Z751K (Pin 9)	6442WD, 2C5
(n) Level 6, Z751K (Pin 10)	6442WD, 2D5
(o) Level 7, Z751K (Pin 11)	6442WD, 2D5
(p) Level 8, Z751K (Pin 12)	6442WD, 2E5
(q) Holding Transistor, Z751K (Pins 4 & 14)	6442WD, 2F5
(r) Suppression Diode, Z751L (Pin 34)	6442WD, 1D6
(s) Suppression Diode, Z751M (Pin 35)	6442WD, 1C6
(t) Four Steering Diodes, Z751N (Pins 2, 1, 3; & 32 & 36)	6442WD, 2F6
2. Reader Data Contacts:	6442WD, 2B2 thru 2F2
(a) Level 1 Contact	6442WD, 2B2
(b) Level 2 Contact	6442WD, 2B2
(c) Level 3 Contact	6442WD, 2E2
(d) Level 4 Contact	6442WD, 2C2
(e) Level 5 Contact	6442WD, 2C2
(f) Level 6 Contact	6442WD, 2D2
(g) Level 7 Contact	6442WD, 2E2
(h) Level 8 Contact	6442WD, 2E2
(i) Universal Contact	6442WD, 2F2
3. Transmitter Data Storage Relays:	
(a) Level 1 Relay K753-1, (Pins 15 & 11)	6442WD, 2B3
(b) Level 2 Relay K753-2, (Pins 25 & 21)	6442WD, 2B4
(c) Level 3 Relay K754-5, (Pins 55 & 51)	6442WD, 2E4
(d) Level 4 Relay K753-4, (Pins 45 & 41)	6442WD, 2C3
(e) Level 5 Relay K753-5, (Pins 55 & 51)	6442WD, 2C4
(f) Level 6 Relay K754-1, (Pins 15 & 11)	6442WD, 2D3
(g) Level 7 Relay K754-2, (Pins 25 & 21)	6442WD, 2D4
(h) Level 8 Relay K754-4, (Pins 45 & 41)	6442WD, 2E3

TABLE C

5A AND 5C TAPE SENDER SYMBOLS, ABBREVIATIONS, AND REFERENCES (Continued)

CIRCUIT ELEMENT	WIRING DIAGRAM
4. Relays:	
(a) Reverse Channel RC K572-L	6442WD, 1B6
(b) All-Space AS K751	6442WD, 1C6
(c) Pulse-Delay PD K752-U	6442WD, 1D7
(d) Motor Start MS K851	6442WD, 3C6
(e) Transmit-Delay TD K852	6442WD, 3E3
(f) Timing Section K754 (Pins 35 & 31)	6442WD, 2E8
(g) Timing Section K753 (Pins 35 & 31)	6442WD, 2F8
(h) Timing Section K755 (Pins 8 & 7)	6442WD, 2F8
5. Terminal Boards:	
(a) TB753, Auxiliary Signal ((1) & (2))	6442WD, 1C7
(b) TB752, Network 2 (Pins F & L)	6442WD, 1D6
(c) TB752, Timing Section Relay Shunt Resistor (Pins E & K)	6442WD, 2E8
(d) TB752, Timing Section Relay Shunt Resistor (Pins C & I)	6442WD, 2F8
(e) TB751, Level 2 Relay Shunt Resistor, (Pins A & G)	6442WD, 2A4
(f) TB751, Level 3 Relay Shunt Resistor, (Pins B & H)	6442WD, 2F4
(g) TB751, Level 4 Relay Shunt Resistor, (Pins C & I)	6442WD, 2C3
(h) TB751, Level 5 Relay Shunt Resistor, (Pins D & J)	6442WD, 2C4
(i) TB751, Level 6 Relay Shunt Resistor, (Pins E & K)	6442WD, 2D3
(j) TB751, Level 7 Relay Shunt Resistor, (Pins F & L)	6442WD, 2D4
(k) TB752, Level 1 Relay Shunt Resistor, (Pins B & H)	6442WD, 2A3
(l) TB752, Level 8 Relay Shunt Resistor, (Pins D & J)	6442WD, 2F3
(m) TB851, Power Distribution	6442WD, Sheet 3
6. Reader Operate Circuits:	
(a) Run Contact	6442WD, 1B3
(b) Stop Contact	6442WD, 1B3
(c) Tape-Out Contact	6442WD, 1B3
(d) Tape Available Contact	6442WD, 1B3
(e) Clutch Magnets	6442WD, 1C3
(f) Clutch Magnet Diode CR1	6442WD, 1C4
(g) Auto Ans (L Key)	6442WD, 1F3
(h) Signal Lamp (48 V), (ILG, IL)	6442WD, 1F3
(i) Thermistor R751, ((1) & (2))	6442WD, 1D6
(j) Power Lamp (28 V), ((1) & (2))	6442WD, 1F7
7. Motor Control Circuits:	
(a) Fuse F851, SL-BL 1 AMP ((1) & (2))	6442WD, 3C3
(b) Fuse F852, SL-BL 2 AMP ((1) & (2))	6442WD, 3C3
(c) Fuse F853, SL-BL 1 AMP ((1) & (2))	6442WD, 3C3
(d) P853, Power Plug, ((1), (2), & (3))	6442WD, 3D2
(e) J851, Tape Reader Jack, ((1), (2), & (3))	6442WD, 3E3
(f) J852, Data Set Jack, ((1), (2), & (3))	6442WD, 3D3
(g) Cable Assembly, TP198045	6442WD, 3E5
(h) Cable Assembly, TP199535	6442WD, 3C7

TABLE C

5A AND 5C TAPE SENDER SYMBOLS, ABBREVIATIONS, AND REFERENCES (Continued)

CIRCUIT ELEMENT	WIRING DIAGRAM
8. Transmitter Power Distribution:	
(a) P853, Power Plug, ((1), (2) & (3))	6442WD, 4B2
(b) Motor Control Assembly, TP198048	6442WD, 4B3
(c) 48 V Power Supply Assembly, TP198000	6442WD and 6442WD, 4B4
(d) Transmitter Circuit Assembly, TP198001	6442WD, 4C3
(e) Power Cord, TP199542, (1, 5, & 2)	6442WD, 4C6
(f) Thermal Cut-Out Switch	6442WD, 4B6
(g) Reader MU43 Motor	6442WD, 4B7
(h) Tape Take-Up Winder Motor (Pins 1 & 4)	6442WD, 4D7
(i) Winder Control (Mercury Gravity Switch) (Pins 2 & 4)	6442WD, 4D7
(j) Electrical Service Panel Assembly, TP148562	6442WD, Sheet 4
9. 5C Sender Cabinet	6413WD
10. TP198000 48 V DC Power Supply	6444WD
11. TP177582 Circuit Card (EC582)	Last page of Actual and Schematic Wiring Diagrams Section
12. 5A and 5C Transmitter Circuit	6442WD, Sheets 1 & 2
13. 5A and 5C Motor Control Circuit	6442WD, Sheet 3
14. 5A and 5C Power Distribution Circuit	6442WD, Sheet 4