DATA LINE SWITCHING

INTERCHANGE ARRANGEMENTS

OPERATING TESTS

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

1.01 This section outlines the operating tests for the various line switching interchange arrangements. The procedures are applicable to the following situations.

(a) In testing the interchange equipment at Teletype Corporation or the Western Electric Company Distributing House wherever they are assembled prior to shipment for installation in the customer's office.

(b) In testing the interchange equipment locally and also with the serving telegraph test center at the time of installation and following routine maintenance or trouble clearing.

1.02 Bell System Practices Sections E12.715.1 and E12.715.2, cover office responsibilities and preservice test procedures for data-line switching systems. In general these practices will also apply to the testing of the interchange equipment.

2. APPARATUS

2.01 The equipment for originating continuous tape operation includes one or two 28D-2 reperforator-transmitters mounted in a 28A apparatus cabinet associated with alarm

© American Telephone and Telegraph Company, 1961
Printed in U.S.A.

and reader circuit per CA-15022-SD, transmitter control circuit per CA-15023-SD, and 154A1 DATA-PHONE equipment per SD-70906-01.

2.02 The equipment for originating torn tape operation consists of a 28F or G transmitter-distributor mounted on a 28A reperforator table, associated with alarm, reader and control unit per CA-15024-SD, and 154A1 DATA-PHONE equipment per SD-70906-01.

2.03 The equipment for terminating operation consists of a 28-type receiving only typing reperforator or 28-type reperforator-transmitter associated with a 28A sequence selector, 28J distributor, control circuit per CA-15021-SD and the 154A1 DATA-PHONE set per SD-70907-01. In addition, the following circuits may be used where applicable: modification of 28 ROTR set per CA-15020-SD, rack mounted electrical service unit for ROTR per EA-14621-SD, reperforator-transmitter control circuit per SD-70868-01, reperforator-transmitter alarm and control circuits per EA-12901-SD, EA-12917-SD, or WA-14419-SD. An extension receiving only teletypewriter may also be provided.

2.04 The equipment for semiautomatic tape preparation consists of an originating station 28 ASR with its 8-level reperforator, a Codomat, an auxiliary 28G transmitter-distributor (5-level), mounted on a 28A reperforator table, associated with alarm, reader, and control circuit per CA-15025-SD, and 154A1 DATA-PHONE equipment per SD-70906-01.

2.05 In order to secure adequate tests at the point of assembly prior to shipment, complete originating and terminating station equipments, together with a No. 5 office simulator per B-734700-B1 or equivalent, should be used in all cases. See Fig. 1 for test setups at point of assembly.

2.06 The 28-type sequence selectors, 28-type distributors, 28-type transmitter-distributors, 28-type receiving only typing reperforators, 28-type reperforator-transmitters, and 28 ASR teletypewriters should be adjusted, lubricated and tested insofar as possible in accordance with the appropriate Bell System Practices prior to the start of the tests.

3. PREINSTALLATION TESTS—ORIGINATING INTERCHANGE FOR CONTINUOUS TAPE OPERATION, ALARM, READER, AND TRANSMITTER CONTROL CIRCUITS

3.01 ***The following tests on the originating interchange equipment for continuous tape operation should be made at the point of assembly prior to the shipment of the equipment to the field for installation.*** Drawing CA-15022-SD, Note 400A or B covers the wiring and interconnecting arrangements for the equipment units. See block diagram shown as Fig. 1.

3.02 Connect the leads from the alarm and reader unit shown as connecting to the line into a local dummy circuit. Provide a source of automatic test signals such as a 14- or 28-type transmitter-distributor arranged so that it can be connected into the dummy circuit.

3.03 Connect the leads from the 154A1 DATA-PHONE set shown as connecting to the telephone lines to the No. 5 office simulator per B-734700-B1 or equivalent. Also provide a receiving only typing reperforator arranged for the same speed of operation as the equipment under test and wired for 30 ma magnet operation, to be used for monitoring in the MON jack of the terminating circuit CA-15021-SD.

3.04 After connection to the ac service has been made and all power switches operated to the ON position, the dc voltages should be checked. The 48-volt rectifier has built-in voltage regulation, therefore no adjustment is possible, but it should be determined that the voltage reads between —45 and —50 volts. The 130-volt rectifiers in the electrical service units are not adjustable but should be checked for proper output.

3.05 Care should be taken that the control circuit is properly strapped to generate the proper DDD numbers and the pseudomnemonic code as specified in the order. Care should also be taken that the reperforator-transmitters meet the bias tolerance tests as outlined in standard instructions. It is assumed that the 154A1 DATA-PHONE sets have been checked and adjusted using the 165C1 telegraph test set or

equivalent, and the frequencies of the 43A1 units adjusted to within 0.5 cycles of the assigned frequency.

Search for Start of Message and Data Transmission Test (Option Z, Continuous Tape)

3.06 Prepare test tape as shown in Fig. 5 and send it into the reperforator side of the reperforator-transmitter from the transmitter-distributor as mentioned in 3.02. The resulting action is as follows.

(1) The circuit should step through the LTRS and/or BLANKS in the leader of the tape.

(2) When the first start-of-message is read, (any character other than LTRS or BLANKS) the DDD number is sent. The MF tones may be heard from the monitoring amplifier in the No. 5 office simulator and the digit lamps (1 to 10) light momentarily as the called number is outpulsed. They will be difficult to observe, as the pulsing rate is ten digits per second.

(3) When answer-back is received from the terminating station, the pseudomnemonic code is sent, and as soon as confirmation is received, the message text will be transmitted.

Note: While the first message is being sent, the ROH relay in the terminating interchange circuit CA-15021-SD should be blocked in the operated position. This is to prevent the terminating circuit from going on-hook at the end of the first message.

(4) The entire tape should be transmitted with the one DDD connection, after which the connection should be broken down. While the text of the last message is being sent, the ROH relay in the terminating circuit should be unblocked.

3.07 Measure the transmission of the reperforator-transmitter by plugging a 164C1 measuring set into the LT jack of the transmitter control circuit CA-15023-SD and rerunning the test tape per Chart 1 as in 3.06. Adjust the distributor contacts of the reperforator-transmitter for less than 2 per cent distortion.

3.08 Adjust the spark killer on the SLR relay in the alarm and reader circuit in accordance with Note 110, CA-15022-SD, Sheet D1.

3.09 Rerun the test tape, per Fig. 5 as in 3.06, and after the entire tape has been transmitted examine the tape in the monitoring ROTR for the last transmission. Observe the presence of the following conditions.

(1) Any LTRS or BLANKS before the first message, between messages, or after the last message should have been deleted.

(2) The pseudomnemonic which was generated by the control circuit should appear in the tape ahead of the mnemonic code of the first message.

(3) Where a message ended in ↟H↟ in the test tape, this should appear in the monitor tape, followed by NNNN which was generated by the transmitter control circuit.

(4) Where a message ended in NNNN in the test tape, this should appear in the monitor tape.

(5) The last message in the test tape, which ended in NNNN, should be followed by ↟H↟ which was generated by the terminating circuit.

(6) No characters or functions in the test tape should have been deleted except LTRS and BLANKS mentioned in 3.09(1). Note particularly that none of the carriage return (CR) or line feed (LF) functions have been deleted or garbled.

3.10 Restart the test tape, per Fig. 5, but send only the first message, stopping the transmitter-distributor in the LTRS and BLANKS between message 1 and message 2. In this case, it is unnecessary to block and unblock the ROH relay in the terminating circuit. Again check the tape in the monitoring ROTR. It should agree with 3.09(1), (2), and in (3), the ↟H↟ should be followed by >NNNN signifying an end of transmission.

REPERFORATOR TROUBLE Alarm

3.11 While sending the test tape from the transmitter-distributor into the reperforator side of the RT, turn off the reperforator-transmitter power switch. The resulting action is as follows.

(1) Within the space of three or four characters, the alarm buzzer should sound and the REPERF TRBL lamp should light.

(2) Operate the SILENCE AUDIBLE key and observe the following indications.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Turn on the RT power switch.

(4) Operate the REPERF TRBL ALARM RELEASE key and observe the following indications.

(a) The REPERF TRBL lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

TORN TAPE Alarm

3.12 Insert in the transmitting head of the RT a piece of tape which has been torn in the text of a message. Observe the following indications.

(1) When the torn place passes over the sixth pin:

(a) The alarm buzzer should sound.

(b) The TORN TAPE lamp should light.

(c) The transmitter should stop.

(d) The station should go on-hook.

(2) Operate the SILENCE AUDIBLE key and observe the following conditions.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Repair or replace the torn tape and operate the TORN TAPE ALARM RELEASE key. Observe the following conditions.

(a) The TORN TAPE lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

3.13 Insert in the transmitting head of the RT a piece of tape which has been torn in the LTRS or BLANKS following a message ending in NNNN. When the torn place passes over the tape-out pin, the action should be the same as covered in 3.12.

3.14 Insert in the transmitting head of the RT a piece of tape which has been torn in the LTRS or BLANKS following a message ending in ↓ H ↓ . When the torn place passes over the tape out pin, the action should be the same as in 3.12 except that in addition the transmitter control circuit should have generated > NNNN before going on-hook. (Verify on monitor copy.)

START FAILURE Alarm

3.15 After tape becomes available in the RT, if a start of message is not read within 11 seconds, the timing circuit in the transmitter control circuit will time out and operate the alarm. This test may be made in either of two ways, i.e., by cutting or tearing the feed holes to prevent the tape from feeding, or by placing in the transmitting head of the RT a tape containing a string of LTRS and/or BLANKS which cannot be stepped through in 11 seconds (approx. 8 or 9 inches of tape).

(1) In either case, 11 seconds after the tape becomes available, observe the following indications.

(a) The START FAILURE lamp should light.

(b) The alarm buzzer should sound, and

(c) Search for start of message continues uninterrupted.

(2) Operate the SILENCE AUDIBLE key, and observe the following indications.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Operate the START FAILURE ALARM RELEASE key and observe the following indications.

(a) The START FAILURE lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

..Repeat the tests several times, averaging the time-out time. If it is more or less than 11 seconds, adjust the P potentiometer in the transmitter control circuit so that the timer averages 11 seconds.

DIAL FAILURE Alarm

3.16 Once the transmitter has gone into dial mode, if for any reason dialing fails to start or once started, stops for 11 seconds, the timer will time out and operate the alarm. Proceed as follows:

Note: This alarm will not activate if the called station fails to respond with an answer-back signal. In that case, the selector switch would step around to Step 1 and the dialing sequence would be started again, with up to eight such attempts being made.

(1) After blocking the CT relay in the 154A1 DATA-PHONE set in the unoperated position, send a valid message into the reperforator. The transmitter should step through the Start of Message code (SOM) and present the first DDD digit to the DATA-PHONE set. Since the DATA-PHONE set will see no originating register from the No. 5 office simulator, it will not act on the digit and after 11 seconds:

(a) The DIAL FAILURE lamp should light.

(b) The alarm buzzer should sound.

(2) Operate the SILENCE AUDIBLE key and observe the following indications.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Unblock the CT relay and operate the DIAL FAILURE ALARM RELEASE key. Observe the following indications.

(a) The DIAL FAILURE lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

MESSAGE INTERRUPTED Alarm

3.17 Send part of a message into the reperforator, stopping the transmitter-distributor in the text of the message. When all of the tape has been transmitted from the RT, the circuit should wait up to 30 seconds for more tape to become available.

Note: The 30-second timer is not adjustable, with the 11-second timer properly adjusted, the other timer should be very close to 30 seconds.

3.18 After 15 or 20 seconds, send the rest of the tape as covered in 3.17. Transmission from the RT should resume immediately.

3.19 Send part of a message into the reperforator as covered in 3.17.

(1) After 30 seconds when the timer times out, observe the following indications.

(a) The MESSAGE INTERRUPTED lamp should light.

(b) The alarm buzzer should sound.

(c) The station should go on-hook.

(2) Operate the SILENCE AUDIBLE key and observe the following indications.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Operate the MESSAGE INTERRUPTED ALARM RELEASE key and observe the following indications.

(a) The MESSAGE INTERRUPTED lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

CONNECTION LOST Alarm

3.20 While transmitting tape from the reperforator-transmitter, hold the armature of the RCR relay in the alarm and reader circuit CA-15022-SD to its spacing contact.

(1) After about one half second, observe the following indications.

(a) The CONNECTION LOST lamp should light.

(b) The alarm buzzer should sound.

(c) The station should go on-hook.

(2) Operate the SILENCE AUDIBLE key and observe the following indications.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Operate the CONNECTION LOST ALARM RELEASE key and observe the following indications.

(a) The CONNECTION LOST lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

NO CONNECTION Alarm

3.21 After blocking the CF relay in the transmitter control circuit in the unoperated condition, send a message from the transmitter-distributor into the reperforator and proceed as follows.

(1) The transmitter control circuit will send the DDD number, receive answer-back, and send the pseudomnemonic, but as confirmation is not received to complete the call, the circuit will time out in 11 seconds and restart the dialing sequence. On the eighth attempt, observe the following indications.

(a) The NO CONNECTION lamp should light.

(b) The alarm buzzer should sound.

(c) The station should go on-hook.

(2) Operate the SILENCE AUDIBLE key and observe the following indications.

(a) The buzzer should be silenced.

(b) The ALARM GUARD lamp should light.

(3) Unblock the CF relay and operate the NO CONNECTION ALARM RELEASE key. Observe the following indications.

(a) The NO CONNECTION lamp should be extinguished.

(b) The ALARM GUARD lamp should be extinguished.

LOW TAPE Alarm

3.22 Insert in the 28A apparatus cabinet a roll of paper which has been depleted to the beginning of the red tracer in the paper.

(1) Observe that the LOW TAPE alarm does not operate.

(2) Further deplete the paper supply on the roll until about 15 thicknesses of paper remain on the roll. Observe the following indications.

(a) The LOW TAPE lamp should light.

(b) The alarm buzzer should sound.

(3) Operate the LOW TAPE BUZ RLS key 90 degrees in a clockwise direction. Observe the following indications.

(a) The buzzer should be silenced.

(b) The LOW TAPE lamp should remain lighted.

(4) Replenish the paper supply in the cabinet. The alarm buzzer should again sound.

(5) Restore the LOW TAPE BUZ RLS key to its normal position. Observe the following indications.

(a) The buzzer should be silenced.

(b) The LOW TAPE lamp should be extinguished.

TRANSMITTER CONTROL Key

3.23 While transmitting tape from the reperforator-transmitter, operate the TRANS CONTROL key to the STOP position. The resulting action is as follows.

(1) The transmitter should stop immediately.

(2) The TRANS GUARD lamp should light.

(3) The timer should be disabled.

3.24 Restore the TRANS CONTROL key to the SEND position. The resulting action is as follows.

(1) Transmission should resume.

(2) The TRANS GUARD lamp should be extinguished.

(3) The timer is again activated.

3.25 While the text of a message is being transmitted from the reperforator-transmitter, operate the TRANS CONTROL key to the HOLD position. The resulting action is as follows.

(1) The TRANS GUARD lamp should light.

(2) The transmitter should continue to run until an end of message is read, at which time the transmitter stops.

3.26 Restore the TRANS CONTROL key to the SEND position. The resulting action is as follows.

(1) The TRANS GUARD lamp should be extinguished.

(2) The tape should start to feed through the transmitting head as the circuit searches for another start of message.

TRANSMISSION Key

3.27 Operate the XMSN key, a locking-type key located inside the 28A apparatus cabinet. The T relay in the 154A1 DATA-PHONE set should be operated. Release the XMSN key and the T relay in the DATA-PHONE set should be released.

CALL TELCO Key

3.28 While transmitting tape from the reperforator-transmitter, operate the TRANS CONTROL key to the HOLD position. When the next EOM is read, the transmitter will stop.

3.29 Operate the TRANS CONTROL key to the STOP position, remove the message tape from the transmitting head of the RT, and insert in its place a prepared test tape, which does not contain an EOM code. Operate the CTC key (nonlocking and located inside the 28A apparatus cabinet) and then restore the TRANS CONTROL key to the SEND position.

. . ***Should a start failure alarm occur before the above sequence is completed, it will be necessary to operate the start failure alarm release key and reoperate the CTC key before restoring the TRANS CONTROL to the SEND position.***

(1) The prepared test tape should be transmitted immediately. With the test arrangement being used, it is not possible to

determine that the DDD number of the STC was dialed. However the connection should be maintained to the terminating station and any number of tapes sent as long as none contains an end-of-message code.

3.30 Insert in the transmitting head of the RT a message containing an EOM code (NNNN). When the EOM code is transmitted the station should go on-hook and the transmitter control circuit be restored to normal.

RESET Key

3.31 Block the CF relay in the transmitter control circuit in the unoperated position. Start a test tape to the STC as covered in 3.28 and/or 3.29. Observe the resulting action.

(1) The DDD number should be transmitted, and answer-back received but due to the blocking of the CF relay, the call cannot be completed. This simulates a condition where the CTC key would be operated by the attendant but for some reason, the call to the STC would not be completed successfully.

(2) Observe that all timers are disabled.

3.32 Operate the RESET key (nonlocking and located inside the 28A apparatus cabinet). The station should go on-hook and the transmitter control circuit should be restored to normal.

Search for Start of Message and Data Transmission Test (Option "Y," One Message at a Time)

3.33 Prepare and send test tape as covered in 3.06 and Fig. 5. The operation should be as in 3.06 (1), (2), and (3) except this time do not block the ROH relay in the terminating circuit. After each EOM is read, the station should go on-hook with the terminating station being redialed each time a start of message is read.

3.34 After the entire tape has been transmitted, examine the tape in the monitoring ROTR for the following conditions.

(1) Any LTRS or BLANKS before the first message, between messages, or after the last message should have been deleted.

(2) The pseudomnemonic which was generated by the transmitter control circuit should appear in the monitor tape ahead of the mnemonic code of each message.

(3) Where a message in the test tape ended in ↟H↟, this should appear in the monitor tape followed by NNNN which was generated by the transmitter control circuit.

(4) Messages in the tape which ended in NNNN should appear on the monitor tape with the NNNN followed by ↟H↟ which was generated by the terminating circuit.

(5) No characters or functions in the test tape should have deleted except the LTRS and BLANKS mentioned in (1).

3.35 Send one message into the reperforator as covered in 3.10. Again check the tape in the monitor ROTR. It should agree with 3.34.

Note: With "Y" option, >NNNN is never generated and transmitted.

Alarms with Option "Y"

3.36 The alarms and various control keys should function the same regardless of whether Option "Z" or "Y" is used. It is suggested that the alarms be tested again as covered in 3.11 through 3.32 to determine that their operation has not been affected by the change from Option "Z" to "Y".

Tests of Second RT and Control Circuits Where Provided

3.37 If the 28A apparatus cabinet contains a second 28-type reperforator-transmitter associated with a second control circuit and 154A1 DATA-PHONE set, these should be tested in accordance with 3.01 through 3.36 as above.

4. PREINSTALLATION TESTS — ORIGINATING INTERCHANGE FOR TORN TAPE OPERATION, ALARM, READER, AND TRANSMITTER CONTROL CIRCUITS

4.01 ***The following tests on the originating interchange equipment for torn tape operation should be made at the point of assembly prior to the shipment of the equipment to the field for installation.*** Drawing CA-15024-SD,

Note 400A, covers the wiring and interconnecting arrangements for the equipment units.

4.02 Refer to 3.03, 3.04, and 3.05. In 3.05 disregard reference to reperforator-transmitters.

Search for Start of Message and Data Transmission Test (Options "T" and "X")

4.03 Prepare test tape (Fig. 5) and after moving the START-STOP lever of the transmitter-distributor to the STOP or FREE position, insert the tape in the transmitter. The resulting action is as follows.

(1) Move the START-STOP lever to the RUN position.

(2) Proceed as covered in 3.06, (1) through (4).

Note: When power is first turned on, the circuit will proceed as in 3.06 (1) and (2), time out, and start the dialing sequence over. On the second and succeeding attempts, the entire sequence of operations should take place. This is due to the fact that the E relay, which is normally operated at the beginning of a dialing sequence, is not operated until after the start of the first, incomplete dialing attempt.

4.04 Measure and adjust the transmission as covered in 3.07 and 3.08.

4.05 Check the monitor tape as covered in 3.09.

4.06 Check for generation of > NNNN as covered in 3.10.

DIAL FAILURE Alarm

4.07 Test as in 3.16 except in (1) place the test tape in the transmitter distributor after blocking the CT relay.

MESSAGE INTERRUPTED Alarm

4.08 Insert a test tape in the transmitter as covered in 4.03 (1) and proceed as follows.

(1) While transmitting the text of a message, operate the START-STOP lever to the STOP position. The circuit should wait up to 30 seconds before alarming.

Note: The 30-second timer is not adjustable, with the 11-second timer properly adjusted, the other timer should be very close to 30 seconds.

(2) After 15 or 20 seconds, move the START-STOP switch to the RUN position. Transmission should resume immediately.

(3) Send part of a message as covered in 4.08. When the circuit times out in 30 seconds, the action should be as covered in 3.19 (1) through (3).

CONNECTION LOST Alarm

4.09 Same as 3.20 (1) through (3) except in the first sentence substitute, "While transmitting tape from the transmitter distributor, ..."

NO CONNECTION Alarm

4.10 Same as 3.21 (1) through (3) except delete the last three words of the first sentence, " . . . into the reperforator."

TAPE TROUBLE Alarm

4.11 Insert a test tape in the transmitter as in 4.03, then while transmitting a message text, lift the tape to open the stop-run contacts. The circuit should wait up to 30 seconds for tape to again become available. After 15 or 20 seconds, release the tape. Transmission should resume immediately.

4.12 Again insert a test tape and stop as covered in 4.11.

(1) When circuit times out in 30 seconds, observe the following indications.

(1) The alarm buzzer sounds.

(2) The TT lamp lights.

(3) The MI lamp lights.

(4) The station goes on-hook.

(2) Operate the SA key and observe the following indications.

(a) The buzzer should be silenced.

(b) The AG lamp should light.

(3) Operate the MI and TT ALARM RLS keys and observe the following indications.

(a) The AG lamp should be extinguished.

(b) The TT lamp should be extinguished.

(c) The MI lamp should be extinguished.

4.13 Insert a test tape as covered in 4.11 except stop the tape in the LTRS and/or BLANKS following a message which ended with NNNN. The resulting action should be the same as in 4.12 (1) through (3).

4.14 Insert a test tape as covered in 4.11 except stop the tape in the LTRS and/or BLANKS following a message which ended in ↑H↑. The action should be the same as covered in 4.02 (1) through (3) except that before the station goes on-hook > NNNN should be generated and transmitted.

4.15 Insert a test tape as covered in 4.11 and proceed as follows.

(1) While transmitting the message text, operate the red button on the transmitter-distributor which will release the tape gate. Observe the following indications.

(a) The alarm buzzer should sound.

(b) The TT lamp should light.

(c) The NO EOM lamp should light.

(d) The station should go on-hook.

(2) Operate the SA key and observe the following indications.

(a) The buzzer should be silenced.

(b) The AG lamp should light.

(3) Operate the TT ALM RLS key and observe the following indications.

(a) The AG lamp should be extinguished.

(b) The NO EOM lamp should be extinguished.

(c) The TT lamp should be extinguished.

4.16 Insert a test tape and stop it as covered in 4.15 except stop the tape in the LTRS and/or BLANKS following a message ending in NNNN. The station should go on-hook.

4.17 Insert a test tape and stop it as covered in 4.15 except stop the tape in the BLANKS and/or LTRS following a message ending in ↑H↑. The control circuit should generate and transmit SPACE > NNNN after which the station should go on hook.

TRANSMITTER CONTROL Key

4.18 While the text of a message is being transmitted, operate the transmitter control key to the HOLD position. Observe the following indications.

(1) The TG lamp should light.

(2) The transmitter should continue to run until an EOM is read, at which time:

(a) The transmitter should stop.

(b) The buzzer should operate.

(c) The TT lamp should light.

4.19 Operate the SA key and observe the following indications.

(1) The buzzer should be silenced.

(2) The AG lamp should light.

4.20 Restore the transmitter control key to the SEND position and operate the TT ALM RLS key. Observe the following actions.

(1) The AG lamp should be extinguished.

(2) The TT lamp should be extinguished.

(3) The tape should start to feed through the transmitter as the circuit searches for a start of message.

TRANSMISSION Key

4.21 The same as covered in 3.28 except that the XMSN key is located on the inner left side of the table on which the transmitter-distributor is mounted.

CALL TELCO Key

4.22 After moving the START-STOP lever of the transmitter-distributor to the STOP or FREE position, insert a prepared test tape which does not contain an EOM code in the transmitter-distributor and proceed as follows.

(1) Operate the CTC key (nonlocking) and located with the XMSN key mentioned in 4.21 and also operate the START-STOP lever to the RUN position.

(2) The resulting action should be as covered in 3.29 and also refer to the Note under 3.29.

4.23 Insert in the transmitter a tape containing an EOM code (either ↟H↟ or NNNN). When the EOM is transmitted, the station should go on-hook and the control circuit should be restored to normal.

RESET Key

4.24 Block the CF relay in the transmitter control circuit in the unoperated position. Start a test tape to the STC as covered in 4.22 (1) and (2). The resulting action should be as in 3.31 (1) and 3.32 (1) except that the RESET key is located with the XMSN key mentioned in 4.21.

Search for Start of Message and Data Transmission Test (Option "W," Conversion of Fourth N to LTRS)

4.25 The operation with Option "W" is the same as with Options "T" and "X" up to the point where either ↟H↟ or NNNN is read at the end of a message. Prepare and transmit a test message as covered in 4.03. The resulting action is the same as covered in 3.06 (1) through (4).

4.26 Examine the monitor tape and observe the presence of the following.

(1) Any LTRS or BLANKS before the first message, between messages, or after the last message should have been deleted.

(2) The pseudomnemonic which was generated by the control circuit should appear in the tape ahead of the mnemonic code of the first message.

(3) Where a message ended in ↟H↟ in the test tape, this should also appear in the monitor tape.

(4) Where a message ended in NNNN in the test tape, this should appear as NNN ↟ LTRS in the monitor tape.

(5) The last message in the tape, whose EOM code was NNNN should appear on the monitor tape with the fourth N converted to a LTRS as covered in (4), followed by NNNN which was generated by the control circuit as an end-of-transmission code.

(6) No characters or functions in the test tape should have been deleted except the BLANKS and/or LTRS mentioned in 4.26 (1). Note particularly that none of the CR or LF functions have been deleted or garbled.

4.27 Send only the first message in the tape as covered in 3.10. Again check the monitor tape. It should agree with 4.26 (1), (2), and (6), and the ↟H↟ at the end of the message should appear in the monitor tape followed by NNNN.

Alarms with Option "W"

4.28 The alarms and various control keys should function the same regardless of whether Options "T" and "X" or "W" is used

except that covered in 4.11. "Tape Trouble Alarm," NNNN would be generated rather than > NNNN. It is suggested that the alarms be tested again as in 4.04 through 4.24 to determine that their operation was not affected by the change from Options "T" and "X" to Option "W".

5. PREINSTALLATION TESTS — TERMINATING INTERCHANGE EQUIPMENT CONTROL CIRCUIT

5.01 ***The following tests on the terminating interchange equipment should be made at the point of assembly prior to the shipment of the equipment to the field for installation.*** Drawing CA-15021-SD, Note 401 covers the wiring and interconnecting arrangements for the equipment units. See also block diagram shown as Note 302.

5.02 In order for a thorough test to be made of the terminating control equipment, a complete test setup is required as specified in 2.05 and Fig. 1. Refer to 3.04 and check dc voltage. Care should be taken that the terminating teletypewriter equipment be adjusted and lubricated in accordance with standard instructions. It is assumed that the 154A1 DATA-PHONE sets have been checked and adjusted using the 165C1 telegraph test set or equivalent, and the frequencies of the 43A1 units adjusted to within 0.5 cycles of the assigned frequency.

Data Transmission Test

5.03 Prepare and send a test tape as covered in 3.06 or 4.03 depending on which type of equipment and transmitting control is used. If CA-15022-SD and CA-15023-SD are used, arrangement of the transmitter control circuit for Option "Y", one message at a time, will remove the necessity for blocking and unblocking the ROH relay as described in 3.06 (3). If Option "Y" is used the action should be as covered in 3.34 (1) and (2); if Option "Z" is used, the action should be as covered in 3.06 (1) through (4). If CA-15024-SD control circuit is used, the action would be as covered in 4.03 (1) and (2).

(a) Examine the tape in the reperforator and observe the presence of the following.

(1) Any LTRS or BLANKS before the first message, between messages or after the last message should have been deleted. (See 5.09.)

(2) The pseudomnemonic which was used for confirmation purposes should not appear in the tape.

(3) Where a message ended in ↟ H ↟ in the test tape, this should appear in the reperforator tape; the NNNN which was generated by the control circuit should not appear.

(4) Where a message ended in NNNN in the test tape, this should appear in the reperforator tape followed by ↟ H ↟ which was generated by the terminating control circuit.

(5) No characters or functions in the test tape should have been deleted except the LTRS and BLANKS mentioned in (1). Note particularly that no CR or LF functions have been deleted or garbled.

Note: The fact that the call from the originating station was completed successfully indicates that the confirmation signal was returned by the sequence selector at the proper time. No lost connection alarm at the originating station indicates that circuit assurance pulses of the proper length were being returned by the universal contacts. Should a lost connection alarm occur, the circuit assurance pulse may be measured at the SEND MEAS jack of the 154A1 terminating DATA-PHONE set and the universal contact mechanism should be adjusted to send a pulse of as near 50-millisecond length as possible. This assumes that the speed of the system is 100 wpm and that the pulse length is 50 milliseconds. For other speeds or other pulse lengths, interpolation must be performed to determine the character which a monitor should print upon receiving a circuit assurance pulse.

TRANSMISSION Key

5.04 Operate the XMSN key, a locking-type key inside or under the reperforator cabinet or table. The T relay in the 154A1 terminating DATA-PHONE set should be operated. Release the XMSN key. The T relay in the DATA-PHONE set should be released.

BUSY OUT Key

5.05 Operate the BUSY OUT key and then the MADE BUSY lamp should light.

5.06 Attempt to send a tape as covered in 5.03. As the terminating station appears busy to the No. 5 office simulator, the originating station should not be able to complete the connection, but should time out and make repeated attempts to establish the call.

5.07 Release the BUSY OUT key. The MADE BUSY lamp should be extinguished.

5.08 Again send a tape as covered in 5.03. The call should be completed on the first attempt.

Reperforator Trouble Test

5.09 While receiving a message in the terminating station reperforator, turn off the reperforator power switch. Observe the following indications.

(1) The REP TBL lamp should light.

(2) The alarm bell should sound.

(3) A CONNECTION LOST alarm should appear at the originating transmitter control location.

5.10 Turn the reperforator power switch back on and operate the REP TBL RLS key. Observe the following indications.

(1) The REP TBL lamp should be extinguished.

(2) The alarm bell should be silenced.

(3) The CONNECTION LOST alarm in the originating control circuit should be handled as covered in 3.20 (1), (2) and (3).

Tape Feed-Out Test

5.11 Whenever a ROTR is provided, automatic noninterfering tape feedout is furnished to provide a sufficient number of LTRS characters between messages for the purpose of tearing tape. Check the tape in the terminating reperforator to determine that several inches of LTRS characters appear between each message, and the first characters of a message are not deleted or garbled because of the automatic tape feed-out feature.

Low Tape Test

5.12 Insert in the reperforator a roll of tape which has been depleted to the beginning of the red tracer in the paper. Test as covered in 5.08.

5.13 Further deplete the paper supply until about 15 thicknesses of tape remain on the roll. Test as covered in 5.06.

Note: If the station fails to meet this requirement, adjust the LOW TAPE MAKE BUSY lever of the TTY equipment to bring it within limits.

5.14 Replenish the paper tape supply in the reperforator.

6. PREINSTALLATION TEST—SEMI-AUTOMATIC 8-LEVEL TAPE PREPARATION—INTERCHANGE ENTRY AND MANUAL RE-ENTRY

6.01 ***The following tests on the equipment for semiautomatic tape preparation at interchange entry or manual re-entry locations should be made at the point of assembly prior to shipment to the field for installation.*** Drawing CA-15025-SD, Note 400A covers the wiring and interconnecting arrangements for the equipment units. A complete test setup similar to that shown in Fig. 1 should be used.

6.02 Refer to 3.03 and 3.04. Care should be taken that the teletypewriter equipment meets the bias tolerance tests as outlined in standard instructions. It is assumed that the 154A1 DATA-PHONE sets have been checked and adjusted using the 165C1 telegraph test set

or equivalent, and the frequencies of the 43A1 units adjusted to within 0.5 cycles of the assigned frequency.

6.03 This section covers mainly the testing of the 5-level TD and its associated control circuit together with certain functions of the 28 ASR originating station equipment which are required to perform the interchange or manual re-entry operations. Adjustment and testing of the 28 ASR, Codomat, and DATA-PHONE set, as well as all keys and lamps normal to an originating station should be per standard instructions.

Tape Preparation — Interchange Entry (Option "X")

6.04 Prepare test tape, per Fig. 3, and proceed as follows.

(1) Insert the tape in the 5-level TD with the < marked (*) over the sensing pins or the tape may be positioned ahead of this point, so long as another CR or LF is not included.

(2) Operate the SOM key of the 28 ASR. The SOM characters and control hole 7 should be punched in the 8-level tape.

(3) Operate the nonlocking ADDRESSING key and then the ADDRESSING lamp should light.

(4) Address by insertion of Codomat card. The DDD number and mnemonic code should be punched in the 8-level tape together with control holes. The ADDRESSING lamp should be extinguished.

Note: The use of the ADDRESSING key in this manner will result in the mnemonic code being accompanied by the control hole 7 to simulate a pseudomnemonic code. When the Codomat card is restored automatically to the file, the effect of the operation of the ADDRESSING key will also be restored; i.e., if more than one address is to be codomated with simulated pseudomnemonic coding, the ADDRESSING key must be operated for each address.

(5) Operate the nonlocking TRANSFER key and observe the following action.

(a) The 8-level reperforator should be switched to the 5-level TD.

(b) The TRANSFER lamp should light.

Note: As soon as the 8-level tape has been prepared to the point where the TRANSFER key is operated, the transmitter control switch of the 28 ASR can be positioned to let that machine start setting up the DDD connection.

(c) The tape should start to feed through the TD with the first characters sent being deleted. When either < or ≡ is read in the tape of the 5-level TD, this deletion of characters should stop and the following characters should be converted to ↓ s until the first ↓ s character is read in the tape. This LTRS character will be perforated in the 8-level tape with the EOA control code (6th and 7th control holes) automatically inserted. From this point on the 5-level TD sends everything to the 8-level reperforator.

(d) When ↓ H ↓ is read in the tape, the 5-level TD should stop and the control circuit should cause the generation of NNNN and insertion of the EOM control code (0 and 6 control holes with the third N).

(e) The TRANSFER lamp should be extinguished.

(f) The reperforator should be switched back to the ASR and Codomat ready for processing another message.

(g) The completed tape should look like that shown as Fig. 4.

6.05 Prepare a test tape similar to that shown in Fig. 3 except use NNNN as the EOM code. Insert the tape in the 5-level TD as covered in 6.04 (1). Observe the following action.

(1) The action should be as covered in 6.04 (2), (3), (4), and (5) (a) through (c).

(2) When the third N is read, the control circuit will cause the control code for EOM (0 and 6 control holes) to be punched in the tape in line with the third N. After the fourth

N has been sent, the 5-level TD will stop and the action should then be as covered in 6.04 (5) (e) and (f).

(3) The completed tape should look like that shown as Fig. 4 except that ↓ H ↓ will not appear in the tape.

6.06 Prepare a test tape similar to that shown in Fig. 3 except do not include either EOM code. Insert the tape in the 5-level TD as covered in 6.04 (1). Observe the following action.

(1) The action should be as covered in 6.04 (2), (3), (4), and (5) (a) through (c).

(2) When the end of tape is reached in the 5-level TD, the action should be as follows.

(a) The 5-level TD should stop.

(b) The reperforator should switch back to the Codomat.

(c) The TRANSFER lamp should be extinguished.

(d) The alarm buzzer should sound.

(e) The NO EOM lamp should light.

(3) Operate the ALARM SILENCE key on the ASR and then the buzzer should be silenced.

(4) Operate the EOM key on the ASR and then:

(a) ↓< ≡ ≡ ≡ ≡ ≡ ≡ NNNN should be inserted in the tape with the corresponding EOM control holes (0 and 6) in line with the third N.

(b) The NO EOM lamp should be extinguished.

Note: Step 3 above may be omitted. Operation of the EOM key will also silence the buzzer.

Tape Preparation — Manual Re-entry (Option "W") — CONTINUOUS TAPE Key Normal (Single Message)

6.07 Messages which could not be delivered on the one automatic attempt by the intercept arrangement will be received in a 5-level typing reperforator. Each message will be preceded by the generated sequence followed by the mnemonic code of the intercepted address. The message which follows will be in standard IATA format and will have NNNN as the EOM code.

6.08 The intercept servicing equipment must reprocess the message in the 5-level tape into an 8-level tape inserting the addressing information and control codes required by the ASR to set up the connection and deliver the message in the manner of a normal originating station. Because of the organization of the message in the 5-level tape the mnemonic code must be accompanied by the control code for a pseudomnemonic code. If the Codomat card selected has the control code for a pseudomnemonic already present, this shall indicate that the "intercepted" message is meant for the broadcast circuit or an interchange location. The effect of operating the ADDRESSING key under this condition shall cause the control logic to follow an alternate mode of operation when reprocessing the message, otherwise it will follow the normal mode. The alternate mode of operation is required because messages intercepted for the broadcast circuit and interchange locations have CDCs preceding the text (see Fig. 8 and 9) which must be accompanied by CDC control holes in the 8-level tape to assure proper delivery of the message.

Normal Mode of Operation

6.09 When the Codomat card selected has mnemonic code control holes, proceed as follows.

(1) Prepare a test tape per Fig. 6 and insert in the 5-level TD with any character of the mnemonic code of the intercepted address over the sensing pins. (The exact positioning is not critical within the mnemonic code sequence of characters indicated.)

(2) The remainder of the test should be as covered in 6.04 (2) through (4), (5)(a) through (c), and 6.05 (b).

(3) The completed tape should look like that shown in Fig. 7.

Alternate Mode of Operation

6.10 When the Codomat card selected has pseudomnemonic code control holes with the 13th to 20th characters, proceed as follows. Prepare a test tape per Fig. 8 and insert as covered in 6.09 (1) as follows.

(1) Operate the SOM key of the 28 ASR and then the SOM characters and control hole 7 should be punched in the 8-level tape.

(2) Operate the nonlocking ADDRESSING key and then the ADDRESSING lamp should light.

(3) Address by insertion of Codomat card as follows.

(a) The DDD number and pseudomnemonic code should be punched in the 8-level tape together with the proper control holes.

(b) The ADDRESSING lamp should be extinguished.

(4) Operate the nonlocking TRANSFER key and observe the following actions.

(a) The 8-level reperforator should be switched to the 5-level TD.

(b) The TRANSFER lamp should light.

Note: As soon as the 8-level tape has been prepared to the point where the TRANSFER key is operated, the transmitter control switch of the 28 ASR can be positioned to let that machine start setting up the DDD connection.

(c) The tape should start to feed through the TD with all initial characters being discarded until (>) is read, which is deleted. The characters following the SPACE (>) should be punched in the 8-level tape accompanied by the CDC control hole (No. 6) until <or≡is read in the tape. The <or≡shall be discarded and all characters that follow should be converted to ↓s until a ↓ s is read in the tape. At this time the EOA control holes (6 and 7) should be punched in the tape with this ↓s character. From this point on the control should allow the complete text to be sent from the 5-level TD into the 8-level tape without punching any control holes.

(d) At the end of the message when the third N is read in the tape, the control circuit should cause the control code for EOM (0 and 6) to be punched in the 8-level tape in line with the third N. The next character, which should be the fourth N will then be punched in the tape also.

(e) The TRANSFER lamp should be extinguished.

(f) The 5-level TD should stop and the 8-level reperforator should be switched back to the Codomat ready for reprocessing the next message.

(g) The completed 8-level tape should look like that represented in Fig. 9.

6.11 Should end of tape occur before NNNN is read in the 5-level TD, the action would be as covered in 6.06 (2) through (4).

Tape Preparation — Manual Re-entry (Option "W") — CONTINUOUS TAPE Key Operated — Spliced Tape

6.12 If there are a number of messages from the 5-level typing reperforator which are to be sent to the same terminating station, the messages can be spliced together, if desired, to form a spliced tape sequence of messages. Each message will be preceded by the generated <≡ sequence and will have NNNN as the EOM code.

Normal Mode of Operation

6.13 When Codomat card selected has mnemonic code control holes proceed as follows.

(1) Prepare a tape per Fig. 10 and insert as in 6.09.

(2) Operate the CONTINUOUS TAPE key (locking) and then the CONTINUOUS TAPE lamp should light.

(3) The remainder of the test should be the same as for a single message per 6.04 (2) through (4) and (5) (a) through (c) up to the time that NNN of the EOM code of the first message is read in the tape of the 5-level TD.

(4) The operation of the CONTINUOUS TAPE key shall cause the control to change the character following NNN (which should be the fourth N) to a LTRS character and shall not put in the control code for EOM.

(5) The control shall then blind the 8-level reperforator until <or≡of the generated sequence preceding the start of the next message in the tape is read and deleted.

(6) The characters which follow will be changed to LTRS until the first LTRS character is read in the tape; this LTRS will be perforated along with control holes 6 and 7. Then the 5-level TD is allowed to send everything in its tape to the 8-level reperforator until an NNN sequence is again read in the tape.

(7) The sequence just described shall continue until the last message in the tape is reached and either the control sees the end of tape in the 5-level TD before <or≡, or the CONTINUOUS TAPE key is restored to normal. If following the conversion of the fourth N to ↑ s, an end of tape occurs before <or≡is read, the action is as follows.

(a) The 5-level TD should stop.

(b) The NO EOM lamp should light. (There should be no audible alarm.)

(c) The 8-level reperforator should be unblinded and put under control of the 28 ASR.

(d) The TRANSFER lamp is extinguished.

(e) Operation of the EOM key on the ASR should cause the NO EOM lamp to be extinguished and the EOM characters and control code to be punched in the 8-level tape.

(f) Restoration of the CONTINUOUS TAPE key should cause the CONTINUOUS TAPE lamp to be extinguished.

(8) Restoration of the CONTINUOUS TAPE key during the text of the last message of the spliced tape shall negate the effect of the key. If this is done, the CONTINUOUS TAPE lamp should be extinguished and when the NNN sequence of the EOM code is read in the tape of the 5-level TD the control should cause the third N of the tape to be inserted in the 8-level tape with the control code for end of message (0 and 6) and should allow the fourth N to be punched in the tape. The 5-level TD should stop, and the control of the 8-level reperforator should be transferred to the 28 ASR.

(9) The completed 8-level tape should look like that shown in Fig. 11.

Alternate Mode of Operation

6.14 When Codomat card selected has pseudo-mnemonic code control holes, proceed as follows. Prepare a test tape per Fig. 12 and insert as covered in 6.09 (1) as follows.

(1) The operation should be the same as for alternate mode with a single message 6.10 (2) through (4) and (5) (a) through (c) up to the point where the EOM code is read in the first message.

(2) With the CONTINUOUS TAPE key operated, the control should change the character following NNN (which should be the fourth N) to a LTRS character and shall not put in the control code for EOM. The 5-level TD should then discard all characters which follow until a SPACE (>) is read in the tape and discarded. After a SPACE (>) is read the 5-level TD should stop discarding characters, ↑ H ↑ should be generated for insertion in the 8-level tape, and then the 5-level TD should be allowed to send everything in its tape to the 8-level reperforator until an NNN sequence is again read in the tape.

(3) This process should be repeated for each message in the tape until the control, after having read NNN and performed the logic de-

scribed above, sees an end of tape in the 5-level TD before a SPACE (>). In this case the action would be as covered in 6.13 (7) (a) through (f).

(5) Restoration of the CONTINUOUS TAPE key before the EOM code of the last message of the sequence has been read in the tape of the 5-level TD should result in action as described in 6.13 (8).

(6) The completed 8-level tape should look like that represented in Fig. 13.

7. INSTALLATION TESTS—ORIGINATING INTERCHANGE FOR CONTINUOUS TAPE OPERATION, ALARM, READER, AND TRANSMITTER CONTROL CIRCUITS

7.01 ***The following tests on the originating interchange equipment for continuous tape operation should be made at the time of installation.*** Drawing CA-15022-SD, Note 400A or B covers the wiring and interconnecting arrangements for the equipment units.

7.02 In addition to the standard teletypewriter tools and supplies, the following equipment is required by the maintenance man to satisfactorily adjust and test an originating interchange station.

(1) 154A1 DATA-PHONE Test Set per SD-70908-01, (166A1)

(2) 28A Stroboscopic Test Set (modified especially for line switching)

(3) 164C1 Transmission Measuring Set or equivalent

7.03 After connection to the customer's ac service leads are made, the dc voltage should be checked. As the rectifier has built in voltage regulation, no adjustment is possible but it should be determined that the voltage is between −45 and −50 volts.

7.04 Care should be taken that the reperforator-transmitters have been adjusted and lubricated in accordance with standard instructions. It is assumed that the 154A1 originating DATA-PHONE sets have been checked and preliminary adjustments made using the 166A1 test set per Section 591-010-500 and drawing CD-70908-01. The major tests the maintenance man should have completed are listed as follows.

(1) The 431A1 unit of the DATA-PHONE set is a standard unit. The maintenance man should have adjusted for 80V LP-C by reading at the R LOOP pin jacks on the test set and adjusting the LOOP CUR control on the DATA-PHONE set.

(2) A check for 80V on the SEND loop should have been made at the S LOOP pin jack of the test set.

(3) A check and adjustment, if adjustment is necessary, of the loop current in both the SEND and RECEIVE loops should have been made at the LOOP SEND and LOOP REC jacks of the test set.

Note: These are not the same loops that were checked in (1) and (2) above. These are the loops between the DATA-PHONE set and the TTY equipment. The 43A1 unit feeds a polar relay on the RECEIVE loop and is fed by another polar relay on the SEND loop. These relays in turn feed or are fed by the loops between the DATA-PHONE set and the TTY equipment.

(4) The level of the 43A1 unit should have been adjusted by reading at the BRIDGE T and R pin jacks and adjusting the SEND LEVEL potentiometer on the 43A1 unit.

(5) The frequency of the 43A1 unit should have been adjusted per SD-70908-01, Section II, 8. ***It is imperative that the frequency of the unit be accurate to within 0.5 cycles of the assigned frequency.***

Note: There are many other tests the maintenance man can make locally without the aid of the STC. These tests are covered in standard instructions and will not be listed here. The above tests are necessary before the STC can perform any tests with the station.

Modem Bias and Frequency Checks

7.05 Since some of the following tests must be made with the STC, establish a connection to the testboard using the following procedure.

(1) Operate the TRANS CONTROL key to the STOP position.

(2) Insert in the transmitting head of the RT a prepared test tape which does not contain an EOM code, otherwise the format is unimportant.

(3) Operate the CTC key (nonlocking key located inside the 28A apparatus cabinet).

(4) Operate the TRANS CONTROL key to the SEND position.

(a) The dialing sequence should start and after the complete DDD number of the STC has been sent, the transmitter will stop and wait for an answer-back from the called station.

(b) When the DDD code is transmitted by the station, a lamp and audible signal should come on in the STC to signify the call and an automatic answer-back should be transmitted back to the originating station.

(c) Receipt of the answer-back disables the alarms and causes the pseudomnemonic code to be transmitted, after which the station waits for confirmation.

(d) The STC must now transmit the confirmation signal by plugging the TTY cord into the proper jack of the appropriate receive DATA-PHONE test set and sending the character 0 from the STC teletypewriter keyboard. The dialing sequence is now complete and the originating station should now transmit the test message.

7.06 Have the STC make a check of the frequency which was adjusted in 7.04(5) to assure that it is within limits.

Note: Since it will be inconvenient or impossible to communicate by teletypewriter in both directions with the STC, it is suggested that a regular telephone connection be established for the purpose of conducting the tests.

7.07 Have the STC send straight fox from the SEND TTY jack in the STC. Make a TMS reading at the REC TEST jack of the DATA-PHONE set and by means of the REC BIAS potentiometer of the 43A1 unit, adjust for zero bias. The total distortion of a single 43A1 link, after adjustment, should be no more than five points.

Distributor Contact and Spark Killer Adjustment

7.08 While sending a miscellaneous test tape from the transmitter portion of the RT, connect a 164C1 measuring set into the LT jack of the transmitter control circuit (CA-15023-SD) and proceed as follows.

(1) Take a bias measurement. If the bias measures two per cent or less, proceed to (3); if over two per cent, go to (2).

(2) Adjust the distributor contacts of the RT to give not over two per cent bias by adjusting the individual contacts while sending from the transmitting head long strings of BLANKS, Ts, Os, Ms, Vs, and LTRS characters.

(3) Adjust the spark killer on the SLR relay in the alarm and reader circuit in accordance with Note 110, CA-15022-SD, Sheet D1.

Modem Loopback

7.09 Without disconnecting the call already set up with the STC, loop the modem unit back to the STC. This may be done by operating the XMSN key inside the 28A apparatus cabinet. (May also be done by operating the T switch of the 166A1 test set.) Operation of either of these switches operates the T relay in the DATA-PHONE set and effectively arranges the 43A1 for back-to-back operation.

7.10 Have the STC take a TMS reading on the looped back straight fox. Proceed as follows.

(1) Adjust the P-1 potentiometer on the 154A1 DATA-PHONE set for a minimum bias reading by the STC. The total distortion of a single 43A1 link in this looped back condition should be no more than ten points after the adjustment is made.

(2) Restore the XMSN key to normal at the conclusion of the test.

(3) Send a message with an end-of-message code in it to terminate the connection to the STC.

Search for Start of Message and Data Transmission Test (Option "Z" Continuous Tape)

7.11 Prepare a test tape similar to that shown in Fig. 5 except in place of the mnemonics shown, insert in all the messages the mnemonic of the terminating station which is located nearest to the originating interchange station and number the message TEST MSG No. 1, etc. It is very likely that a terminating station would be located in the same or an adjacent room.

7.12 After asking the STC to monitor the transmission, insert the tape in the transmitting head of the reperforator-transmitter. Observe the following action.

(1) The circuit should step through the LTRS and BLANKS in the leader of the tape.

(2) When the first start of message is read the DDD number is sent.

(3) When answer-back is received from the translator, the pseudomnemonic code is sent and as soon as confirmation is received, the text of the first message is transmitted.

(4) The entire tape should be transmitted with the one DDD connection, at the end of which the station should go on-hook.

(5) Because of the manner of testing, when the tape runs out a TORN TAPE alarm will occur. Action should be as covered in 3.12 (1), (2), and (3).

7.13 Check with the STC to determine the presence of the following in the monitor copy.

(1) All LTRS and BLANKS before the first message, between messages or after the last message should be deleted.

(2) The pseudomnemonic which was generated by the control circuit should appear in the monitor tape ahead of the mnemonic code of the first message.

(3) Where a message ended in ↑ H ↑ in the test tape, this should be followed in the monitor tape by NNNN which was generated by the transmitter control circuit.

(4) No characters or functions in the test tape should have been deleted except the LTRS and BLANKS mentioned in (1). Have the STC note particularly that no CR or LF functions were deleted or garbled.

7.14 Restart the test tape prepared in 7.10 but send only the first message, stopping the tape in the LTRS and BLANKS between message No. 1 and message No. 2.

7.15 Have the STC check to see that the monitor tape agrees with 7.13 (1) and (2) and in (3) the ↑ H ↑ should be followed by >NNNN.

7.16 Check the copy received by the terminating station mentioned in 7.10. The first transmission should agree with 7.13 (1), (3), and (4). The second transmission should be the same except that in (3) the ↑ H ↑ should be followed by >NNNN.

Reperforator Trouble Alarm

7.17 With the power switch of the RT turned off, move the armature of the FSL relay to its spacing (5) contact. The resulting action should be as covered in 3.11 (1) through (4).

Message Interrupted Alarm

7.18 To perform this test it is necessary to send into the reperforator side of the RT. As the input to the RT may be a local outlet in or from an 81 switching center, an out station on

an 81C1 or D1 outgoing line, part of an 83B system or some other arrangement. It is impossible to describe exactly what steps may be necessary in order to send into the reperforator. It is suggested that if the line to the reperforator side of the RT goes through the STC it could be put into a TLT at the testboard and the copy sent from there. If the input is a local outlet in a switching center, the message could be coded to the particular local outlet and sent from an originating station in the switching center. If no other means seems feasible, a 100A test distributor may be plugged into the RECEIVE loop to the RT at the jackbox and signals sent from there.

7.19 Before sending into the reperforator, ground terminal 15 of the K1 relay with a short piece of wire having alligator clips on both ends; this will prevent a false lost connection alarm while making the test. Also block D1 and SE relays in the operated condition; this will enable the STC to be dialed without the disabling of all the alarms which would result if the CTC key were operated.

7.20 The copy sent is unimportant so long as it is something other than BLANKS or LTRS. Send a short message or a few repeated characters into the RT. Observe the following actions.

(1) The control circuit should see a start of message and dial up the STC. After receiving an automatic answer-back, the pseudo-mnemonic code will be sent, after which the control circuit will wait for confirmation which must be sent manually from a keyboard in the STC. On receipt of confirmation, the text of the message will be sent.

(2) When all of the tape has been transmitted from the RT, the circuit should wait up to 30 seconds for more tape to become available.

7.21 After 15 or 20 seconds, send a little more copy into the reperforator. Transmission from the RT should resume immediately.

7.22 Send more copy into the reperforator. When the last of the tape has been transmitted, the action should be as in 3.19 (1), (2) and (3). Refer also to the note under 3.17.

7.23 Unblock D1 and SE relays and remove the ground from 15 of the K1 relay.

TORN TAPE Alarm

7.24 Prepare circuit as covered in 7.19.

7.25 This is the same as covered in 3.12, 3.13, and 3.14 except the verification of the generation of >NNNN would have to be made from the STC monitor copy.

7.26 Restore circuit as covered in 7.23.

START FAILURE Alarm

7.27 Make tests as covered in 3.15.

DIAL FAILURE Alarm

7.28 The same as 3.16 except that in (1) a test tape may be inserted in the transmitting head of the RT.

CONNECTION LOST Alarm

7.29 Block D1 and SE relays in the operated position.

7.30 Insert a tape in the transmitting head of the RT. The action should be as covered in 7.20 except that since no circuit assurance pulses being returned from the STC, within the space of four or five characters after the receipt of confirmation, will cause the circuit assurance detector to time out and the resulting action should be as covered in 3.20 (1) through (3).

7.31 Unblock D1 and SE relays.

NO CONNECTION Alarm

7.32 Prepare the control circuit as covered in 7.29.

7.33 After cautioning the STC not to send a confirmation signal, insert a test tape in the transmitting head of the RT. The resulting action should be as covered in 3.21 (1) through (3).

7.34 Restore circuit as covered in 7.23.

LOW TAPE Alarm

7.35 Make tests as covered in 3.15.

TRANSMITTER CONTROL Key

7.36 Prepare the control circuit as covered in 7.19.

7.37 Insert a test tape in the transmitting head of the RT. The action should be as covered in 3.24 through 3.27.

TRANSMISSION Key

7.38 This key in effect was tested while performing 7.09 and 7.10.

CALL TELCO Key

7.39 Even though part of the functions of this key have already been tested, it should be tested completely as covered in 3.29 through 3.31 except that in 3.29 (1), the STC will answer the call.

RESET Key

7.40 After cautioning the STC not to send a confirmation signal, originate a call to the STC as covered in 3.29. The DDD number should be transmitted and answer-back received, but because of failure to receive confirmation, the call is not completed.

7.41 The remainder of the test is the same as covered in 3.32.

Search for Start of Message and Data Transmission Test (Option "Y," One Message at a Time)

7.42 The operation with Option "Y" for sending one message at a time is the same as with Option "Z" up to the point where either ↓ H ↓ or NNNN is read at the end of a message. Prepare and send a test tape as covered in 7.11 and 7.12. The action should be as covered in 7.12 (1), (2), (3) and (5). In place of (4) observe the following.

(1) As each end of message is read the station goes on-hook; each time a start of message is read, the translator is redialed, so that a separate connection is established for the transmission of each message.

7.43 Check with the STC to determine that the monitor copy agrees with 7.13 (1) through (4) except that in (2) the pseudomnemonic should appear in the monitor tape ahead of the mnemonic code of each message.

7.44 Check the copy received by the terminating station mentioned in 7.11. The copy should agree with 7.13 (1), (3), and (4).

Alarms with Option "Y"

7.45 With Option "Y" the alarms operate the same as with Option "Z", 7.09 through 7.18 except that in 7.11 the EOM code which was generated would be NNNN.

8. INSTALLATION TESTS—ORIGINATING INTERCHANGE FOR TORN TAPE OPERATION, ALARM, READER AND TRANSMITTER CONTROL CIRCUITS

8.01 ***The following tests of the originating interchange equipment for torn tape operation should be made at the time of installation.*** Drawing CA-15024-SD, Note 400A covers the wiring and interconnecting arrangements for the equipment units.

8.02 Refer to 7.02, 70.3, and 7.04. In 7.04 disregard reference to reperforator-transmitters.

Modem Bias and Frequency Checks

8.03 Since some of the following tests must be made with the STC, establish a connection to the testboard as follows.

(1) Operate the TRANS CONTROL key to the HOLD position.

(2) After moving the START-STOP lever of the transmitter to the STOP or FREE position, insert in the transmitter a prepared test tape which does not contain an EOM code; otherwise, the format is unimportant.

(3) Move the START-STOP lever to the RUN position.

(4) Operate the CTC key which is located on the inner left side of the table on which the transmitter is mounted.

(5) Operate the TRANS CONTROL key to the SEND position.

(6) The resulting action should be as in 7.05 (4) (a) through (d).

8.04 Have the STC make a check of the frequency which was adjusted per 7.04 (5) to assure that it is within limits. Refer to note under 7.06.

8.05 Make a TMS reading and adjust the bias of the 43A1 unit per 7.07.

Distributor Contact and Spark Killer Adjustment

8.06 While sending a miscellaneous test tape, connect a 164C1 measuring set into the LT jack of the control circuit (CA-15024-SD) and proceed as follows.

(1) Take a bias measurement. If the bias measures two per cent or less, proceed to (3); if over two per cent, go to (2).

(2) Adjust the distributor contacts of the transmitter-distributor to give not over two per cent bias by adjusting the individual contacts while transmitting long strings of BLANKS, Ts, Os, Ms, Vs and LTRS characters.

(3) Adjust the spark killer on the SLR relay in accordance with Note 107, CA-15024-SD.

Modem Loopback

8.07 Proceed as covered in 7.09 and 7.10. The XMSN key is mounted with the CTC key.

Search for Start of Message and Data Transmission Test (Options "T" and "X")

8.08 Prepare a test tape and perform the test as covered in 7.11 and 7.12 (1) through (4).

8.09 Have the monitor copy checked per 7.13 through 7.15.

8.10 Check the copy received by the terminating station mentioned in 8.08. It should agree with 7.13 (1), (3), and (4).

DIAL FAILURE Alarm

8.11 Test as covered in 3.16 except in (1) place the test tape in the transmitter-distributor after blocking the CT relay.

MESSAGE INTERRUPTED Alarm

8.12 Block the DI and SE relays and ground K1 relay as covered in 7.19.

8.13 Test as in 4.08 (1) through (3), referring also to 7.20 (1).

CONNECTION LOST Alarm

8.14 Test as covered in 7.29 through 7.31 except in 7.30 insert tape in the transmitter-distributor.

NO CONNECTION Alarm

8.15 Test as covered in 7.32 through 7.34.

TAPE TROUBLE Alarm

8.16 After preparing the control circuit as covered in 7.19 and after receiving confirmation from the STC, test as covered in 4.11 through 4.17.

TRANSMITTER CONTROL Key

8.17 After preparing the control circuit as covered in 7.19 and after receiving confirmation from the STC, test as covered in 4.18 through 4.20.

TRANSMISSION Key

8.18 This key was in effect tested while performing 8.07.

CALL TELCO Key

8.19 This key was in effect tested while performing 8.03.

RESET Key

8.20 Test as covered in 7.40 and 7.41.

Search for Start of Message and Data Transmission Test (Option "W")

8.21 Block the D1 and SE relays and ground K1 relay as covered in 7.19.

8.22 Prepare and send a test tape similar to that shown in Fig. 5. The action should be as covered in 7.20 (1).

8.23 Have the STC check the monitor copy. It should agree with items listed in 4.26.

9. INSTALLATION TESTS—TERMINATING INTERCHANGE CONTROL CIRCUIT

9.01 ***The following tests on the terminating interchange equipment control circuit should be made at the time of installation.*** Drawing CA-15021-SD, Note 401 covers the wiring and interconnecting arrangements for the equipment units. See also the block diagram shown as Note 302. Refer to 7.02 and 7.03 for additional information.

9.02 Make preliminary checks and adjustments of the 154A1 terminating DATA-PHONE set as in 7.04.

Modem Bias and Frequency Checks

9.03 Insert the 166A1 DATA-PHONE set between the terminating control circuit and the 154A1 DATA-PHONE set. All keys should be normal.

9.04 Have the STC dial in the station. Since the station is a slave of the No. 5 office, the connection will not time out but will stay up until the STC goes on-hook or sends an EOM code. Have the STC transmit manually that portion of the mnemonic that the station recognizes (the system designator followed by a space signal).

9.05 Have the STC make a check of the carrier frequency to assure that it is within 0.5 cycles of the assigned frequency. If this requirement is not met, recheck and adjust per standard instructions.

9.06 Have the STC send straight fox and proceed as follows. Make a TMS reading at the REC TEST jack of the DATA-PHONE set or the REC loop of the 166A1 test set and adjust the REC BIAS control of the 43A1 unit for zero bias. The total distortion of a single 43A1 link, after adjustment, should be no more than 5 points. Take a range on the reperforator unit and set range finder in center.

Modem Loopback

9.07 Arrange the 43A1 units for back-to-back operation by operating the XMSN key in the terminating TTY equipment or the T switch of the 166A1 test set.

9.08 Check and adjust the bias as covered in 7.10 (1) and (2).

9.09 Restore the key which was operated in 9.07.

Circuit Assurance Pulse Measurement

9.10 Have the STC send straight fox to the terminating station and place a monitor TTY to read the circuit assurance pulses being returned from the station. The monitor should print the letter O for each TTY character sent to the station.

9.11 If the monitor prints a character other than O, have the STC measure the pulse with a brush recorder or equivalent and adjust the universal contact mechanism to send a pulse length of as close to 50 milliseconds as possible. Refer to note under 5.03.

Data Transmission Test

9.12 Have the STC send test messages similar to those shown in Fig. 5. Examine the tape in the reperforator. It should be as in 5.03 (1) through (5). Disregard the note under (5).

TRANSMISSION Key

9.13 If the XMSN key was operated to perform 9.07, that test is sufficient. If the T switch was used to perform 9.07, operate the XMSN key and have the STC send straight fox and read the looped back signals at the STC.

BUSY OUT Key

9.14 After the STC sends NNNN to disconnect, the station operates the BUSY OUT key. The MADE BUSY lamp should light.

9.15 Have the STC attempt to dial the station, and the station should appear busy.

9.16 Restore the BUSY OUT key and then the MADE BUSY lamp should be extinguished.

9.17 Have the STC dial the station. The call should be completed normally.

Reperforator Trouble Test

9.18 Make test as covered in 5.09 (1) and (2), and 5.10 (1) and (2).

Low Tape Test

9.19 After having the STC send NNNN to disconnect the station, insert in the reperforator a roll of tape which has been depleted to the beginning of the red tracer in the tape.

9.20 Have the STC attempt to dial the station and proceed as follows. The call should be completed successfully and then have the STC send NNNN to disconnect the station.

9.21 Further deplete the paper supply until about 15 thicknesses of paper remain on the roll.

9.22 Have the STC again try to dial up the station. The station should appear busy to the STC.

9.23 Replenish the tape supply in the machine.

Tape Feed-Out Test

9.24 If the terminating TTY equipment is an ROTR check the tape for feedout as covered in 5.11, (1) and (2).

10. INSTALLATION TESTS — SEMI-AUTOMATIC 8-LEVEL TAPE PREPARATION — INTERCHANGE ENTRY AND MANUAL RE-ENTRY

10.01 ***As the tests of the 8-level tape preparation to be performed after installation do not differ from those made at the point of assembly, tests should be made as per Part 6.*** Adjustments and tests of the 28 ASR, Codomat, and originating DATA-PHONE set should be per standard instructions.

11. DEFINITIONS

11.01 Table of symbols and abbreviations used in this section is as follows.

SYMBOL	TTY FUNCTION
↟	Figures (FIGS)
↡	Letters (LTRS)
<	Carriage Return (CR)
>	Space
≡	Line Feed (LF)
≀	BLANK
SOM	Start-of-Message
EOM	End-of-Message
CDC	Call Directing Character

12. REFERENCES

12.01 The following lists references to Bell System Practices, drawings, CD sheets, etc., pertinent to the originating and terminating interchange arrangements for line switching systems.

AA286.040 — 83B Selective Calling Systems

AA286.047 — 154A1 DATA-PHONE Set

591-010-101 — 154A1 Originating DATA-PHONE Set

591-010-102 — 154A1 Terminating DATA-PHONE Set

591-010-500 — 166A1 DATA-PHONE Test Set

591-010-900 LL — Data-Line Switching Interchange Arrangements — Description and Operating Principles

CA-14069 — Automatic Interconnection of 83B System to Foreign System

CA-15021 — Data-Line Switching — Terminating Interchange Station

CA-15022 — Data-Line Switching — Originating Interchange for Continuous Tape Operation — Alarm and Reorder Circuits

CA-15023 — Data-Line Switching — Originating Interchange for Continuous Tape Operation — Transmitter Control Circuits

CA-15024 — Data-Line Switching — Originating Interchange for Torn Tape Operation

CA-15025 — Data-Line Switching — Semi-Automatic Tape Preparation Interchange Entry and Manual Re-entry and Control Unit

CA-15020-SD — Modification of 28 ROTR Set for Use with Terminating Station Control Circuit per CA-15021-SD

CA-15021-SD — Terminating Interchange Circuit

CA-15021-SD — Terminating Interchange Circuit

CA-15022-SD — Originating Interchange for Continuous Tape Operation, Alarm and Reorder Circuits

CA-15023-SD — Originating Interchange for Continuous Tape Operation, Transmitter Control Circuit

CA-15024-SD — Originating Interchange for Torn Tape Operation

EA-12901-ED, ST, T — 28A Apparatus Cabinet

EA-12917-ED, SD, T — Alarm and Reader

EA-14621-ED, SD, T — Electrical Service Unit for 28 Receiving Only Typing Reperforator (Rack Mounted)

WA-14419-ED, SD, T — Interconnection of 81-Type System using 28RT in 28A Apparatus Cabinet

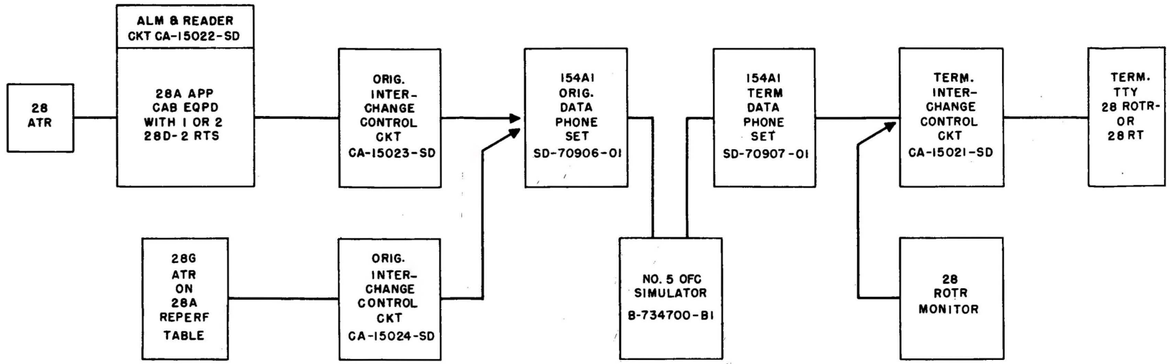


Fig. 1 — Test Setups at Point of Assembly

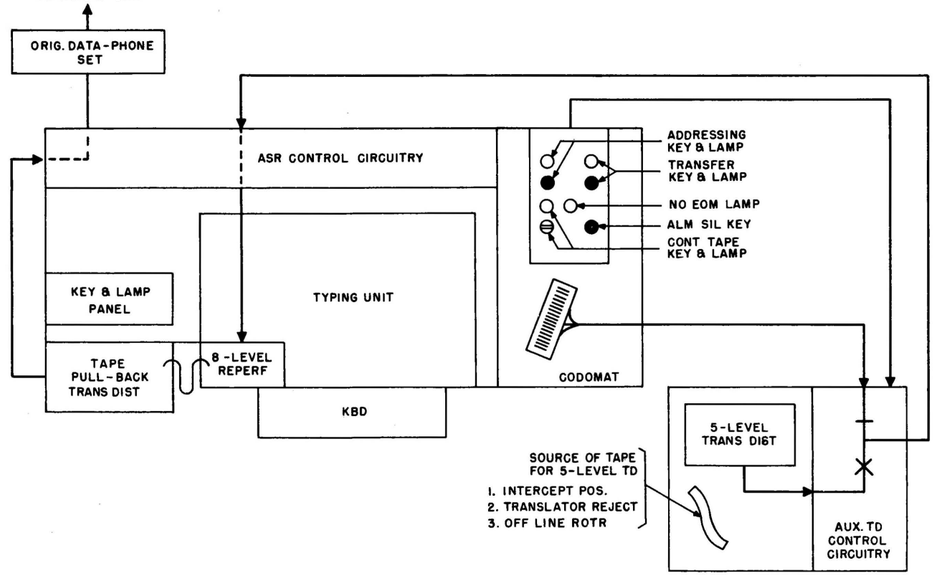


Fig. 2 — Intercept Servicing or Interchange Entry of 5-Level Tapes

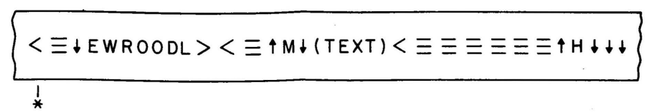
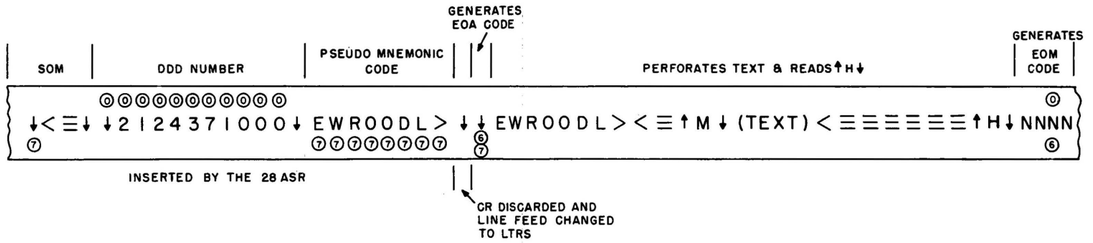


Fig. 3 — Typical Message as Received on TR (Assuming EOM Code of FIG H LTRS)



NOTES:

1. INSERT TAPE WITH < MARKED WITH * OVER SENSING PINS. EXACT POSITIONING NOT CRITICAL AHEAD OF < IF ANOTHER < OR ≡ IS NOT INCLUDED.
2. PRINTED SYMBOLS ARE USED TO REPRESENT PERFORATIONS.

Fig. 4 — Format of 8-Level Tape for Message

Fig. 1, 2, 3, and 4

FORMAT FOR ORIGINATING INTERCHANGE TEST TAPE

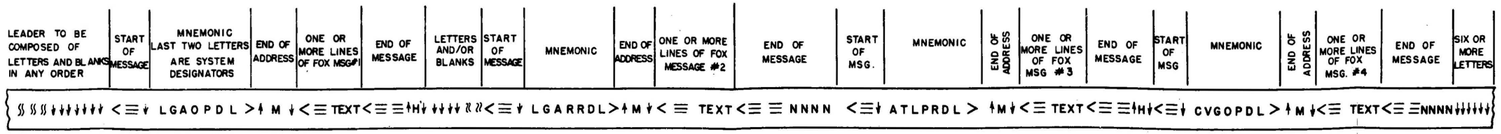
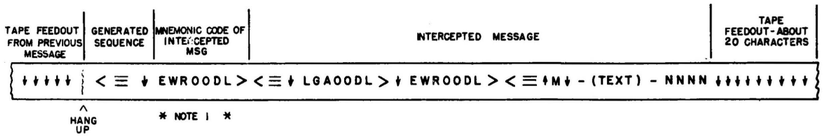


Fig. 5 — Format for Originating Interchange Test Tape

AUTOMATIC DELIVERY ATTEMPT UNSUCCESSFUL - NO ANSWER OR NO CONFIRMATION FROM STATION



NOTE 1 - TAPE INSERTED INTO 5-LEVEL T-D BETWEEN * * MARKS

Fig. 6 — Automatic Delivery Attempt Unsuccessful — No Answer or No Confirmation from Station

REPROCESSED INTERCEPTED MESSAGE FOR EWROODL

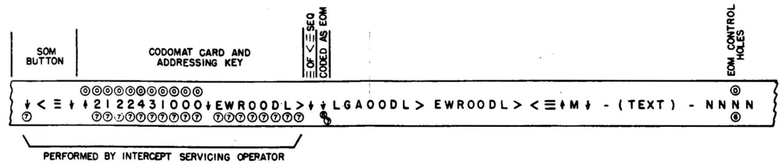


Fig. 7 — Reprocessed Intercepted Messages for EWROODL

AUTOMATIC DELIVERY ATTEMPT UNSUCCESSFUL - MESSAGE INTERCEPTED FOR BROADCAST CIRCUIT

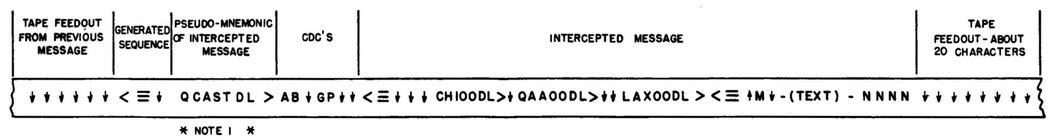


Fig. 8 — Automatic Delivery Attempt Unsuccessful — Message Intercepted for Broadcast Circuit

REPROCESSED INTERCEPTED MESSAGE FOR BROADCAST CIRCUIT

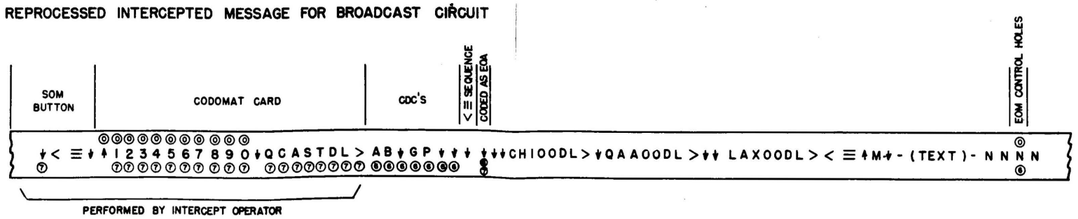


Fig. 9 — Reprocessed Intercepted Message for Broadcast Circuit

Fig. 5, 6, 7, 8, and 9

SPLICED-TAPE SEQUENCE OF THREE INTERCEPTED MESSAGES FOR SAME TERMINATING STATION- 5 LEVEL TAPE

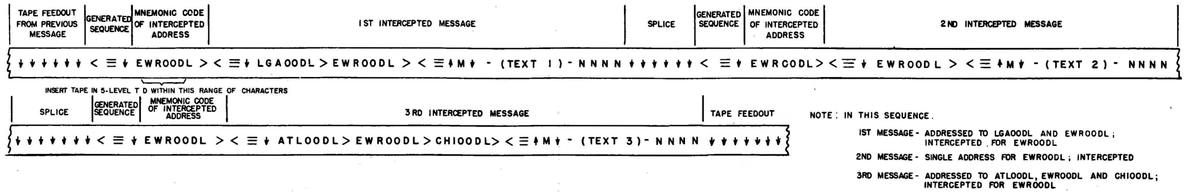


Fig. 10 — Spliced-Tape Sequence of Three Intercepted Messages for Same Terminating Station — 5-Level Tape

8-LEVEL TAPE FORMAT OF REPROCESSED SEQUENCE OF THREE MESSAGES FOR SAME TERMINATING STATION

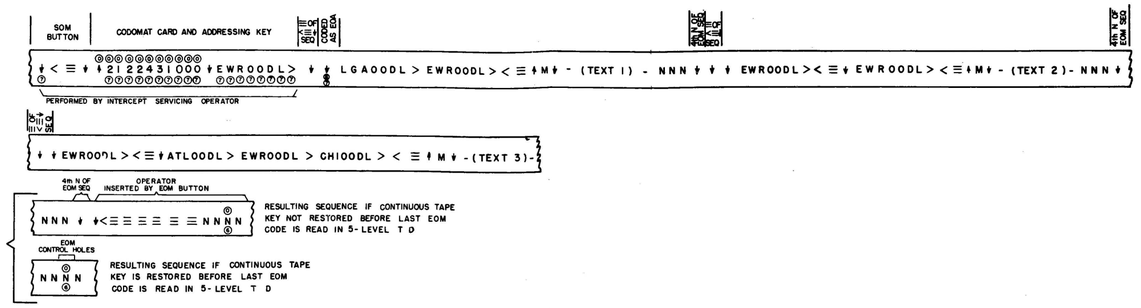


Fig. 11 — 8-Level Tape Format of Reprocessed Sequence of Three Messages for Same Terminating Station

SPLICED-TAPE SEQUENCE OF TWO INTERCEPTED MESSAGES FOR THE BROADCAST CIRCUIT - 5 LEVEL TAPE

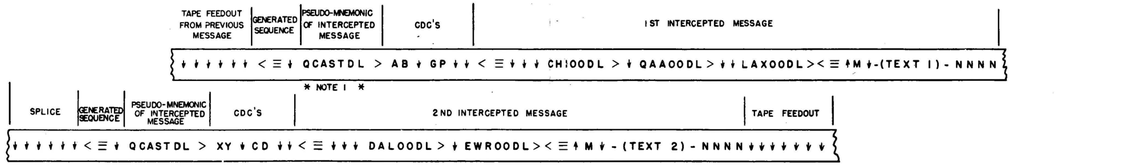


Fig. 12 — Spliced-Tape Sequence of Two Intercepted Messages for the Broadcast Circuit — 5-Level Tape

8-LEVEL TAPE FORMAT OF REPROCESSED SEQUENCE OF TWO MESSAGES FOR THE BROADCAST CIRCUIT

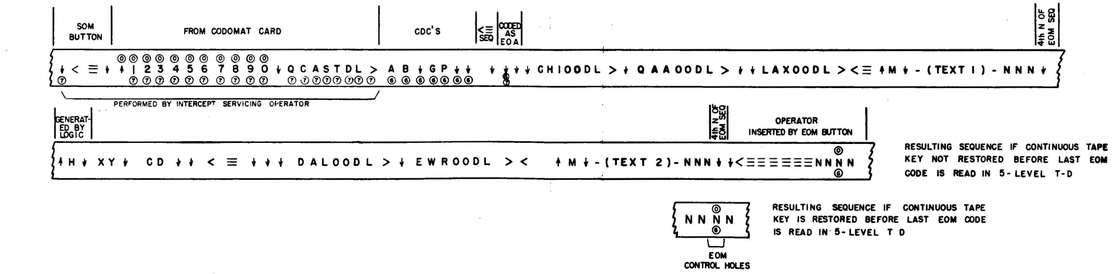


Fig. 13 — 8-Level Tape Format of Reprocessed Sequence of Two Messages for the Broadcast Circuit

Fig. 10, 11, 12, and 13