

"DATASPEED"* TAPE-TO-TAPE SYSTEM

TAPE SENDERS 5A AND 5C

TROUBLESHOOTING GUIDE

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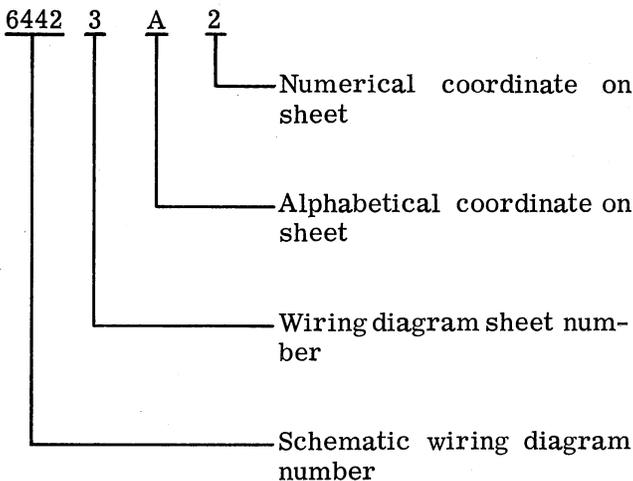
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1. GENERAL

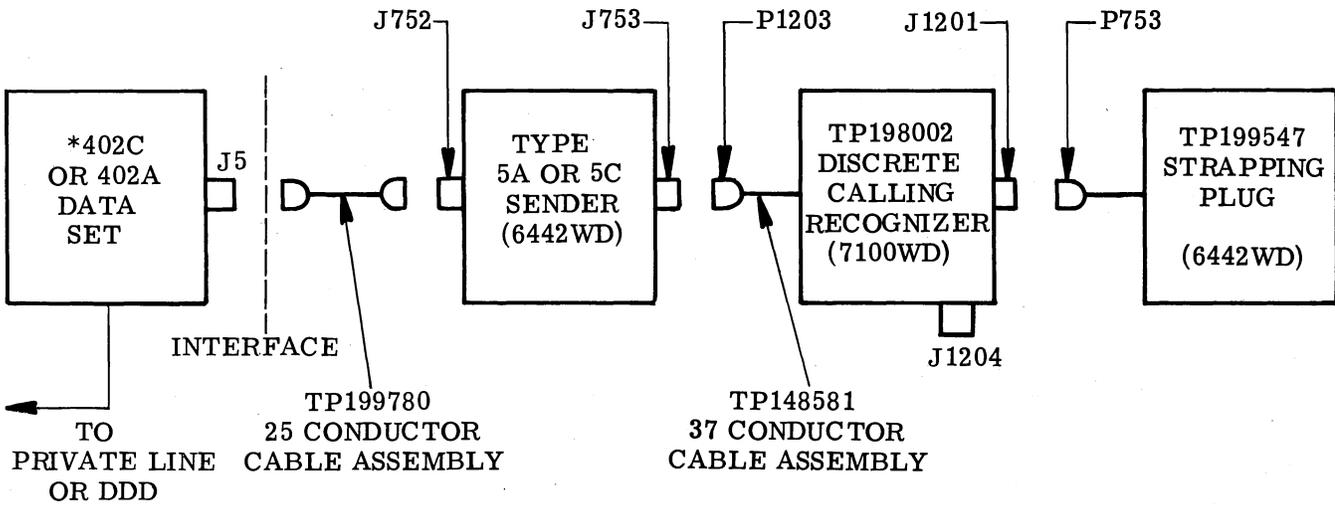
1.01 This section provides troubleshooting procedures for "DATASPEED" Tape Senders 5A and 5C. It is reissued to expand the text, to revise the wiring diagrams, to add a circuit control schematic, and troubleshooting and reference charts. Since this is a general revision, marginal arrows ordinarily used to indicate changes and additions are omitted.

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:



*Trademark of AT&TCo.



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

2. EQUIPMENT REQUIRED

2.01 Aside from the usual tools (screwdrivers, wrenches, etc) troubleshooting may be done with a standard volt-ohm milliammeter.

3. TROUBLESHOOTING

GENERAL

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

3.01 Replace apparatus units or tape reader as required to restore normal operation. Repairs or adjustments of the defective component can then be made in a more suitable environment. Field replacement of etched circuit cards is not recommended as failures may be caused by other defects (high voltage) which quickly cause failure of the replacement card.

3.02 If the type and cause of a trouble are unknown, refer to Paragraphs 3.23 through 3.56, to the troubleshooting chart (Chart 1), 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 circuits peculiar to the 5C Tape Sender Cabinet comprise 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 detailed information regarding 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.

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 service man (Figures 1 and 2). Also included are trouble sources and general information that otherwise may be difficult to obtain (Figure 2 and Charts 1 and 2). 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 1.

C. Control Circuits

3.07 The control circuits (Table 1 and Figures 1, 2, and 3) associated with the data set interface must function as follows 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 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.

DATA SET INTERFACE

TABLE 1
INTERFACE OF 402C TRANSMITTING DATA SET

PIN NO.	LEAD	FUNCTION
1	Frame Ground	Common to data set ground and ac power service ground.
2	Data 1	Conditioned to mark (closure) or space (open) by 5A or 5C Sender.
3	Data 2	
4	Data 3	
5	Data 4	
6	Timing	Alternately conditioned to mark or space by 5A or 5C Sender.
7	Data 5	Conditioned to mark (closure) or space (open) by 5A or 5C Sender.
8	Data 6	
9	Data 7	
10	Data 8	
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 cps is received.
17	Answer-Back AB	Closed to control common when corresponding answer-back tone is received (used by recognizer equipped Sender only).
18	Answer-Back A	
19	Answer-Back B	
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.

(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 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 1), to energize the reader (clutch) operate magnets.
- (b) If wired for reverse channel, the Sender must be used with a 402C2 set which is equipped with a reverse channel receiver.
- (c) The reader neither feeds tape nor transmits data if the Sender ground path to the clutch magnets is opened.

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 cps beep 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 (TP-199542) 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.

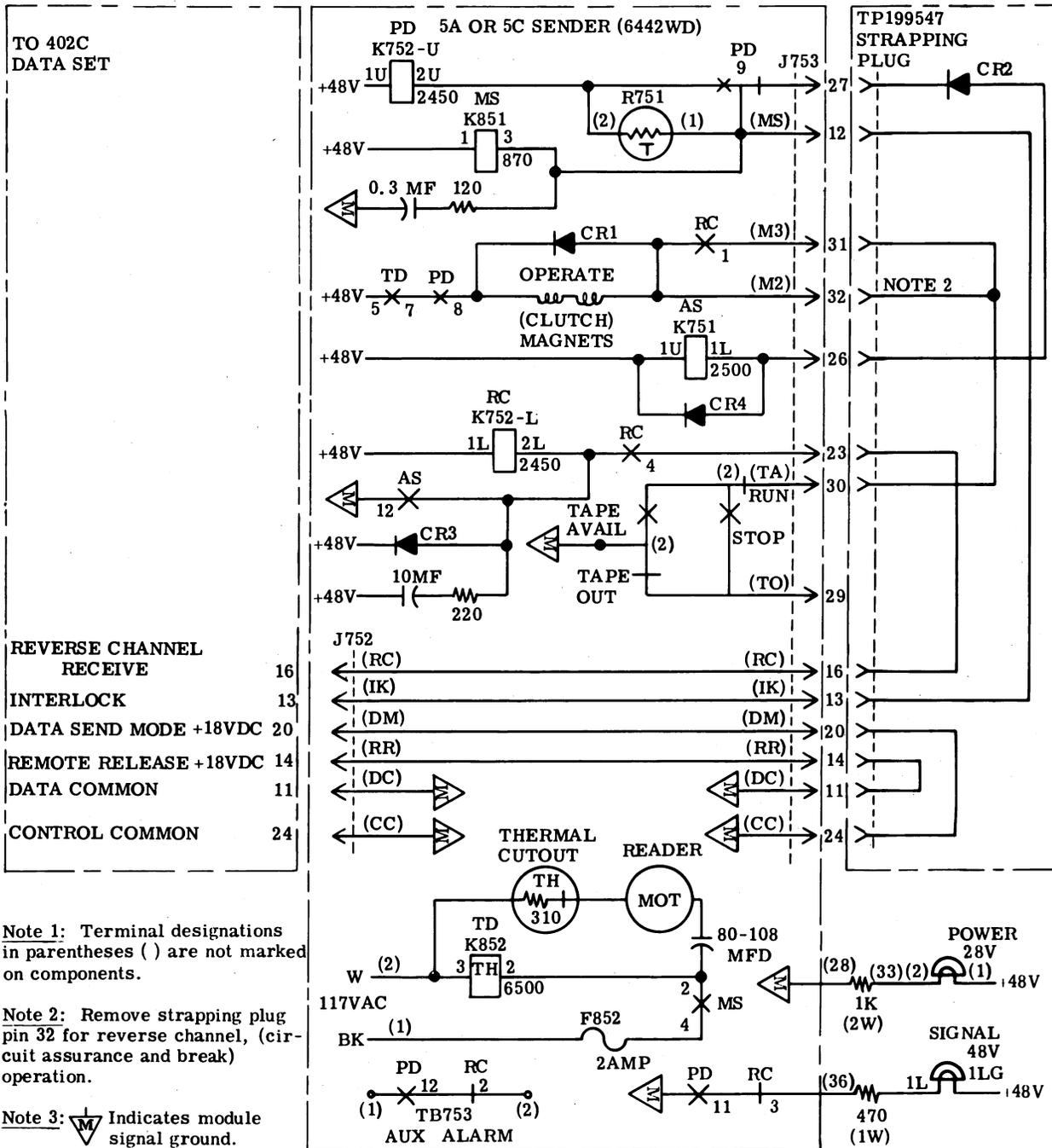


Figure 2 - Tape Sender 5A and 5C Control Circuits

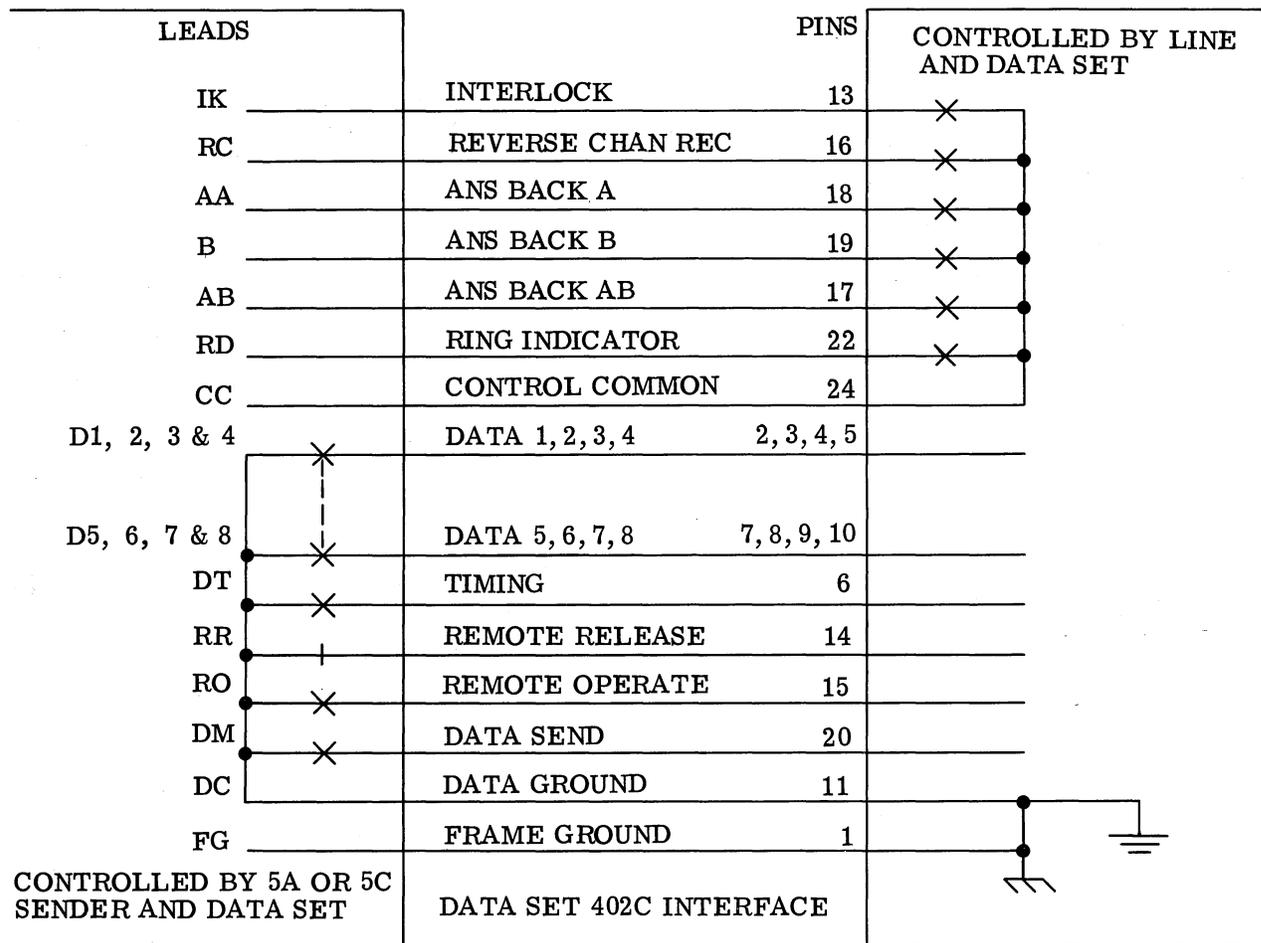


Figure 3 - Typical Interface - Contact Control Arrangement at Data Set

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 Chart 2 - 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.

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 disclosed, refer to the most applicable parts of Chart 1 and paragraphs in this section to correct the condition. If required, refer also to the other related section covering the Sender and extra feature units in use.

A. Tape Sender 5A

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

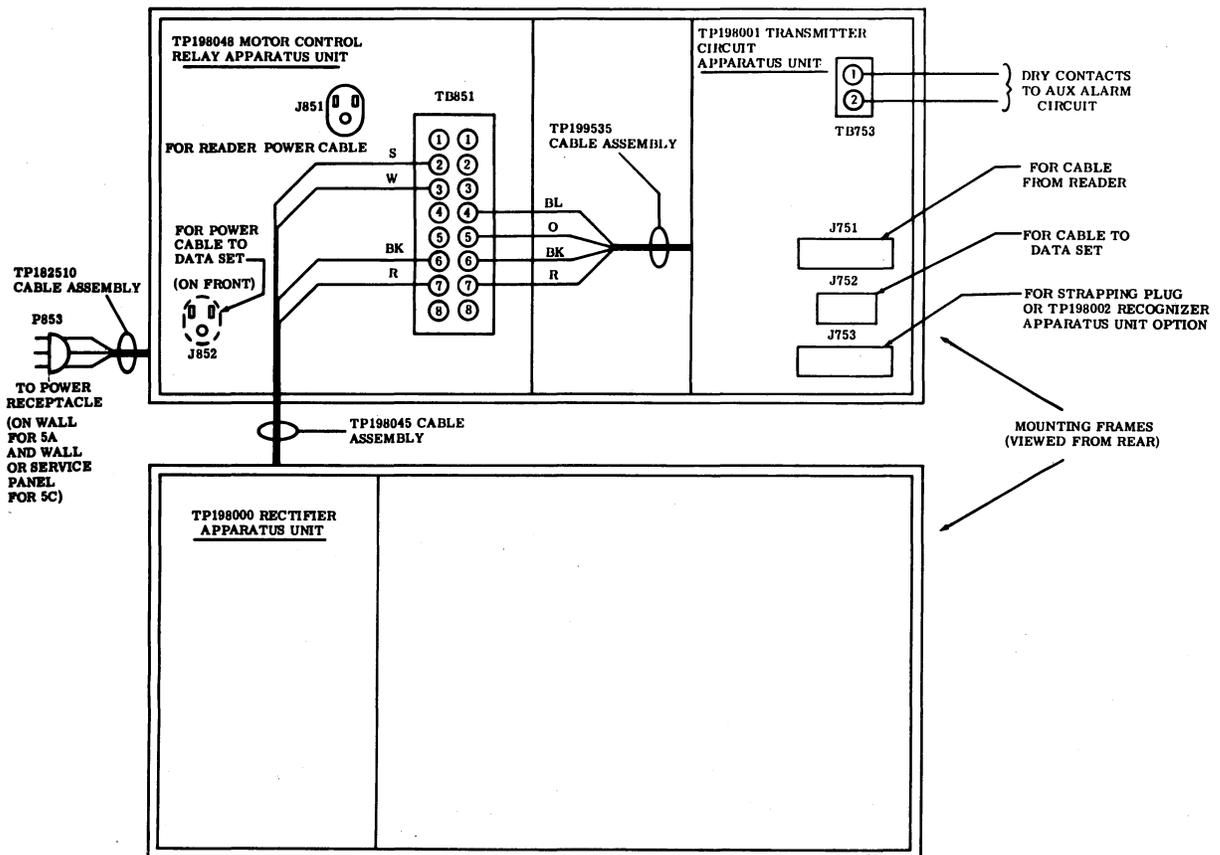


Figure 4 - Connectors, 5A and 5C Tape Senders

- 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 DATASET 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 Symptoms 2, 5, 6, and 7 of Chart 1). 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 cover plate from the tape reader by pulling up on the outer edge of the plate. Slide open the drawer assembly on

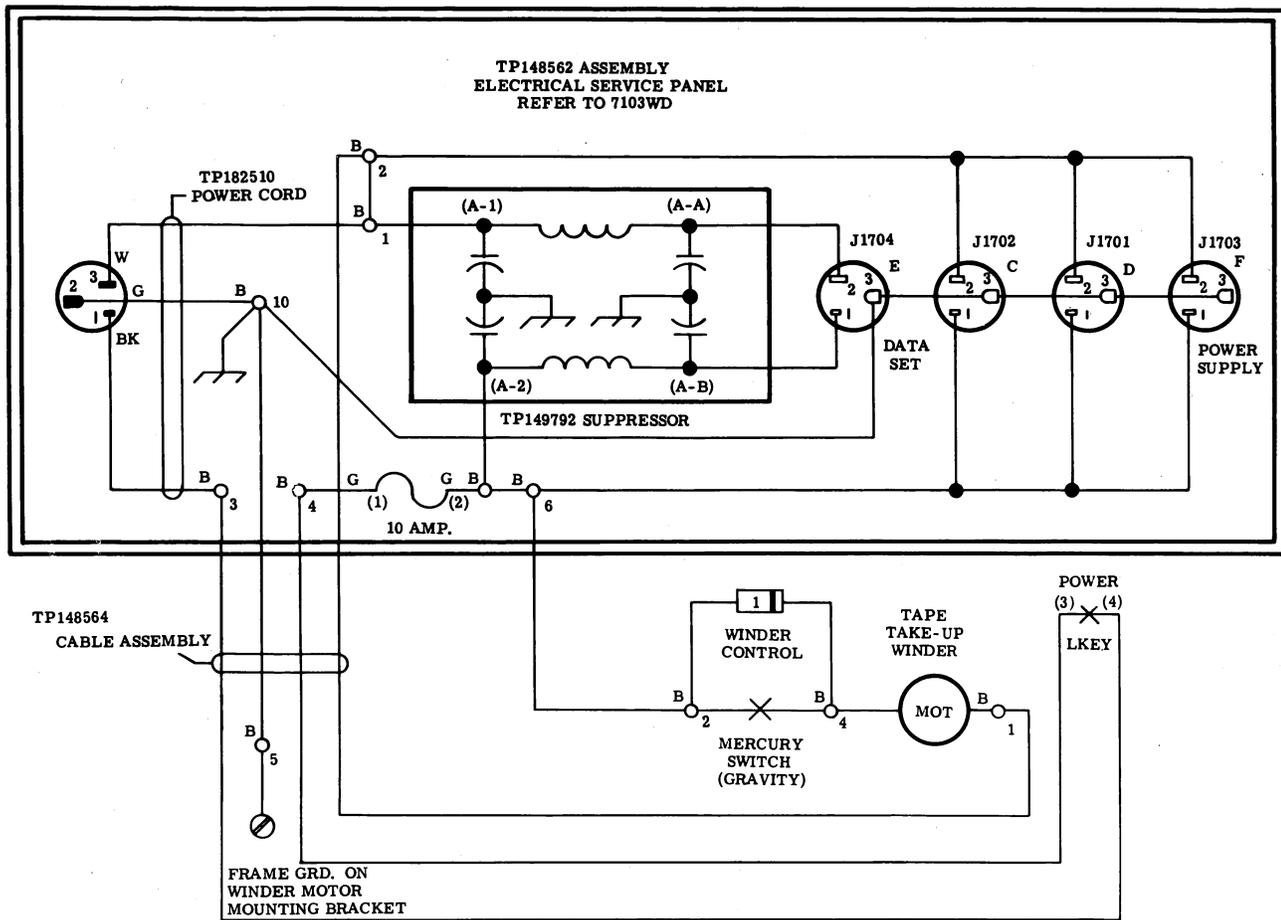


Figure 5 - Additional Wiring for 5C Sender

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

3.40 Reconnect the reader power cord to J851.

3.41 Plug the power cord from the electrical service panel into the outlet supplied by the subscriber.

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 clearly defined by the foregoing checks, operate the system to the full extent of its capabilities in accordance with sections covering operation and installation checkout to determine the frequency of occurrence and type of trouble.

TROUBLESHOOTING PROCEDURES

3.46 The following paragraphs outline preliminary checks and procedures to be followed in using Chart 1 in troubleshooting the 5A and 5C Senders.

3.47 Use a thoroughly pretested data set and line if possible. Recheck if trouble is not easily cleared.

3.48 Make arrangements to run 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 the TROUBLE CHECKOUT Paragraphs 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.

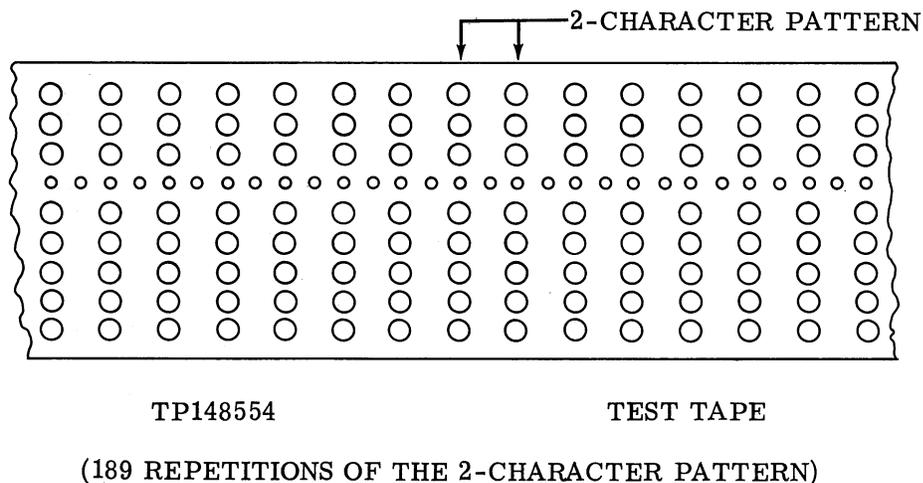


Figure 6 - Recommended Test Tape for Troubleshooting Type 5 Tape Senders

SECTION 592-807-300

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 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 Chart 2 of this section. For location on equipment and for parts ordering information, refer to the actual and schematic wiring diagrams, and to the Tape Sender Cabinet (AC) and electrical components parts sections, respectively.

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

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 and proper 115 v ac and good 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 115 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 115 v ac and ground at J852 for the data set.

(3) 115 v ac 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 TP-199535 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 (4) and good ground (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.)

3.56 If the corrective actions given for probable causes for any trouble symptom of Chart 1 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 diagrams section. Repair or, if necessary, replace defective parts and assemblies such as tape reader (CX type), reader motor, motor control unit, power supply, transmitter, electrical service panel, data set, and line to re-establish service (Paragraph 3.01).

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS

INDEX TO SYMPTOM OR TROUBLE REPORT

<u>SYMPTOM OR TROUBLE REPORT</u>	<u>PAGE</u>
1. No power indication - indicator button on 5C Sender fails to light when pressed. Motor or relays of 5A or 5C Sender will not operate.	14
2. DATA key on data set fails to remain lighted when pressed - data set does not stay on-line in data mode.	14, 15
3. Sender does not answer a call with initial 2025 cps beep signal lasting 2 to 5 seconds, or does not transmit data - drops call after DATA key is pressed.	15
4. Remote Receiver fails to remain on-line - drops call after connection has been established.	15, 16
5. Reader motor fails to start, or stops during transmission of data.	16, 17, 18
6. Reader fails to read tape (transmit) - does not move tape approximately 2 seconds after motor starts.	18, 19, 20
7. Data not transmitted when reader moves (feeds) message tape or test tape.	20
8. Garbled data - random, unclassified errors.	21
9. Garbled with, consistent or repeated, same type of trouble - gain or loss of a code level.	21, 22

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
<p>1. No power indication - indicator button on 5C Sender fails to light when pressed. Motor or relays of 5A or 5C Sender will not operate.</p>	<p>A. Disconnected, loose or defective power cord assembly; TP182510 for 5C Sender electrical service panel and/or TP152510 for TP198000 power supply and reader motor.</p> <p>B. Burned-out 28 v indicator lamp or electrical service panel 10 amp fuse for 5C Sender.</p> <p>C. Blown 2 amp fuse F852 for reader motor or 1 amp fuse F851 for power supply input (both located in TP198048 motor control assembly), or 1.5 amp +48 v dc output fuse F951 in TP198000 power supply.</p> <p>D. Power supply TP198000 defective (ac input present and all fuses good, but +48 v dc output missing or erratic).</p> <p>E. Defective ac or dc wiring or connections.</p> <p><u>Note:</u> All lamps and all relays, except coil of transmit-delay (TD) relay K852 for the reader clutch magnets, are dc operated. The TD relay is energized and the reader motor is operated by ac, applied by the contact of dc motor-start (MS) relay K851.</p>	<p>Plug in, tighten, or replace defective power cord (6442WD4B2 or 6442WD4E2).</p> <p>Replace lamp (6442WD-1F7) or fuse (6442WD-4F3).</p> <p>Replace F852 or F851 (6442WD3C3) or F951 (6444WD).</p> <p>Replace power supply (6444WD and 6442WD, Sheets 3 and 4).</p> <p>Using a voltmeter, trace back (6442WD, Sheets 1 through 4) from known failure to point where proper voltage is obtained. Replace wiring and clean, tighten, or solder connections as required to re-establish circuit (refer to schematic and actual wiring diagrams section).</p>
<p>2. DATA key on data set fails to remain lighted when depressed - data set does not stay on-line in data mode.</p>	<p>A. Permanent RR lead ground, from Sender to data set remote-release interface terminal 14, is open between TP199540 strapping plug pins 11 and 14.</p>	<p>Tighten pins or replace strap (Figure 2 and 6442WD1E5).</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
<p>2. (cont)</p> <p>3. Sender does not answer a call with initial 2025 cps beep signal lasting 2 to 5 seconds, or does not transmit data - drops call after DATA key is pressed.</p> <p>4. Remote Receiver fails to remain on-line - drops call after connection has been established.</p> <p><u>Note:</u> The remote Receiver will not receive data if the Sender AS and PD relays do not operate properly to generate the all-space signal.</p>	<p>B. Defective connections or broken wire in Sender between pin 14 of J752 and pin 14 of J753.</p> <p>C. Defective connections or broken wire in Sender between pin 11 of J753 and module ground at solder lug 52 of relay K754.</p> <p>Same as A through C for Symptom 2.</p> <p>A. Open ground path to coil of all-space (AS) relay K751 from IK lead through TP199547 strapping plug pins 13 and 12 or pin 27, diode CR2 (reversed or defective) in plug, to pin 26 (AS relay must remain operated for approximately 300 ms after data set grounds its IK lead and starts reader motor. Data tones may be heard in handset with data set MON key depressed).</p> <p>B. Open ground path to AS relay at contact 9 of pulse-delay (PD) relay K752-U, caused by premature operation of the PD relay due to a shorted thermistor R751 or defective PD relay</p>	<p>Clean, tighten, resolder connections, or replace wire (6442WD1E8 and 1E5).</p> <p>Clean, tighten, resolder connections, or replace wire, (6442WD1E5 and 6445WD1E5).</p> <p>Same as Symptom 2. If reader motor does not start when Sender answers, refer to Symptom 5, and Par. 3.05, 3.12, and 3.13.</p> <p>To check: Observe AS relay operation by eye and operate relay by hand. Clean, tighten or solder connections or replace IK lead, straps or CR2 diode to re-establish ground path (Par. 3.11, 3.19, 3.20, Figure 2, and 6442WD1C5 and 1D5).</p> <p>Replace thermistor R751 (Figure 2 and 6442WD1D6) replace PD relay (Figure 2 and 6442WD1D7).</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
<p>4. (cont)</p> <p>5. Reader motor fails to start, or stops during transmission of data.</p>	<p>C. Failure of 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).</p> <p>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.</p> <p>A. Loose or defective power cord and connectors; reader power cord TP199542 to J851 of TP198048 motor control assembly, motor control power cord TP182510 to convenience outlet or to J1703 in TP148562 electrical service panel of 5C Sender and TP182510 power cord (Figure 2) from the 5C service panel to a convenience outlet.</p> <p>B. Defective TP198048 motor control assembly or TP198000 48 v dc power supply, refer to Probable Causes C through F.</p>	<p>To check: Operate AS relay (Figure 2 and Par. 3. 19) by hand; if Receiver does not remain on-line, clean and adjust AS relay contacts or replace relay (6442WD2A6 and 7 through 2D6 and 7). Refer also to Par. 3. 16, 3. 17, 3. 18, and 3. 19.</p> <p>Plug in, tighten, or replace cords and connectors as required. Refer to Chart 2 and 6442WD, Sheets 3 and 4 for schematic location of parts.</p> <p>To check, (Par. 3. 12 and 3. 13) remove the TP199542 reader power cord (6442WD4C6) and plug it directly into a convenience outlet. If motor runs, this indicates trouble in the motor or power supply (6444WD) assemblies, and Probable Causes C through F should be checked. If motor does not run, check Probable Cause G. Refer to Chart 2 for schematic location of parts.</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
5. (cont)	<p>C. The 2 amp slow-blow fuse F852 (6442WD3C3) in the TP198048 motor control assembly is blown due to short in motor control circuit (check - replacement fuse blows with reader power cord disconnected). If replaced fuse does not blow, see Probable Cause G.</p> <p>D. Defective motor-start (MS) TP198049 relay K851 or contact-motor does not start when relay operates and closes its contact. Operate relay by hand to check.</p> <p>E. MS relay does not operate due to blown fuse F851 in motor control unit, or 1-1/2 amp fuse F951, defective wiring, or elements of TP198000 48 v dc power supply. Observe relay operation by eye and operate relay by hand to check.</p> <p>F. MS relay fails to operate, when data set grounds interlock (IK) lead, due to open ground path through pins 13 and 12 of TP199547 strapping plug or Sender wiring to terminal 3 of MS relay.</p>	<p>With all power and reader disconnected, check associated wiring (6442WD, Sheets 3 and 4) with an ohmmeter, and eliminate short circuit.</p> <p>Replace relay (6442WD-3C6). Refer to Par. 3. 11, 3. 12, 3. 13, and Figure 2.</p> <p>Replace fuse F851 (6442WD3C3), or fuse F951, wiring, or replace power supply (Par. 3. 13 and 6444WD).</p> <p>Solder, or tighten and clean connections, or replace strap or wiring to re-establish ground path (Par. 3. 11, Figure 2 and 6442WD, Sheets 1 and 3).</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
5. (cont)	G. Thermal cutout on motor unit is operated due to overload on motor or due to obstruction of ventilating holes in top cover - motor does not run when plugged into a convenience outlet; or has excessive noise, vibration, or heating when restarted.	<p>CAUTION: DISCONNECT AC POWER BEFORE REMOVING COVERS FROM READER OR ANY APPARATUS UNIT.</p> <p>Turn reader shaft by hand to check (Par. 3. 12); eliminate bind (refer to reader adjustment section). Remove reader cover and press red thermal reset button located on left side of motor unit below mounting rail to restart motor. If cutout was operated (without shaft bind) clear any obstruction to ventilating holes, shock mounts, or other cause of overheating or vibration. Remove any shipping hardware that may have been overlooked during installation. If trouble is not cleared, replace motor unit.</p>
6. Reader fails to read tape (transmit) - does not move tape approximately 2 seconds after motor starts.	A. Run lever and tape available contacts do not close properly - no contact with lever in RUN position and tape in reader. (Contact springs may have been weakened by leaving lever in FREE position.)	Clean and adjust, or replace contacts (Par. 3. 16, 3. 17 and Figure 2). Refer to reader adjustment section, or replace CX type reader.

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
6. (cont)	<p>B. Thermal, 117 v ac transmit-delay (TD) relay K852 does not operate or close its contact to complete +48 v dc path through contact 8 of pulse-delay (PD) relay K752-U to the clutch magnets; or PD relay fails to operate due to defective strap or pins 12 and 13 of TP199547 strapping plug to IK lead from data set.</p> <p>C. Pulse-delay (PD) relay K752-U fails to operate, and hold itself operated through its contact 9, and complete 48 v dc path through its contact 8 to clutch magnets, due to open thermistor R751 or to defective contacts.</p> <p>D. Reverse-channel (RC) relay K752-L (applies only if reverse channel is used as indicated in Figure 2, Note 2) fails to operate or close its contact 1 due to relay defect or open ground path from data set Reverse Channel Receive 16 (RC) lead through pins 16 and 23 of TP199547 strapping plug and relay coil to +48 v dc; or open ground path at pins 30 to 31 of TP199547 strapping plug.</p>	<p>To check: With PD relay operated, place jumper between pins 5 and 7 of TD relay socket (Par. 3. 14 and 3. 15, Figure 2, and 6442WD3E3); pins are numbered counterclockwise from key of large center hole as viewed from face side of socket. If jumper operates clutch to start reader, replace TD relay. Clean, tighten, or replace strap, pins, or loose connections to IK ground.</p> <p>Replace thermistor or replace PD relay (Par. 3. 15, Figure 2, and 6442WD1D6 and 1D7).</p> <p>To check: Operate RC relay by hand (Par. 3. 16 and Figure 2). Clean and adjust contact 1 (6442WD-1C4), or replace relay (6442WD1B6) or clean, tighten or solder connections or replace wiring and strap to re-establish ground path (Par. 3. 17 and 6442WD1B5).</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
<p>6. (cont)</p> <p>7. Data not transmitted when reader moves (feeds) message tape or test tape.</p>	<p>E. Maladjusted or defective reader armature bail and feed mechanism fails to turn feed wheel.</p> <p>A. Defective universal contacts or operating mechanism, or related connections and wiring in reader - data storage and timing circuits are dependent on these contacts.</p> <p>B. Storage relays K753, K754, or timing pulse relay K755 (6442WD, Sheet 2) fail to hold and time character positions selected by reader due to defective K755 relay contacts or all-space (AS) relay contacts 10 and 11; or a defective relay, connections, or wiring.</p> <p>C. Storage timing and data transmit circuits fail due to loose or defective TP177582 circuit card (EC582) connections or transistor, or shorted resistor or diodes on the circuit card.</p> <p>D. Data is transmitted but not received (punched) by remote Receiver due to defective all-space signal - data tones can be heard in handset with MON key on data set depressed.</p>	<p>Adjust or replace tape feed mechanism. Refer to CX type reader adjustment section.</p> <p>Check, clean, and adjust as indicated in CX type reader adjustment section. Tighten, solder, or replace defective connections or wiring (6442WD, Sheets 1 and 2, and 6440WD).</p> <p>Clean and adjust AS relay contacts 10 and 11 (6442WD2F7), or replace defective relay (most likely - K755). Repair or replace any defective connections, or wiring. Replace relay K753, K754, or K755 (6442WD, Sheet 2. Refer to Par. 3.18).</p> <p>Clean, tighten (press card into socket), or replace the defective card. Refer to Symptom 9, Probable Cause D, and to 6442WD, Sheet 2.</p> <p>Refer to Symptom 4.</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
8. Garbled data - random, unclassified errors.	<p>A. Partial or intermittent failures of the types indicated for Symptoms 6 and 7, or Symptoms 1 through 5.</p> <p>B. Output of TP198000 power supply too high, too low, or fluctuating due to defective connections (check terminal and fuse connection), wiring, or defective power supply unit.</p> <p>C. Defective data set or line, or old style echo suppressors in the telephone circuit, may interfere with transmitted data.</p>	<p>Refer to Symptoms 6 and 7; then 1 through 5. Attempt to eliminate all possibilities and isolate trouble. (Refer to Par. 3. 15 through 3. 21, Figure 2, and 6442WD, Sheets 1 through 4.)</p> <p>Tighten, solder, or replace connection or wiring (Par. 3. 47 through 3. 56 and 6444WD). Repair or replace power supply if the trouble is not cleared and if the ac power source (check) is good (Par. 3. 21).</p> <p>Refer to Telephone Co. for tests. Run Sender tests with test center facilities if available (Par. 3. 17).</p>
9. Garble with, consistent or repeated, same type of trouble - gain or loss of a code level.	<p>A. Tape reader contact, associated with the affected level, fails to close properly for mark condition (hole in tape) or to open for space condition.</p> <p>B. Loose, dirty, or defective slip-connector pin, wiring, cable, or connection between reader and Sender transmitter circuit for affected level.</p>	<p>Check, clean, and adjust reader contacts (6442WD-2B through F2) in accordance with reader adjustment section; or replace tape reader (CX type).</p> <p>Tighten, clean, repair, or replace the defective connection, wiring, or cable (6442WD2B2 through 2F2).</p>

CHART 1

TROUBLESHOOTING 5A AND 5C SENDERS (continued)

SYMPTOM OR TROUBLE REPORT	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
9. (cont)	<p>C. Defective contacts or coil circuit, in 1 of the 4 sections of the K753 relay or K754 relay, or the contact of the all-space (AS) relay K751, associated with the affected level - an open circuit or non-operating relay section normally causes loss of the related mark-code (ground) signal to the data set.</p> <p>D. Loose or defective TP177582 (EC582) circuit card and socket connection or a defective diode (2 diodes per level) on the card in the circuit of the affected level.</p> <p>E. Continuous spacing of one level due to open diode in series with the associated K753 or K754 reed relay coil or open diode in series with the associated A contact.</p> <p>F. Continuous marking of one level due to closed (welded) A or B contact associated with the defective level in the K753 or K754 reed relay.</p> <p>G. Defective data set fails to supply required mark or space frequency signal.</p>	<p>Replace the K753 or K754 relay. Clean and adjust the AS relay contacts in the affected level or replace the relay. Resolder or replace any defective connections or wiring in the circuit. (Refer to Par. 3.01 and 6442WD, Sheet 2.)</p> <p>Clean and tighten related connections (press card firmly into socket). If diode trouble is indicated, check relays, contacts, and resistors in the transmitter circuit that control voltage or current to that diode and eliminate any suspected cause of failure; then replace the card or defective element on the card. (Refer to Par. 3.01 and 6442WD, Sheet 2.)</p> <p>Same as Symptom 9, Cause D. Refer to 6442WD2B3 through 2E3 and 2B5 through 2E5.</p> <p>Refer to Symptom 9, Cause D. Replace the associated K753 or K754 relay. Refer to 6442WD-2B3 through 2E3 and 2A6 through 2D6.</p> <p>Replace data set.</p>

CHART 2

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

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

CHART 2

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

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

CHART 2

5A AND 5C TAPE SENDERS SYMBOLS, ABBREVIATIONS, AND REFERENCES (continued)

CIRCUIT ELEMENT	WIRING DIAGRAM
8. Transmitter Power Distribution: (a) P853, Power Plug, ((1), (2) & (3)) (b) Motor Control Assembly, TP198048 (c) 48 V Power Supply Assembly, TP198000 (d) Transmitter Circuit Assembly, TP198001 (e) Power Cord, TP199542, (1, 5, & 2) (f) Thermal Cut-Out Switch (g) Reader MU43 Motor (h) Tape Take-Up Winder Motor (Pins 1 & 4) (i) Winder Control (Mercury Gravity Switch) (Pins 2 & 4) (j) Electrical Service Panel Assembly, TP148562	6442WD, 4B2 6442WD, 4B3 6442WD and 6442WD, 4B4 6442WD, 4C3 6442WD, 4C6 6442WD, 4B6 6442WD, 4B7 6442WD, 4D7 6442WD, 4D7 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