

ENGINEERING SPECIFICATION FOR
THE AUTOMATIC LINE SWITCHING
SYSTEM ORIGINATING AND
TERMINATING STATION TELETYPEWRITER
EQUIPMENT

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SECTION I

GENERAL DESCRIPTION AND ENGINEERING REQUIREMENTS

A. GENERAL DESCRIPTION

1. Function

- a. The Automatic Line Switching System Originating and Terminating Station Teletypewriter Equipment, in conjunction with Western Electric Data Set 154A1, is designed to accomplish message preparation and transmission on a point to point basis over line switching facilities.

2. General Arrangement and Appearance

- a. The originating station teletypewriter equipment is to be called a "Send Set".
- b. A send set consisting of the following components is mounted in the two cabinets listed
- (1) LAAC Teletypewriter Cabinet
 - (2) LP Page Printer
 - (3) LAK - LARP Keyboard Perforator
 - (4) LMU Motor Unit
 - (5) LFXB Transmitter Base
 - (6) LFXD Pull-Back Transmitter
 - (7) LESU Electrical Service Units
 - (8) 48 V. DC Power Supply
 - (9) Logic Relay Panels
 - (10) IBAC Apparatus Cabinet
 - (11) LR Codomat
 - (12) LCL Twenty-four-hour timer
 - (13) Main Distribution Panel
 - (14) Key and Lamp Panel Assembly
 - (15) Cable Assemblies
 - (16) Paper Winder (Optional)
- c. The terminating station teletypewriter is to be called a "receive set".
- d. The receive set, which is provided in either a single set cabinet or a triple set cabinet, consists of the following components:

- (1) LAC Teletypewriter Cabinet (single receive set)
- (2) LBAC Teletypewriter Cabinet (triple receive set)
- (3) LP Page Printer (one per receive set)
- (4) LB Page Printer Base (in LAC Cabinet only)
- (5) LMU Motor Unit (one per receive set)
- (6) 48V DC power supply
- (7) Key and lamp assemblies
- (8) Cable assemblies
- (9) LESU Electrical Service Unit
- (10) Paper Winder (Optional)

3. Basic Operating Principles

a. The send set performs two classes of operations.

(1) Tape preparation

- (a) Preparation of a message tape is done entirely off-line. The tape preparation operation and circuitry are independent of message processing operation and circuitry. Message tape may be prepared while the message processing circuitry is operating.
- (b) Tape preparation consists of punching start of message, address, end of address, text, and end of message into the tape with control holes necessary to the message processing operation. Start of message, end of address, and end of message functions are automatically perforated from the keyboard by a single depression of the SOM, EOA, and EOM keys respectively. The address may be perforated either automatically from the Codomat or manually from the keyboard. The text may be perforated automatically from the Codomat if cards are provided or manually from the keyboard. Control holes are perforated automatically and need only be selected during manual perforation of the address.
- (c) Tape preparation is blind and does not provide a monitor copy.
- (d) Eight level tape is used. The levels are numbered 0 through 7 and feed holes are perforated between the two and three levels. Five level 7.42 Baudot code perforated in tape levels 1 thru 5 is used for telephone numbers and information to be transmitted. The 0, 6, and 7 tape levels are used for control purposes during message processing.

(2) Message processing

- (a) Message processing requires that the operator insert a message tape into the transmitter and throw the transmitter stop-run lever to the "run" position. All further processing is automatic.

- (b) Due to present telephone facilities connection is made to one addressee at a time. The tape is pulled back for each new connection and transmission.
 - (c) After dialing an address is completed the transmitter will pierce the edge of the tape (eighth level) to indicate the attempt to call. Also, the transmitter will pierce the six level of the tape to indicate that confirmation from the correct station has been received. Thus the addresses which are called are marked and a completely processed tape having all addresses pierced in both the six and eight levels can be retransmitted only by utilizing a manual resend button.
 - (d) The station shall make repeated attempts to obtain a connection. When three attempts fail to obtain a connection the logic shall function automatically to attempt delivery to the intercept station.
 - (e) Five level, 7.42 Baudot code is transmitted at 100 wpm.
 - (f) A circuit assurance feature provides for a circuit assurance pulse to be received by the send set for each character transmitted to assure suitable line and connection conditions.
 - (g) A monitor copy shall be made for each message during transmission. The monitor copy will indicate each addressee connected.
 - (h) The send set supplies all dialing and message information to a Data Set 154A1 and receives all answer-back, confirmation, and circuit assurance pulses from the data set.
- b. The receive set performs the following operations.
- (1) Normal Message Receiving
 - (a) The receive set receives information being sent by the originating station from the originating Data Set 154A1 and the answer back, confirmation and circuit assurance pulses are sent back to the originating station through the receiving data set.
 - (b) Information received is printed out in copy suitable for use by the terminating station.
 - (c) A typing unit interchange option allows the receive set to have its message received on the typing unit of a local send set. Provision is made to make the receive set busy for replacement of paper or other work.

4. Classification

- a. Both the send and receive sets consist of parts, assemblies, and coded units which may or may not be assembled by the factory into complete packages.

B. ENGINEERING REQUIREMENTS

1. Originating Station Teletypewriter Equipment

a. Operational Features

(1) Message Tape Preparation

- (a) The originating teletypewriter station arrangement shall permit the addressing and preparation of messages in the form of perforated tape. Optional arrangements shall be provided for addressing messages either by means of a device employing a rotary file of perforated cards and an associated card reader or by means of the keyboard. The station design shall permit automatic insertion of the time of day and the originating station's identity. The clock shall be optional equipment which shall be omitted when the time of day feature is not required. Means of advancing over the positions of the time of day and station identity characters on their distributing mechanism or of strapping non-printing fill characters in their place shall be provided for use when these features are not required. Means shall be provided to rub-out tape punching errors, including those within the address portion of the message.

(2) Message Transmission

- (a) After messages are prepared the originating station equipment shall proceed in conjunction with the originating Data Set - 154A1 to establish connections and effect deliveries of the message to all addressees over the Direct Distance Dialing network without further operator attention except under special conditions. The system shall accommodate single or multiple address traffic on the basis of setting up a separate connection and transmitting the message to each of the destination stations involved in the address pattern, one at a time. In effecting delivery the station shall make repeated attempts to obtain a connection when required. When a reasonable number of attempts fail to obtain a connection to an addressee, the station shall function automatically to attempt delivery of the message over the DDD network to an intercept station. The message as delivered to the intercept station shall be in such a form that one automatic re-entry attempt can be made to deliver the message to the addressee before manual attention is required to service the message at the intercept location.

(3) Answer Back

- (a) The originating station shall obtain answer back when a connection is made to a terminating station. The identity of the station will be checked under Confirmation as indicated below.

(4) Confirmation and Circuit Assurance

- (a) The originating station shall obtain confirmation when connecting to a terminating station, (thus insuring connection to the correct terminating station), and during the course of message delivery shall obtain assurance from the terminating station indicating that signals are being received (thus insuring that a satisfactory connection is maintained for message transmission).

(5) Alarms

- (a) An alarm shall signal for operator attention in case the originating station cannot obtain the equivalent of dial tone, dialing or message transmission is interrupted, circuit assurance ceases from the terminating station, a reasonable number of attempts to reach intercept fail, tape is torn or remains snarled, tape does not have proper format or other similar conditions occur which require manual operation.

(6) Codomat

- (a) The optional addressing aid, which Teletype has named CODOMAT, shall facilitate perforating the DDD telephone number as well as the customer's address code for a station when a particular card is selected and pulled into the card reader. Insertions such as the telephone number and control perforations which are required for purposes of obtaining connections and handling of the tape shall not affect the message copy, which shall be delivered in the format specified by the airlines' "Report of ATA/IATA Working Group on Interline Message Format for Machine Processing in Automatic Reservations Systems."
- (b) The Codomat, a pivoted head card reader (LR1), is an optional accessory to the send set; and will be electrically connected to the send set through appropriate cables.
- (c) The Codomat shall provide means such that an operator having knowledge only of station mnemonic (memory-aiding) address codes will be able to perforate automatically into the tape the following types of information:

1. For a station reached directly over the switched network - the telephone number, the mnemonic code, required nontyping functions, and the necessary control perforations.
 2. For a station on the broadcast circuit, or on a system of another airline (such as an 8LD1 system) - The telephone number and psuedo-mnemonic code of the intermediate access location, the CDC and mnemonic code of the distant station, required non-typing functions, and the necessary control perforations.
- (d) The Codomat shall have a capacity of 1500 to 1750 code addresses.
- (e) Each Codomat card shall have its index information, usually a mnemonic code, on a visible tab. The index tab shall be suitably devised so as to accept typed, pen and ink, or other printed entries legibly. Also, the portion of the card between the perforating area and the tab, on the side facing an operator, shall be capable of accepting legibly typed, pen and ink, or printed entries (such as special operating instructions). The cards shall be obtainable in different colors to permit an easy differentiation among various classes of cards. The required address information shall be contained on the card in the form of eight level perforations.
- (f) In operation, the desired card will be selected, pulled down into a slot where the holes in the card will be read by a traveling sensing head and corresponding perforations will be made in eight level tape. The card will then be automatically flipped back into the rotary file.
- (g) The Codomat shall be capable of reading up to 22 characters from a single Codomat card, and shall send only the characters encoded on a card.
- (h) The Codomat shall be arranged so that cards can be added with ease.
- (i) Suitable Codomat card punching devices shall be provided to permit preparation of Codomat cards in either small or large quantities.
- (7) Transmitter and Tape Bins
- (a) The transmitter shall be coded LFXD.
 - (b) The transmitter shall be capable of:

1. Sensing eight levels and an additional marking or pierced level in the originating tape.
2. Piercing or otherwise marking the originating tape to record call attempt, whether successful or not.
3. Marking the originating tape by perforating a control level or other suitable means to record a confirmed call attempt.
4. Distributing five levels from the sensed originating tape.
5. Locking or clamping a forward feed wheel and feeding the tape from a rear feed wheel, in the vicinity of the sensing contacts, in order that tape may be diverted into a forward tape bin or storage loop for subsequent replay.
6. Pulling back the tape for replay so that the proper character is positioned over the sensing pins. The speed of pulling back the tape shall be as high as practicable; a rate of at least ten times the forward rate, or 50 feet per minute, is suggested. Tape replay for a multiple address message may have to take place a large number of times, say 15 or 20, or more in extreme cases. A fast forward tape advance, at a rate comparable to the pull back rate, shall be provided to advance a completely handled message out of the transmitter (from the forward bin or storage loop).

(c) The replay feature shall be capable of handling lengths of tape as follows:

1. Without a forward tape bin to contain the stored loop of tape of the message in process, a four foot message (eighty words) shall be handled.
2. With a forward tape bin to contain the stored loop of tape of the message in process, at minimum, a twenty foot message (four hundred words) shall be handled with a future ideal of handling a one hundred foot message (2000 words).

(d) Tape storage bins shall be provided as optional equipment to keep tape off the floor. The storage bins shall have capacities at least as great as follows:

Forward Bin - 20 feet
Rear Bin - 65 feet (to allow for more than one message)

The bins shall be designed so that the tape flows freely

into and out of them, either from the perforator or from the forward or reverse tape handling operations of the transmitter.

- (e) The transmitter shall be capable of being stopped and started as required by the station logic.
- (f) The transmitter shall be capable of driving relays that will translate the Baudot code (during outpulsing of a telephone number) into a one-out-of-ten number presentation to the Data Set 154A1 for each digit outpulsed.
- (g) The transmitter shall be capable of detecting either an end of tape or a taut tape condition.

(8) Monitor Printer

- (a) Home copy is required when sending in order that the addressee to whom a message is being delivered is readily determinable in case an interruption occurs. Two options shall be provided for obtaining home copy on multiple address messages. Under one option a complete home copy shall be obtained on the initial delivery while each succeeding delivery shall result in copying only the address code for the addressee. In the second option the typing unit shall receive complete copy for all transmissions of the message.

(9) Typing Unit Interchange

- (a) An optional arrangement shall be provided to permit substituting the typing unit of a send set for the typing unit of a receive set at the same location when the typing unit of the receive set is out of service due to trouble, for convenience, or for maintenance. The transmitter of the send set shall be made inoperative when the substitution is made since it could not print a monitor copy and the receive set copy simultaneously.

(10) Tape Handling

- (a) The send set shall be arranged to operate with "torn tape" - that is, the send set transmitter will accept a strip of tape perforated with just one or several messages.
- (b) The send set shall also be arranged to operate with continuous tape if feasible - the send set shall be arranged such that prepared message tape may be run directly from the perforator to the transmitter with the message tape to be stored in a loop if prepared

faster than the transmission or with the transmitter so arranged to operate under tight tape conditions if the message tape is prepared slower than the transmission.

(11) System Function Tests

- (a) Arrangements shall permit test calls to a telephone company service test center. These arrangements shall modify the station's normal operation as may be required for purposes of the test.
- (b) Arrangements shall provide for looping of the demodulator and modulator of the Data Set 154A1 of the send set, leaving the Teletypewriter receive loop connected to receive signals from the demodulator. This arrangement shall disconnect the teletypewriter send loops. Arrangements shall provide for customer operation of this loop back function under direction of the telephone company. The station shall be equipped with a bell to permit the test center to signal the customer when tests are completed.

(12) Transmission Speed

- (a) Transmission over lines shall be at 100 wpm.

b. Mechanical Requirements

(1) Desired Physical Characteristics

(a) Cabinets

- 1. Basically the originating station equipment will be housed in a Model 28 cabinet similar in appearance to an ASR cabinet (modified as necessary) and the Codomat cabinet which shall be newly designed since the Codomat is a new Teletype product. Mounted within the Codomat cabinet shall be accessory equipment to the originating station including the Codomat unit and a twenty-four-hour timer. These two cabinets, housing their respective apparatus, will be placed side by side. Equipment in the send set cabinet shall include the following:

- a. Keyboard
- b. Monitor page printer
- c. Tape perforator
- d. Transmitter
- e. Key and lamp panel
- f. Two electrical service units
- g. Main distribution panel

- h. Tape preparation panel
- i. Message processing panel
- j. Alarm panel
- k. Intercept panel
- l. Translator panel
- m. 48 volt DC power supply
- n. Motor unit

(b) Keys, Lamps, and Controls - All keys and lamps required for customer use in operating and supervising the station shall be mounted in the teletypewriter equipment.

1. Keys, lamps and controls not used in the preparation of tape are not to be associated with the keyboard.

a. Alarm Cut-off

(1) Two position key (locking) - This key shall disable the alarm buzzer.

b. Manual Re-send

(1) Key (nonlocking) - This key shall enable the operator to manually re-send the start of message portion of message tapes which have been completely or partially processed and are marked with pierces indicating completed transmission.

c. Reset

(1) Key (nonlocking) - Following an alarm condition, the operator shall correct the alarm conditions when necessary, remove the tape from the transmitter, and operate the Reset key to clear alarm circuits and extinguish alarm lamps. The Reset key shall restore the logic circuitry to normal. The Reset key may also be used to terminate a call to a telephone company serving test center or to any other location.

d. Call Telco

(1) Key (nonlocking) - This key will be used by the customer on test calls to the serving test center (STC). The Call Telco key shall condition the station logic to disable all timers (including circuit assurance) after receipt of answerback indication that a connection is established. It shall immediately disable the torn tape alarm, and connect the monitor typing unit to the

receive loop of the originating station. It shall also condition the circuitry to disable the unreached DDD number memory following confirmation in order that no attempt will be made to send to intercept when repeated attempts are required to reach the STC. The conditions as described shall be established by momentary operation of the Call Telco key and conditions shall be restored to normal by operation of the Reset key or by transmission of an end of message code. The Call Telco key shall be accessible to the operator but so located as to make inadvertent operation unlikely.

e. Normal, Stop For Priority, Hold, Monitor

(1) Four position key (locking) - This key shall control transmission in the following manner:

- (a) Normal - Normal sending station operation. The regular transmitter stop-run key will be used when it is desired to start or stop the transmitter. Using the stop-run key the operator may stop the transmitter in any phase of its operation.
- (b) Stop For Priority - Stop sending after current delivery, if in progress.
- (c) Hold - Stop sending after all deliveries of the message being currently handled.
- (d) Monitor - The transmitter reads the tape and the message is printed by the originating station monitor printer as long as the Reset key is held down. This allows reading of a questionable tape without on line transmission. No piercing or otherwise destructive marking will be made on the tape. Only the five intelligence levels will be read.

f. Transmitter Stop-Run Switch - The regular transmitter stop-run switch will be used when it is desired to start or stop the transmitter.

g. XMSN Test

(1) Key (locking) - This key shall operate a relay in the Data Set 154A1 to

connect the demodulator and the modulator of the data set back-to-back for transmission tests by the telephone company. This key is used only under the direction of the telephone company and shall be accessible to the operator but so located as to make inadvertent operation unlikely.

h. Timer Disable

- (1) Key (locking) - This key shall disable timers for maintenance tests of station operation. It shall be inaccessible to the operator.

i. XMTR Step

- (1) Key (nonlocking) - This key shall permit stepping the transmitter one character at a time during maintenance tests of station operation. It shall be inaccessible to the operator.

j. Clock-Setting Controls

- (1) Part of the Clock - These controls shall be recessed or otherwise protected from inadvertent operation.

k. Torn Tape

- (1) White lamp - This lamp shall light in the on-hook condition when in torn tape operation the end of tape is reached. Under this condition no audible alarm shall be given. Operation of the transmitter stop-run switch to the "stop" position shall extinguish the lamp. This lamp shall light in the off-hook condition if the tape-out pin senses a tear in the tape. (In this case an audible alarm shall be given and the Tape Check lamp shall also light).

l. Tape Check

- (1) Red lamp - This lamp shall light if the format sequence is not valid whether because of an error in tape preparation, an error in loading the transmitter, or because a tear in the tape prevented the message from being handled in its entirety. (An audible alarm shall also be given).

m. Dialing Failure

- (1) Red lamp - An 11-second timer shall start timing when the station goes off-hook. It shall be recycled for each digit and for each character of the mnemonic code transmitted before confirmation and shall be disabled following confirmation. (The timer operation shall be effective on calls to intercept as well as on calls to regular terminating stations.) Time-out occurs on failure to receive answerback or confirmation but no alarm indication is made. On completion of time-out the set resumes the processing of the message tape. The Dialing Failure lamp shall be lighted and the audible alarm sounded if time out occurs after going off-hook and prior to completion of outpulsing of a telephone number or if time out occurs during transmission of a mnemonic.

n. Message Interrupted

- (1) Red lamp - The message interrupted lamp shall light if the 45-second timer circuit times out as a result of the transmitter stopping for tangled tape or any other reason. (An audible alarm shall also be given). The 45-second timer shall be recycled if transmission is resumed before time-out occurs.

o. Connection Lost

- (1) Red lamp - This lamp shall light if circuit assurance is not received from the terminating station or if the line connection is lost. (An audible alarm shall also be given).

p. Intercept Not Reached

- (1) Red lamp - This lamp shall light when six attempts to reach intercept fail. (An audible alarm shall also be given).

2. Pushbutton Keys connected with Tape Preparation which cause insertion of a complete sequence including control holes and which shall be closely associated with the keyboard:

- a. SOM - Start of Message key. Depression of the SOM key shall cause the start of message function

to be perforated into the tape. The SOM function shall conform to the IATA format and include the control perforations for system operation.

- b. EOA - End of Address key. Depression of the EOA key shall cause the end of address function to be perforated into the tape. The EOA function shall conform to the IATA format and shall include control perforations for system operation. The end of address function shall also include the optional features of time of tape preparation and the mnemonic identifying code of the sending station. Means shall be provided to advance over or strap non-printing fill characters into the positions filled by the time of day and station identity where these optional features are not required.
 - c. EOM - End of Message key. Depression of the EOM key shall cause the end of message function to be perforated into the tape. The EOM function shall conform to the IATA format and shall include control perforations for system operation.
3. Other keys required for tape preparation which should be closely associated with the keyboard:
- a. FEED OUT - Tape feed-out key. Depression of the FEED OUT key shall cause the tape to be fed out with no perforated code holes as long as the key is held depressed.
 - b. RUB OUT - Error correction key for use where code or control level perforations are involved. Operation of the RUB OUT key causes perforation of all levels in the tape. The RUB OUT key is used in conjunction with the BACK SPACE key to correct errors when perforating tape from the keyboard. It is satisfactory for the send set design to require the rubout of an entire item when an error is corrected; for example, rubout of the DDD number and the mnemonic code to correct a perforating error in the mnemonic code.
4. Keys which cause insertion of control holes with signal holes inserted from the keyboard. The use of these keys is infrequent and they should not be too closely associated with the keyboard:
- a. LOCAL AREA - Key to permit insertion of a DDD number from the keyboard for a receiving set within the same DDD area as the send set. This key shall condition the send set to insert the zero control code with "figures" and the ten digits of the DDD number and the seven control code with the last seven digits of the DDD number as it is perforated from the keyboard.

- b. DISTANT AREA - Key to permit insertion of a DDD number from the keyboard for a receiving set not in the same DDD area as the send set. This key shall condition the send set to insert the zero control code with "figures" and the ten digits of the DDD number and the seven control code with all ten digits of the DDD number as it is perforated from the keyboard.
 - c. CDC - Key to permit perforation of a CDC (Call Directing Code) from the keyboard. This key shall condition the send set to perforate the 6 control code level with each character of the CDC and "letters" as the CDC is perforated from the keyboard.
 - d. PSMN - Key to permit perforation of a psuedo-mnemonic code from the keyboard. This key shall condition the send set to perforate the seven control code level with each of the seven characters of the psuedo-mnemonic and "space" as the psuedo-mnemonic is perforated from the keyboard.
- (c) Separation of Data Set 154A1 from the send set.
- 1. The station design shall permit a reasonable separation between the Data Set and the Teletype-writer. Separation must be such that cable lengths do not exceed 200 feet. The connection between the Data Set and the Teletypewriter equipment shall be by means of a separable connector to permit insertion of a suitable testing device.
- (d) Name plate
- 1. Space shall be allotted as necessary for Teletype, patent and serial number name plates.
- (e) Mechanical Features of Relay Panels
- 1. The equipment to be located in the lower portion of the send set cabinet (five relay panels and a DC power supply) shall be designed such that they are removable from the front of the cabinet and can be removed to a point just in front of the keyboard without being disconnected or in any way preventing normal operation. Cables facilitating the above requirement shall be guided such that they return to a set position upon reinsertion of the panel. The cabling will be prevented from running up against relays, stepping switches or other equipment which might be harmed by the pressure of the cables.
 - 2. The five above mentioned relay panels shall be separate entities. Their exterior cables shall be terminated by

locking type connectors thus making installation of a respective panel into a cabinet a relatively simple operation.

(2) Environmental Conditions

- (a) The Automatic Line Switching System send set and Data Set 154A1 shall be designed to operate under all normal and extreme office conditions including those peculiar to areas at or nearby airport locations.
- (b) Per standard Teletype practice, all parts shall be free from corrosion and suitably plated, coated, or otherwise protected from corrosion since application of the system could take it to various types of above normal corrosive atmospheres.

(3) Shipment Capabilities

- (a) All apparatus shall be capable of withstanding the rigors of commercial shipment and storage.
- (b) Care shall be taken in design to make the assembled send set capable of withstanding the normal rigors of commercial shipment and storage. Similar care shall be taken in designing the Codomat cabinet and equipment. In both cases it may be necessary to remove certain apparatus for special handling.

(4) Lubrication Data

- (a) All originating station apparatus requiring lubrication shall have relubrication periods compatible to standard servicing periods.

c. Electrical Requirements

(1) Input Power

- (a) The originating station equipment shall run on nominal 115 volt, 60 cycle power. Rectifiers shall be included where necessary within the equipment and shall operate on the 115 volt, 60 cycle input.
- (b) All input power to the originating station teletypewriter equipment shall be brought into a send set electrical service unit from which it will be distributed to the various station components.
- (c) All input power to the send set components shall be fused.
- (d) A convenience outlet shall be provided for servicing use.

- (e) Acceptable input voltage values shall be $\pm 10\%$ of the nominal value.
- (f) A distribution panel shall be included in the send set cabinet to facilitate interconnection of components.
- (g) The send and receive loop currents of .020 amperes between a send set and Data Set 154A1 will be supplied by the Data Sets.
- (h) The Data Set 154A1 will be furnished 48 V.D.C. power by the send set.

2. Terminating Station Teletypewriter Equipment

a. Operational Features

(1) Message Reception

- (a) The terminating teletypewriter station arrangement shall, in conjunction with the terminating Data Set 154A1 permit the reception of messages over the Direct Distant Dialing network. The station shall operate without operator attention except under special conditions (such as replacement of paper).
- (b) The receive set shall operate at 100 wpm.

(2) Answer Back, Confirmation and Circuit Assurance

- (a) When the receive set goes off hook it shall send a continuous answer back signal to the send set.
- (b) The receive set shall return a confirmation signal on receipt of its mnemonic code.
- (c) Following confirmation, the receive set will send discrete circuit assurance pulses to the originating station send set as long as signals are being received.

(3) Typing Unit Interchange

- (a) An optional arrangement shall be provided to permit substituting the typing unit of one send set for the typing unit of one receive set at the same location when the typing unit of the receive set is out of service due to trouble or for maintenance.

(4) Operator Signal

- (a) The receive set teletypewriter shall be equipped with a bell to be used in calling the attention of an operator to a special message - such as for a high priority message or for a message from the Service Test Center (STC).

(5) Busy

- (a) Arrangements shall provide for making the station busy to incoming calls when the machine is out of service. This feature shall be automatic when power is removed from the station or when the machine is out of paper or forms. Where the machine arrangement consists of a sequence selector controlling a teletypewriter, low tape or low paper in the controlled machine shall make the station busy. The busy feature shall permit the operator to manually make the station busy while changing paper or when the station has trouble.

(6) Functions of Terminating Station Logic

- (a) The receive set shall respond to an incoming call signal from the Data Set 154A1 by indicating readiness to receive the call with answer back. This signal must be sent continuously as long as the receive set is off-hook.
- (b) The receive set shall copy all signals in the receive loop until receipt of the end-of-message sequence, NNNN, following which the machine shall go on-hook until another message is received.
- (c) The receive set shall, in response to its mnemonic code return a confirmation signal to the originating station.
- (d) Following confirmation, the receive set shall return circuit assurance signals for each character received thereafter.
- (e) The receive set shall return to the idle condition upon a signal from the Data Set 154A1 or as an end-of-message code is received. In returning to the idle condition the receive set shall be on-hook until called again. The receive set will be blinded while on-hook.
- (f) Confirmation signal - The form of the confirmation signal shall be a momentary, spacing signal in the send loop such as might be generated by momentary operation of a stunt box contact.
- (g) Circuit assurance - The circuit assurance signals shall consist of a nominal .050 second spacing signal in the send loop which shall be returned for each character received following confirmation.
- (h) Alarms - No alarms shall be provided as part of the regular receive set.

(7) Test Calls from Telephone Company Service Test Center

- (a) Telephone Company Serving Test Centers (STC) will have occasion to make test calls to terminating stations. During these test calls communication with the customer will be by telephone or by means of the customer's originating station equipment. Under direction of the STC the customer will operate the XMSN TEST key to permit a test of round-trip transmission from the test center to the station and back to the test center. The typing unit will copy signals sent by the test center during the test. After checking transmission the test center will notify the operator to restore the XMSN test key to normal.

b. Mechanical Requirements - Receive Set

(1) Desired Physical Characteristics

- (a) Cabinets - Two types of cabinets will be used for receive sets for the Automatic Line Switching system. One will be a single unit model 28 receive only cabinet, and the other shall be especially designed to house three separate receiving units. It shall also be capable of housing receive units of other systems now in operation.
- (b) Station Design - The terminating station design shall permit any of the following machine arrangements at a terminating station.
1. A receiving only page printer.
 2. A receiving only page printer with an extension receiving only typing reperforator or reperforator-transmitter which copies the entire message along with the primary machine.
 3. A receiving only page printer with an extension receiving only page printer or an extension receiving only typing reperforator or reperforator-transmitter which copies a portion of the message under control of the primary machine.
 4. A sequence selector with a receiving only page printer or a receiving only typing reperforator or reperforator-transmitter which copies signals under control of the sequence selector. Circuit assurance, if obtained from the sequence selector, shall be withheld if power is removed from the motor of the controlled teletypewriter.
- (c) Separation between receive set and Data Set 154A1 - The station design shall permit a separation between the receive set (the teletypewriter along with its logic equipment) and the Data Set 154A1 such that cable lengths do not exceed 200 feet. The connection shall be made with separable connectors.

(d) Keys and Lamps - All keys and lamps for customer use shall be mounted in the teletypewriter equipment.

1. BUSY key (locking) - This key shall make the station busy to any subsequent calls. When operated while the station is off-hook it shall make the station busy when the station next goes on-hook.
2. XMSN TEST key (locking) - This key shall operate a relay in the Data Set 154A1 to connect the demodulator and modulator of the data set back-to-back for transmission tests by the telephone company. This key shall only be used under the direction of the Telephone Company and shall be accessible but so located as to make inadvertent operation unlikely.
3. BUSY lamp - This lamp shall light when the BUSY key is operated, provided the station is on-hook or when it becomes on-hook. The lamp will serve as an indication that the station has been made busy. This lamp is required primarily to avoid a situation which could occur when the BUSY key is operated immediately after a connection has been made to the receive set but before transmission has begun. Under this condition the terminating station could begin to receive copy after the operator has supposed it made busy. The BUSY lamp will have an auxiliary function in serving as a guard lamp when the station is made busy.

(e) Standard Components

1. To the extent possible components should be of Western Electric manufacture (or manufactured according to KS Specifications) to facilitate maintenance of the equipment.

(f) Nameplates

1. Space shall be allotted as necessary for Teletype, patent, and serial number nameplates.

(g) Environmental Conditions

1. The Automatic Line Switching System receive set Data Set 154A1 shall be designed to operate under all normal and extreme office conditions including those peculiar to areas at or nearby airport locations.
2. According to standard Teletype practice all parts shall be free from corrosion and suitable plated, coated, or otherwise protected from corrosion since

application of the system could take it to various types of above normal corrosive atmospheres.

(h) Shipment Capabilities

1. All apparatus including the receive set assembled as a unit shall be capable of withstanding the rigors of commercial shipment and storage.

(i) Lubrication Data

1. All terminating station apparatus requiring lubrication shall have relubrication periods compatible to standard field servicing periods.

c. Electrical Requirements

(1) Input Power

- (a) The terminating station equipment shall run on nominal 115 volt, 60 cycle power. Rectifiers shall be included where necessary within the equipment and shall operate on the 115 volt 60 cycle input power.
- (b) All input power to receive set components shall be fused.
- (c) A convenience outlet shall be provided for servicing use.
- (d) Acceptable input voltage values shall be $\pm 10\%$ of the nominal value.
- (e) While the Data Set 154A1 will obtain its AC power from customer outlets, the receive set shall supply 48 volts DC to be used by the terminating station data set.
- (f) The send and receive loop currents of 0.20 ampere will be supplied by the Data Set 154A1.

SECTION II

DETAILED DESCRIPTION AND THEORY OF OPERATION

A. DETAILED DESCRIPTION

1. General

- a. The Automatic Line Switching System is a teletypewriter communication network in which telephone switching facilities are employed to make connections between sending and receiving points.
- b. Separate sending (originating) and receiving (terminating) stations are provided. Each station consists of two units - a Teletype Send or Receive Set and a Data Set - 154A1. A message to be transmitted is first manually perforated in tape at a Sending Station. The sending equipment, through telephone dialing facilities, automatically makes connection with a Receiving Station, transmits the message, and terminates the connection. The Receiving Station need not be attended.
- c. A detailed description of each component used in the Automatic Line Switching System send and receive sets is given in the individual bulletin and specification covering the component. These publications are listed in Table II-1.

2. Features

- a. Connections between individual Sending and Receiving Stations are made in much the same manner as with voice telephone calls. Direct Distance Dialing (DDD) numbers are used in making these connections through a modified No. 5 Crossbar Office. Associated with each DDD number is a mnemonic (memory-aiding) code. These codes are used as station identifiers and consist of seven letters followed by a space. The DDD number and the mnemonic code make up the address of a station. A special unit, the Codomat, permits the address to be automatically placed in the tape from a card that has been manually chosen and placed in a reader.
- b. A message may be sent to a number of addresses from the same perforated tape. This is accomplished by a pull-back feature which automatically pulls the tape back and permits it to be re-read as successive called stations are reached. A confirmation feature assures the Sending Station that it has reached the proper Receiving Station, and a circuit-assurance feature keeps it informed that the Receiving Station is getting copy.
- c. Once the message to be transmitted has been manually perforated in tape, the automatic action of the equipment closely parallels a person making a telephone call. The send equipment requests a dialing connection from data set (person takes telephone

off hook). Reading from the tape, the equipment sends the dialing number to the telephone office one digit at a time (person dials number). Equipment receives answer-back (called party says, "Hello"). Equipment sends mnemonic code (person inquires if he has reached the correct party). Called equipment sends confirmation signal (called party says, "Yes"). Equipment reads and transmits called equipment's mnemonic and text of message (person verbally conveys information). Called equipment assures sending equipment that it is receiving the message (called party intermittently answers). Equipment signals that message is complete and disconnects (person says, "Good-bye," and puts telephone on hook). Receiving equipment disconnects (called party puts telephone on hook).

- d. If there is no answer within a specified time after a call has been originated, the Sending Station releases itself and tries again. It makes three attempts, and then automatically sends its message to "Intercept", an arrangement provided at a Message Center (not covered in this specification). At Intercept, an additional automatic attempt is made to complete the call. If this attempt is unsuccessful, an operator takes over. Visual and audible alarms are provided at the stations to indicate various troubles, such as dialing failure, connection lost, incorrect tape format, etc.

3. Code

- a. Message information is conveyed in the system by a five-level binary code. It occurs electrically at the Stations as multi-wire (parallel) or single-wire (start-stop) d.c. signals and on the telephone transmission facilities as tone-frequency signals. This information is recorded as code holes in tape and as printed characters. Transmission speed is 100 WPM.
- b. The processing of messages is controlled by the message tape which has eight levels. Five levels are devoted to the code described above. Permutations of the other three levels are used as control functions to tell the equipment to go "on or off hook", start or stop reading tape, etc. In addition, a pierce is placed in the edge of the tape for control purposes. In effect, this constitutes a ninth level.

4. Sending Station (Also Referred to as Originating Station)

a. General

- (1) The Sending Station provides facilities for tape preparation and message processing. Tape preparation consists of perforating the control, address, and message information in tape. Message processing involves the automatic operations associated with sending the message to the proper station including dialing, recognizing answer-back, sending mnemonic, recognizing confirmation etc. The Sending Station consists of a Teletype Send Set and A Data Set 154A1.

b. Send Set

- (1) The sending station teletypewriter equipment will be referred to as a "send set". The send set incorporates the electromechanical units and logic circuitry needed for tape preparation and message processing. Tape preparation is performed "off line" by an operator. Message processing is performed automatically in conjunction with the Data Set 154A1 which couples the send set to the telephone carrier and switching facilities. A monitor printer provides a local page copy of the outgoing messages. The major apparatus in the send set is housed in a Model 28 cabinet commonly referred to as an ASR cabinet. An addressing aid, the Codomat, and the clock, used to insert time of day into each message, are housed in a specially designed cabinet. This accessory equipment is included under the term send set. The send set components are listed in Table II-2 and are described below.
- (2) Keyboard (LAK20) - In conjunction with the Perforator, Codomat, Clock and logic circuitry, the keyboard provides the means whereby an operator prepares tape for eventual message transmission. It converts the selective depression of its keys into multi-wire code signals which are used by the perforator to punch intelligence and control holes in the tape. It also serves as a base for the typing unit, perforator and motor unit. It is similar to the basic ASR keyboard described in Bulletin 249B, but differs as follows. Auxiliary and code reading contacts are used to code the perforator's selector magnets. Special keys and push buttons aid the operator in tape preparation. The keys are labeled FEED OUT, SOM, EOA, EOM and RUB OUT. The push buttons are located to the right of the keys and are illuminated when operated. They are labeled LOCAL AREA, DISTANT AREA, PSMN, and CDC. The use of these keys and buttons is described below. A signal generator is inoperative, but is left in place for possible future application.
- (3) Perforator (Multi-Magnet Reperforator - LARPS01) - Under the control of the keyboard, Codomat and logic circuitry tape is prepared in the eight-level perforator for use in transmission. The perforator converts multi-wire code signals received from the other components into mechanical motions that perforate the intelligence and control holes in the tape. For description and principles of operation, see Specification 60048S.
- (4) Transmitter Distributor (LFXD) and Base (LFXB) - The transmitter distributor (TD) reads the tape and supplies the information in electrical form to the logic circuitry, the monitor printer and the Data Set 154A1. It includes a reader and a distributor. The reader senses the code holes in tape and converts them into multi-wire signals

which it supplies to the distributor and logic circuitry. The distributor converts the five-wire intelligence signals into single-wire start-stop signals which are applied to the monitor and to the data set. The LFXD is similar to the LBXD (see Bulletin 242B), but has provisions for reading eight levels, has pull-back and runout features, has a tape piercing arrangement, and has special auxiliary and tight-tape contacts. It is mounted on a base which is, in turn, mounted in the send set cabinet. For description and principle of operation, see Specification 60079S.

- (5) Typing Unit (LP) - Under the control of the logic circuitry, the Typing Unit monitors certain information transmitted by the TD so that a local copy is available. It converts the start-stop signals produced by the TD into mechanical motions which print the information on page copy. For description and principles of operation, see Bulletin 216B.
- (6) Electrical Service Units (LESU56 and 57) - Two electrical service units (LESU56 and LESU57) are mounted in the send set cabinet. The LESU56 serves as a point of convergence for all a.c. wiring from various components of a Sending Station. Its description and principles of operation are contained in Specification 60168S. The LESU57 serves as the link between the local loop of a Sending Station and the external loop of which the Data Set 154A1 is the access point. For its description and principles of operation, see Specification 60181S. The Electrical Service Units are mounted under the dome lid of the send set cabinet.
- (7) Line Relay (RY30) - Two line relays are mounted on the LESU57. One receives circuit assurance signals from the receiving station during transmission. The other serves as a link between the Send Set and the external line for transmission purposes. For description, see Bulletin 120B.
- (8) Motor Unit (LMU12) - The motor unit through various drive parts provides mechanical motion for the keyboard, the typing unit and the transmitter distributor. For its description, see Bulletin 249B.
- (9) Circuit Panels
 - (a) General - A number of circuit panels accommodate the logic and control circuits associated with the send set. The five panels described below incorporate most of the logic circuitry. These are mounted in the lower portion of the send set cabinet. The electrical components including relays, stepping switches, diodes, resistors, capacitors, etc. are mounted on a frame and are enclosed by front and rear covers.

- (b) Tape Preparation Panel (145100) - Contains logic circuitry associated with the preparation of tape. For component layout, see 4241WD-W1 of Detached Schematics. The following relays are included: blank reset (BRR), start of message (SMR), local area (LAR), pseudomnemonic (PMR), figures (FGR), codomat (CMR), rub out (ROR), reset (RSR), end of message (EMR), distant area (DAR), call directing code (CDR), CDC Reset (CRR), end of address (EAR), and rub out release (RRR). The following stepping switches are included: start and end of message (SESS), control (punch) circuit (CCSS), and end of address (EASS). This panel is covered in 4241WD of the Detached Schematics.
- (c) Message Processing Panel (145050) - Contains logic circuitry associated with the processing of messages. For component layout, see 4240WD-W1. The following relays are included: permutation seven (P7R), permutation none (PNR), pull back B (PBRB), timer reset (TRR), permutation six and seven (P67R), permutation 3 (P3R), pull back A (PBRA), serving test center (STC), permutation zero seven 2 (P07R2), line blind (LBR), pull forward (PFR), torn tape (TOTR), permutation zero and seven 1 (P07R1), memory EOM (MER), upper notch memory (UNMR), unsent DDD number (UDR), permutation zero six 8 (P068R), monitor blind (MBR), tape clamp (TCR), confirmation (CFR), permutation zero 6 (P06R), transmitter off-hook (TOHR), translator shift (TSR), answer back (ABR), permutation zero (P0R), transmitter off-hook A (TOHA), on-hook (ONHR), line shunt (LSR), line unblind B (LURB), line unblind (LUR), and four spare positions. Also included are the following: A lower notch stepping switch (LNSS), six cables, a timer disable key which prevents alarms during testing, and a step key for stepping the Transmitter Distributor one character at a time during tests. The cover must be removed to operate the keys. This panel is covered in 4240WD of the Detached Schematics.
- (d) Translator Panel (145225) - Contains logic circuitry associated with the translating of DDD numbers from five wire electrical signals to one-out-of-ten form. For component layout, see 4240WD-W13 in the Detached Schematics. The following relays are included: recognition zero (R0), recognition six, (R6), recognition six auxiliary (R6A), recognition seven (R7), recognition eight A (R8A), recognition eight B (R8B), numbering relays 1 through 5 (NR1 through NR5), tight tape (TTR), and two spare positions. This panel is covered in 4240WD of the Detached Schematics.
- (e) Alarm Panel (145250) - Contains the logic circuitry associated with activating the station alarm buzzer and the individual alarm lamps on the key and lamp panel.

For component layout, see 4240WD-W10 in the Detached Schematics. The following relays are included: Circuit assurance (CAR), reset (RES), station alarm A (SALA), station alarm B (SALB), timer A (TORA), timer B (TORB), stop run/recognition eight X (SRR/R8X), recognition eight A (R8A), permutation zero six 2 (P06R2), permutation six seven 2 (P67R2), permutation zero seven 4 (P07R4), tape check format (TCFR), and one spare position. A capacitor, an electron tube and a variable resistor are used in the timing circuit. This panel is covered in 4240WD of the Detached Schematics.

- (f) Intercept Dialing Panel (145350) - Contains logic circuitry associated with contacting Intercept when unable to reach a called station. For component layout, see 4240WD-W16 in Detached Schematics. The following relays are included: intercept transfer A (ITRA), intercept transfer B (ITRB), intercept transfer C (ITRC), intercept distributor stepping (IDSR), intercept alarm (IALR), and two spare positions. Also included is an intercept stepping switch (INSS). The panel is covered in 4240WD of the Detached Schematics.
 - (g) Power Supply Panel (145204) - Provides 48 volts, 4 ampere d.c. to the Data Set 154A1 and all logic except the tape preparation panel. It operates from 115 volt a.c. input.
 - (h) Key and Lamp Panel (145200) - Includes the following alarm lamps: MESSAGE INTERRUPTED, DIALING FAILURE, TAPE CHECK, CONNECTION LOST, INTERCEPT NOT REACHED, and TORN TAPE. The following controls are included: a MANUAL RESEND key which permits resending a tape that has already been transmitted, an ALARM CUT-OFF key for silencing the station audible alarm, a RESET key for restoring the circuitry to normal following an alarm condition, and a TRANSMITTER switch which provides four modes of operation for the Transmitter Distributor. Also included is a buzzer which serves as an audible indication of all alarm conditions. This panel is covered in 4240WD of the Detached Schematics.
 - (i) Distribution Panel (145000) - Furnishes a central means of interconnecting all the components of the Sending Station. It is mounted at the upper rear of the lower compartment of the cabinet behind the other panels. It includes nine cables, a signal bell and six fuses which protect the circuit panels and the power supply.
- (10) LAAC230 Cabinet - Provides housing facilities for components of the Send Set. The body, including a rear and two side panels and upper and lower shelves, is a welded unit. A dome lid may be opened to gain access to the keyboard base, the

typing unit, the motor unit, the perforator and the electrical service units. A two-piece cover encloses the TD below its top plate. A lower compartment provides space for the circuit panels. A front panel door may be removed to gain access to these panels. A power switch controls the a.c. power to the set. The cabinet is 38 $\frac{1}{2}$ " high, 36" wide and 18-5/6" deep and weighs 145 pounds. See Bulletin 249B.

- (11) Codomat (Card Reader LRL and Cabinet LBAC226) - The codomat automatically causes the address of a called station to be placed in the tape from a card that has been manually chosen and inserted into the reader. The cards are pre-punched with the address and are stored in a reel with a capacity of approximately 1800 cards. They may be swung into the Reader without being removed from the reel. Once the information is read, the card is automatically returned to storage. The card reader is mounted in a special cabinet which sits to the right of the send set cabinet. For description and principles of operation, see Specification 60134S.
- (12) Twenty-Four-Hour Timer (LCL1) - The Timer provides a means a of converting the time of day to multi-wire code. It is used along with circuitry to automatically insert in the tape the time of day that a message is prepared. It is mounted on the codomat cabinet behind the card reader. For description and principles of operation, see Specification 60143S.

c. Data Set 154A1

- (1) The Data Set 154A1 connects the send set with telephone carrier and switching facilities. It accepts the DDD digits from the send set and dials the number. It recognizes the signal from the telephone office that the called station has gone "off-hook" (answer-back) and informs the send set. And it accepts the start-stop d.c. signals from the send set and converts them to tone frequency signals for transmission of the telephone lines. See Bell System literature for further information.
- (2) The send and receive loop currents between the Data Set 154A1 and the send set will be .020 amperes in magnitude and will be supplied by the data set.

5. Receiving Station (also referred to as Terminating Station)

- a. General - The receiving stations provide apparatus for automatically receiving and recording the messages from the telephone carrier and switching facilities. Each station consists of a Teletype Receive Set and Data Set 154A1. There are two types of receive sets - single and multiple. The single set is used to terminate one line. Where the station terminates additional lines, the multiple set may be employed.
- b. Single Receive Set
 - (1) The receiving station Teletypewriter equipment will be referred

to as a "receive set". The single receive set consists of a Model 28 Receive-Only Page Printer Set. It terminates a single line of the system. It receives the messages as start-stop signals from the data set and prints them on page copy. In addition, it includes facilities for responding to an incoming call by giving an "off-hook" indication; for responding to the end of message by giving an "on-hook" indication; and for generating confirmation and circuit-assurance signals. The set's components are listed in Table 2 of Section 4 and are described below. The various optional combinations are indicated in Table 3-A of Section 4. For description and principles of operation, see Bulletin 216B.

- (2) Typing Unit (LP) - Receives the start-stop signals from the Line Relay and converts them to mechanical motions which print the messages on page copy. Basically, two types of units are employed: friction-feed and sprocket-feed. The LP Stunt Box is equipped to recognize the mnemonic code and the NNNN of the EOM, and to generate confirmation, on hook, and circuit-assurance signals.
- (3) Receive-Only Base (LB4) - Provides mounting facilities for the typing unit, motor unit and drive parts. Buttons to effect local carriage return and line feed for the typing unit are included.
- (4) Motor Unit (LMU3) - Provides mechanical motion for the typing unit.
- (5) Electrical Service Unit (LESU58 or 59) - Serves as a link between the local loop of the Receiving Station and the external lines of which the Data Set 154A1 is the access point. It is also the center of the logic circuitry. The LESU58 is used in receive sets without the typing unit interchange option and the LESU59 is used in receive sets with the typing unit option.
- (6) Line Relay (RY30) - Receives the start-stop signals from the Data Set 154A1 and repeats them for use by the typing unit. It is mounted on the electrical service unit. See Bulletin 120B.
- (7) Power Supply (144611) - Provides 48 volts, 2 amperes d.c. to the logic in the electrical service unit and the Data Set 154A1. It operates from a 115 volt a.c. input. It is located in the lower portion of the cabinet.
- (8) Key and Lamp Panel - The 144600 Panel provides the following keys: a BUSY key which permits the set to temporarily decline to receive incoming messages while it is being serviced, a XMSN key which is operated under direction of the telephone company for test purposes, and a TU INTRCHG key which permits receiving the messages on the monitor Typing Unit of an

associated send set (e.g. while the receive set is being serviced).

It provides the following lamps: a busy lamp which lights when the BUSY key is operated and when the paper-out contacts are operated, a distortion lamp which indicates signal distortion on the line, and transmission test lamp which lights when the XMSN key is operated. The 145220 panel is the same as the 144600 except that it has no TU INTRCHG key. This panel is mounted on the under side of the cabinet's lid.

- (9) Single RO Cabinet - Houses the components of the single receive set. It includes provisions for mounting the busy, transmission test, and distortion lamps. A power switch which controls a.c. power to the set is located on the right front of the cabinet.

c. Multiple Receive Set

- (1) The receiving station teletypewriter equipment will be referred to as a "receive set".
- (2) The multiple receive set terminates up to three lines of the automatic line switching system. It accommodates three complete printer sets. The function of each set is the same as that of a single Receive Set. The components that comprise the set are described below.
- (3) Typing Unit (LP) - See paragraph 5.b.(2) above.
- (4) Motor Unit (LMU21) - See 5.b.(4) above.
- (5) Electrical Service Unit (LESU58 and 59) - See paragraph 5.b.(5) above. Three of these units may be located in the lower portion of the cabinet.
- (6) Line Relay (RY30) - See paragraph 5.b.(6) above.
- (7) D.C. Power Supply (145017) - Provides 48 volt, 4 ampere d.c. to the logic and the data sets. It operates from a 115 volt a.c. input. It is located in the lower portion of the cabinet and is shared by up to three printer sets and their associated data sets.
- (8) Key and Lamp Panels - The 145010 panel provides a BUSY key, TU INTRCHG key, a XMSN TEST key, a BUSY lamp, a DISTORTION lamp, and XMSN TEST lamp. The function of these keys and lamps are covered in paragraph 5.b.(8) above. It also provides a switch which controls a.c. power to the associated printer. The 145450 panel is the same except that it has no TU INTRCHG key. Three of these panels are mounted at the upper front of the cabinet. In addition, there is a fuse

panel which includes a switch that controls all power to the cabinet.

- (9) Multiple Page Printer Cabinet (LBAC227) - Provides an enclosure for the components of the Receive Sets. For description, see Specification 60088S.

d. Data Set 154A1

- (1) The Data Set 154A1 provided by the Bell System connects the teletypewriter equipment to the telephone carrier and switching facilities. It receives the incoming messages as tone frequency signals and translates them to start-stop d.c. signals suitable for the Receive Set. It also responds to incoming calls (goes "off-hook") and provides for the transmission of the confirmation and circuit-assurance signals generated by the Receive Set. It also gives an "off-hook" indication to the telephone facilities. See Bell System literature for further information.
- (2) The send and receive loop currents between the Data Set 154A1 and the receive set will be .020 amperes in magnitude and will be supplied by the data set.

B. THEORY OF OPERATION

1. General

- a. This section describes the operation of the station and loop equipment of the Automatic Line Switching System. Detailed coverage of the individual units is contained in separate publications as indicated in Table II-1. Detailed explanation of the circuitry appears in the Circuit Descriptions (CD) of the Detached Schematics.
- b. Basically the system operates as follows (see Figures II-1 and II-2): Using the Keyboard, an operator at a sending station prepares a perforated tape containing the information to be transmitted to a Receiving Station. The tape includes the following: a start of message sequence (SOM); one or more addresses of the station(s) to be called, each made up of the called station's telephone number (DDD) and mnemonic code; an end of address sequence (EOA) consisting of an EOA code, the time of day and the Sending Station's mnemonic; the text of the message; and an end of message sequence (EOM). The operator may use the codomat which will effect automatic insertion of the address once a card has been manually selected.
- c. The tape is placed in the Transmitter Distributor (TD) of the send set. The TD is started and the tape is advanced until a SOM is sensed. The excess tape is pulled forward, and the SOM is positioned over the TD's sensing pins. The tape is then advanced until a DDD number is sensed. The station goes "off-hook" and the DDD number is presented to the Data Set 154A1 in a

suitable form. The data set dials the number and the station awaits an answer back. The No. 5 Crossbar Office makes connection with the called Receiving Station which goes "off-hook". The crossbar office sends an answer back signal to the Sending Station. The latter then transmits the mnemonic code and awaits confirmation. On receipt of its mnemonic, the Receiving Station returns a confirmation signal. The sending station then pulls back the tape and the following is transmitted: SOM, mnemonic code, EOA, text and EOM. The DDD number is ignored. The sending and receiving stations then go "on-hook" and the crossbar office disconnects the circuit. If the tape contains a second address, it is pulled back, and the message is sent to the second station in a manner similar to that described above. If not, the send set proceeds to the next message if there are more in the tape.

- d. The various automatic operations of the equipment are controlled by logic circuitry. This consists of relays, stepping switches, etc., most of which are located in the lower portion of the Send Set Cabinet. This circuitry is referred to as "logic" in the following general treatment of the operation. A detailed, step-by-step explanation of this circuitry appears in the Circuit Description (CD) of the Detached Schematics.

2. Tape (Figure II-2)

- a. The system employs an eight-level tape. In addition, a eighth-level pierce is placed in the tape by the TD. The levels are numbered zero to eight from top to bottom (Figure II-2). The first through fifth levels are devoted to the standard teletypewriter code and are referred to as intelligence levels. The zero, sixth, seventh, and eighth are control levels. These singly or in combination perform specific control functions as follows:
 - (1) Sixth Level - With FIGS preceding DDD indicates confirmation has been received. Elsewhere it indicates presence of CDC's.
 - (2) Seventh Level - With first character of SOM causes logic to pull tape forward. Elsewhere indicates presence of pseudo-mnemonic.
 - (3) Eighth Level - When placed with FIGS preceding DDD, indicates that dialing attempt has been made.
 - (4) Zero-Seventh Levels - Indicates presence of DDD number and performs certain control functions.
 - (5) Sixth-Seventh Levels - Indicates presence of EOA and performs certain control functions.
 - (6) Zero-Sixth Levels - With third N of EOM indicates that Sending Station should go "on-hook".

- (7) Zero-Sixth-Eighth Levels - With FIGS preceding DDD number, indicates that connection has been made with called station.

3. Functions

- a. The following abbreviations and symbols indicate the functions associated with the transmission of information by teletype-writers:

<u>Symbol</u>	<u>Abbreviation</u>	<u>Meaning</u>
↑	FIGS	Figures Shift
<	CR	Carriage Return
≡	LF	Line Feed
∨	LTRS	Letters Shift
□ or >	SP	Space
∥	BL	Blank

4. Character Sequences

- a. The following character sequences are used in the operation of the system
- (1) Start of Message (SOM) - LTRS with seventh control hole, CR, LF, LTRS: Placed at beginning of all messages. Causes tape to be pulled forward to start message processing.
 - (2) Direct Distance Dialing (DDD) Number - A permutation of ten digits with a zero and seventh control hole associated with each digit (Local area DDD's have seventh control hole with last seven digits only): Provides means whereby an address is reached through telephone dialing facilities.
 - (3) Mnemonic Code - A combination of seven letters constituting the address of a station. The letters are chosen to aid the memory (e.g., ATLODL for Atlanta Operations Office Delta). The last two characters and SP serve as an indication for the called station to transmit the confirmation signal. Preceded by a special DDD number and followed by CDC's, pseudomnemonic codes are used to gain access to broadcast circuits.
 - (4) Call Directing Code (CDC) - Ordinarily consist of two letter combinations followed by LTRS with a six level control hole perforated with each character. Usually followed by a mnemonic code, the CDC's serve as addresses for stations on a broadcast circuit.
 - (5) End of Address (EOA) - CR, LF with six and seven control level holes, FIGS, M. LTRS. Associated with the EOA is the time of day that the message was prepared (4 digits) and the Sending Station's mnemonic (seven characters).

- (6) End of Message (EOM) - CR, LF, FIGS, V, LARS, CR, six LF's and 4N's with a zero and six level control hole associated with the third N. The FIGS, V combination is an optional feature. The sending stations use the zero and six control holes as an indication to go "on-hook". The receiving stations use the four N's as an indication to go "on-hook".

5. Special Keys and Controls

a. The following special keys and buttons are on the Keyboard:

- (1) Distant Area Button - For manually punching DDD number. Causes zero and seven control holes to be punched with each digit.
- (2) Local Area Button - For manually punching local area dialing numbers. Omits seven level control hole from first three digits.
- (3) Pseudomnemonic Button - For manually punching pseudomnemonic code. Causes seven level control hole to be punched with each character.
- (4) CDC Button - For manually punching call directing codes. Causes six level control hole to be punched with each character.
- (5) SOM Key - Automatically inserts start of message sequence in tape.
- (6) EOA Key - Automatically inserts end of address sequence (including time and sending station's mnemonic) in tape.
- (7) Feed Out Key - For feeding out blank tape.
- (8) Rub Out Key - For perforating all levels (zero through seven) when an error has been made in tape preparation.

b. The following special controls are on the Send Set:

- (1) Transmitter Switch - For placing TD in different modes of operation. Four positions:

Normal

Stop for Priority - Stops TD at end of message in progress to permit transmission of urgent message.

Hold - Stops TD after message in progress has been transmitted to all addresses.

Monitor - Causes Monitor to print information read from tape. TD will read only as long as the Reset button is held depressed.

- (2) Call Telco Key - Permits Sending Station's typing unit to receive copy from Service Test Center for test purposes.
- (3) Step Key - Steps TD one character at a time for test purposes.
- (4) Timer Disable Key - Prevents alarms during test.
- (5) Transmission (XMSN) Key - Permits transmitting from test room through Data Set 154A1 and back to test room for test purposes.

6. Special Signals

- a. Answer Back - An indication to the sending station that the No. 5 crossbar office has made connection with the called receiving station. Consists of a polarity reversal in the circuit to the sending station's data set.
- b. Confirmation - An indication to the Sending Station that the proper receiving station has been reached and is ready to receive the message. Consists of a short spacing signal which is sent by the receiving station at the receipt of its mnemonic. It is recorded in the tape by a six level pierce.
- c. Circuit Assurance - An indication that continuity between the sending and receiving stations is being maintained and that copy is being received. Consists of a spacing pulse originated by the receiving station following the receipt of each character.

7. Alarms

- a. A visual alarm and an audible alarm are activated by the following conditions:
 - (1) Message Interrupted for 45 seconds after confirmation has been received.
 - (2) Intercept Not Reached after six attempts.
 - (3) Dialing Failure - Alarm is activated if dialing or transmission of mnemonic is stopped for approximately 15 seconds.
 - (4) Connection Lost or failure to receive circuit assurance.
 - (5) Tangled tape not cleared within approximately 15 seconds (Message Interrupted, alarm activated).
 - (6) Tape Check - Alarm activated if the tape format deviates from the following sequence: SCM, address, EOA, text, and EOM. It is also activated if the DDD number contains more or less than ten digits, or the mnemonic contains more than eight or less than five characters.

8. Tape Preparation

- a. **General** - A message tape shall be prepared according to the format listed below. Every message will have all components listed. They must be in the proper order and must include the proper control code holes. The send set will alarm out and stop processing the message upon detection of incorrect format.

- (1) Leader of tape
- (2) Start of Message (SOM) Sequence
- (3) Address-Single or Multiple
- (4) End of Address (EOA) Sequence
- (5) Text (always starting with CR and LF)
- (6) End of Message (EOM) Sequence

b. **Start of Message**

- (1) In preparing a message tape, the operator first depresses the feed out key to feed out a short length of blank tape.
- (2) Then the start of message sequence (SOM) is perforated by depressing the SOM key. (See 4241WD-D3 in the Detached Schematics.) Logic disables all the control keys, lights a guard lamp on the send set cabinet and causes the start and end of message stepping switch (SESS) to step to position 1. At position 1, the SESS codes the perforator's selector magnets for LTRS and energizes its clutch magnet. The perforator punches LTRS, and its auxiliary contacts step the SESS to position 2. The second character is perforated, and the operation continues in this manner until all the characters of the SOM are in the tape.
- (3) When the last character is perforated, the SESS steps to position 23. If the SOM key has been released, the control keys are reactivated and the guard lamp is turned out. The SESS then steps to its home position. The address may now be perforated into the tape.

c. **Address From Codomat**

- (1) The address can be perforated in the tape by using the Codomat. The address, which is prepunched in the codomat cards, consists of the direct distance dialing (DDD) number and the mnemonic code of the Receiving Station to be called. (See 4241WD-D3)
- (2) The operator inserts the card with the address of the station to be called into the Codomat's reader. This action disables

all the control key, lights the guard lamp, and activates the codomat. The codomat's sensing head moves down the card reading the perforations.

- (3) The codomat codes the perforator's selector magnets and through the send set, logic circuitry operates the perforator's clutch magnet. The perforator perforates the address into the tape exactly as punched in the card. As the perforator's shaft rotates, the perforator's magnet release contacts de-energize the Codomat magnet, and logic releases the perforator's clutch magnet. The magnet release contact closes, and the codomat reads the next character while the perforator is in the previous punch cycle. The circuitry energizes the clutch magnet, and the perforator punches the next character. This process continues until all the characters of the address are in the tape.
- (4) When the codomat senses a blank following the last character of the address, the logic circuitry deactivates the perforator and starts the codomat motor. The card is ejected from the reader and the circuitry and sensing head are reset. All the control keys are activated and the guard lamp is turned out. The address is thus perforated in the tape. (See 4241WD-D3) One or more cards may be selected consecutively.

d. End of Address (EOA) Key

- (1) The end of address code (EOA), the time of day and the Sending Station's mnemonic can be perforated in the tape by depressing the EOA key. The EOA consists of CR, LF with six and seven level control holes, FIGS, M and LTRS. The time consists of four digits preceded by FIGS and followed by LTRS. The mnemonic consists of seven characters. See 4241WD-D3. An exception to the above is a location which has two stations with the same DDD number but different mnemonics. In this case, the EOA will perforate only the first three characters of the mnemonic. The last four characters must then be perforated manually from the keyboard.
- (2) When the EOA key is depressed, logic circuitry disables all control keys, lights the guard lamp, and locks in the time of day in the timer. The end of address stepping switch (EASS) steps to position 1 where it controls the coding of the perforator's selector magnets and energizes its clutch magnet. The perforator punches the first character of the EOA (CR).
- (3) As the perforator's shaft rotates, its auxiliary contacts cause the EASS to step to the next position where it controls the perforation of the next character. This process continues

until the EOA is perforated and the EASS is at position 7. When the switch is at positions 7, 8, 9 and 10, it is coded by the timer contacts and, in turn, controls the perforator's selector magnets so that the time is perforated. When it is at position 13, it causes the perforator to begin to punch the sending station's mnemonic.

- (4) When the EASS reaches position 22, the EOA block has been perforated, and logic turns out the guard lamp, activates the control keys, and causes the EASS to step to its home position.
- e. Text - After EOA has been placed in the tape, the operator manually perforates CR and LF and the text of the message from the keyboard. The text is always to be preceded by CR and LF. See 4241WD-D3. When a key is depressed, the keyboard's auxiliary and code reading contacts code the perforator's selector magnets and energize its clutch magnet. The perforator punches the character and is deactivated until the next key is depressed.
- f. End of Message (EOM)
- (1) The end of message sequence is perforated by depressing the EOM key. The EOM consists of CR, LF, FIGS, V, LTRS, CR, six LF's and four N's. There is a zero and sixth control hole with the third N. (4241WD-D3). The FIGS, V combination is optional and is provided on some equipment to place a semicolon between messages.
 - (2) When the operator depresses the EOM key, logic disables all the control keys and lights the guard lamp. It also steps the start and end of message stepping switch (SESS) to position 6. The SESS controls the coding of the perforator's selector magnets and energizes its clutch magnet. The perforator punches the first character (CR) of the EOM.
 - (3) As the perforator's shaft rotates, its auxiliary contacts cause the SESS to step to the next position where it controls the perforation of the next character. This process continues until the SESS is at position 23 at which time the EOM has been perforated. Logic then turns out the guard lamp, activates the control keys, and causes the SESS to step to its home position if the EOM key has been released.
- g. Manual Perforation of Local Area Dialing Number
- (1) The local area push button is used to provide control holes when a local-area dialing number is perforated manually from the keyboard. See Chart 2 of 4241WD-D3.
 - (2) When the local area button is pushed, logic circuitry lights the local area lamp and disables all the control keys. Depression of the FIGS key causes logic to step the control

(punch) circuit stepping switch (CCSS) to position 1 and to energize the zero selector magnet of the perforator. The keyboard auxiliary and code reading contacts set up FIGS in the perforator's selector magnets and energize its clutch magnet. FIGS is perforated with zero control hole. As the perforator's shaft rotates, the CCSS is placed under the control of the perforator's auxiliary contacts.

- (3) The operator then depresses the key for the first digit of the DDD number. Under the control of keyboard auxiliary and code reading contacts, the perforator punches the digit with a zero control hole. As the perforator's shaft rotates, its auxiliary contacts step the CCSS to position 2 and condition the zero level selector magnet for perforation of the next digit.
- (4) The above operation will be repeated when the keys for the second and third digits are depressed. However, in the case of the third digit, when the CCSS steps to position 4, the perforator's auxiliary contacts energize the zero and seven level selector magnets. These two control holes will be perforated with the fourth through the tenth digits of the dialing number.
- (5) After the local area dialing number has been perforated, the CCSS is in position 11 (home). When the LTRS key is depressed, logic circuitry deactivates the control-level circuitry and LTRS is perforated. All control keys are reactivated and the local area lamp is turned out.

h. Manual Perforation of Distant-Area DDD Number

- (1) The distant-area push button is used to provide control holes when a DDD number is perforated manually from the keyboard. See chart 1 of 4241WD-D3.
- (2) When the operator depresses the distant-area button, logic activates the distant-area lamp and disables all the control keys. The operator then depresses the FIGS key. The operation that follows is the same as that described above in paragraph g except that both zero and seven level control holes are perforated with each digit of the DDD number.
- (3) When the LTRS key is depressed at the end of the DDD number, logic deactivates the control-hole circuitry, and LTRS is perforated. The control keys are reactivated and the distant-area lamp is turned out.

i. Manual Perforation of Pseudomnemonic

- (1) The pseudomnemonic (PSMN) button is used to provide code holes when a pseudomnemonic sequence is perforated manually from the keyboard. See Chart 3 of 4241WD-D4.

- (2) When the PSMN button is pushed, logic lights the PSMN lamp and deactivates all the control keys. The control (punch) circuit stepping switch (CCSS) steps to position 1 and operates the seven level selector magnet of the perforator.
- (3) The operator then depresses the key for the first character of the pseudomnemonic. The operation is then the same as that covered in paragraph g above, except that a seven level control hole is perforated with each character. After the pseudomnemonic has been perforated, the CCSS is at position 9. Logic then turns out the PSMN lamp, reactivates the control keys, and steps the CCSS to its home position. The PSMN function can be reset by operation of the "LTRS" key. Then if the PSMN key is depressed by accident, it can be reset without punching 8 characters.

j. Manual Perforation of Call Directing Codes (CDC)

- (1) The call directing code (CDC) button is used to provide control holes when CDC's are perforated manually from the keyboard. See 424LWD-D9, Chart 3.
- (2) When the CDC button is pushed, logic lights the CDC lamp and disables all the control keys. The control (punch) circuit stepping switch (CCSS) steps to position 1 and conditions the circuitry for the sixth control hole. The operator depresses the key for the first character of the DCD. Under the control of the Keyboard auxiliary contacts, the perforator punches the character with a six level control hole. The perforator auxiliary contacts cause the CCSS to step to position 2. The above operation is repeated for all characters until the operator selects "letters".
- (3) The operator then depresses the LTRS key. LTRS is perforated with a six level control hole, and logic turns out the CDC lamp, reactivates the control keys, and causes CCSS to step to its home position.

k. Rub Out

- (1) The rub out key is used to perforate all levels (zero through seven) when an error occurs in tape preparation. The tape is back spaced to the point where the error was made, and all characters following are deleted. The one exception is the case where an error is made in an address. In this case, the entire address including the DDD number, mnemonic or pseudomnemonic code, any related CDC's and their mnemonic codes must be rubbed out or the dialing attempt and confirmation pierces will not be properly inserted or the CDC's (if included) may not be transmitted properly. If an error is made in perforating a CDC or its mnemonic code and it is undesirable to rub out the entire single address block all the way back to the DDD number; only the CDC and its mnemonic

code need be rubbed out if two fill characters such as "space" or "letters" are inserted immediately after the rub out.

- (2) When the rub out key is depressed, the logic circuitry energizes the perforator's selector magnets and clutch magnet. The perforator punches all levels. The rub out key must then be depressed and released once for each character to be rubbed out.

l. Tape Back Space

- (1) The Back Space Key is used to pull the tape back into the perforator one character at a time to enable use of the rub out key to delete errors. Depression of the back space key energizes a solenoid in the back space mechanism of the perforator to pull the tape back one character.

m. Feed Out

- (1) The feed out key is used to feed out blank tape whenever a leader or trailer to a message is desired. The length of blank tape is used to bridge the gap between the perforator and TD. If a group of messages are being prepared, a trailer is not needed after each one - only the last one. When the feed out key is depressed, it activates the perforator. As long as the key is held down, blank tape will be fed out.

9. Message Processing

a. Pull Forward

- (1) Tape is placed in the reader of the TD. The transmitter switch on the key and lamp panel is placed in its "Normal" position. The stop-run switch on the TD is placed in the "Run" position.
- (2) The reader of the TD starts and advances the tape until the seven level control hole with the first character (LTRS) of the SOM (see 424OWD-D6, Chart 5) is sensed. Logic circuitry then causes the reader to run out the tape until it is taut between the reader feed wheel and the pull-forward feed wheel. Previously processed tape is thus pulled forward out of the TD. The TD's tight-tape contacts stop the pull-forward operation and cause the pull-forward feed wheel to be latched with the CR character of the SOM over the sensing pins. This establishes a reference point for pull back. The reader steps the tape on.

b. Dialing

- (1) A direct distance dialing (DDD) number consists of a permutation of ten digits. All the digits have a zero control

hole associated with them. All the digits of a distant-area DDD number also have a seven level control hole (4240WD-D6, Chart 5). When the number of the called station is in the local area of the sending station, the first three digits do not have a seven level control hole associated with them (4201WD-D7, Chart 6). Only the digits with both zero and seven level control holes are dialed.

- (2) The reader advances the tape until it senses the zero and seven level control holes with the first digit. Logic circuitry causes the DataSet 154A1 to go "off-hook".
- (3) Logic places the reader under the control of the data set and connects its contacts to the translator circuitry. The reader reads out the first digit as five-wire electrical signals to the translator circuitry. The latter converts it to one-out-of-ten form and applies it to the data set. The latter processes the digit and sends it to the No. 5 crossbar office via tone frequencies, and simultaneously calls for the second digit by activating the reader. The reader reads out the second digit. This overlap operation continues through the tenth digit. The lower notch stepping switch (LNSS) is stepped once for each digit. The monitor printer is blinded.
- (4) As the tenth digit is read out, the reader auxiliary contacts and the lower notch stepping switch (LNSS) cause the TD to pierce the tape at the lower edge (eight level) to indicate a dialing attempt has been made. An electrical timer is started which allows approximately 15 seconds for the No. 5 crossbar office to make connection with the called receiving station. The absence of control holes with the character (LTRS) following the tenth DDD digit causes the reader to stop.

c. Answer Back

- (1) An answer back is an indication that the crossbar office has successfully made a connection with a receiving station. It consists of a polarity reversal which is recognized by the Data Set 154A1. When the answer back is received, the data set signals the answer back logic. The logic unblinds the monitor and removes the reader from the data set's control.
- (2) The reader and distributor are started. The reader reads the mnemonic sequence and codes the translator circuitry. The translator circuitry, in turn, codes the distributor contacts. The distributor converts the characters from five-wire d.c. signals to single-wire, start-stop signals and sends them to the monitor and Data Set 154A1. The latter transmits them on the line as tone frequencies and the monitor prints them on page copy.

d. Confirmation and Pull Back

- (1) Confirmation is a signal to the sending station indicating that the called station has been reached and is ready to receive the message. When the SP at the end of the mnemonic is sensed, the reader auxiliary contacts and logic stop the reader and start the timer which gives the station approximately 15 seconds to respond with a confirmation signal.
- (2) The mnemonic is received by the Data Set 154A1 at the called receiving-only station as tone frequencies. It is converted to start-stop d.c. signals by this set and sent to the R/O Printer Set which records it on page copy. When the stunt box on the printer recognizes its own mnemonic code (specifically the last two characters and "space"), its contacts key the data set which sends a spacing signal back to the sending station.
- (3) The sending station recognizes the space signal as a confirmation and signals logic. Logic resets the 15 second timer and causes the TD to place a six level pierced hole in the tape in line with the eight level pierce, and to pull the tape back until it is taut for transmission of all address mnemonic codes, EOA, the message text, and EOM.

e. Blinding DDD Number

- (1) The DDD number is not sent to the line and monitor following pull back because it is only needed for the dialing operation. When the tape is pulled back, the TD's tight-tape contacts operate and logic starts the reader. The reader reads and the distributor transmits the SOM minus the first LTRS character. When the reader senses the zero, six and eight level control holes preceding the DDD number (424OWD-D6, Chart 5), logic circuitry in conjunction with the reader auxiliary contacts blinds the line and monitor. The reader then advances the tape over the DDD number.
- (2) When the reader senses the first character following the DDD number (LTRS), the fact that it has no control holes causes logic to unblind the monitor and line. The reader senses and the distributor transmits the mnemonic code, the EOA sequence, the time, the calling station mnemonic, the text of the message and the end of message sequence (EOM) (see 424OWD-D6, Chart 5). This intelligence is received and printed at the called station.
- (3) The receiving station sends back an indication that continuity is being maintained and that it is printing copy. (The indication is not an assurance that it is printing correct copy). Each time the receiving station receives a character, its universal contacts generate a spacing pulse which is transmitted on the line. When this signal is received by the sending station, 35, 65, and 500 millisecond timers are activated in the send set circuit assurance detector. If within 500 milliseconds an acceptable

signal (i.e. between 35 and 65 milliseconds long) is received, the 35- and 65- millisecond timers cause the 500- millisecond timer to be reset. The above operation is then repeated throughout the transmission of the message. If at any time an acceptable signal is not received within approximately 500 milliseconds, the sending station will alarm and transmission will be discontinued.

f. End of Message

- (1) When the stunt box at the receiving station receives the NNNN of the ECM it causes the station to go "on-hook".
- (2) When the reader at the sending station senses the third N character of the EOM with zero and six level control holes and then the last character without control holes, logic circuitry stops the reader and causes the station to go "on-hook". The No. 5 crossbar receives the "on-hook" signal and disconnects.
- (3) If torn tape is being used, the tape-out pin on the reader operates and keeps the reader deactivated. If continuous tape is being used, logic starts the reader which advances the tape in search of the next SOM. Dialing, connection, pull-back and transmission occurs as described above. This procedure continues until all messages in the tape are sent.

g. Answer Back Not Received

- (1) After the DDD number has been dialed, the reader stops, (an 8-level pierced hole was inserted during dialing), and the timer is started which gives the crossbar office approximately 15 seconds to make connection with the called station. If the answer-back is not received, the time out causes the data set to go "on-hook". The reader steps through the mnemonic in search of another DDD number.
- (2) The tape is not pulled back on the SP character following the DDD number. If no uncalled DDD number is found, the tape will be pulled back when the six and seven level control holes with the first character (CR) of the EOA are sensed. After the tape is pulled back taut the reader will step the tape on again looking for an uncalled DDD number.

- h. Counting Dialing Attempts - When the dialing operation is repeated for a DDD number due to previous unsuccessful attempts to call the number, an eight level pierced hole (with no sixth pierce) is sensed. This sensing of the eight level causes the lower notch stepping switch (LNSS) to step an additional position. The LNSS thus reaches position 10 one character earlier than during the first dialing attempt and causes the eight level pierced hole to be placed one character earlier than the previous eight level pierce. The timer is reset. If connection

is again not made, the DDD number must be redialed after the tape is pulled back and a pierced hole will be placed another character earlier. After the third attempt, the message is sent to Intercept as covered below in paragraph j.

- i. Confirmation Not Received - After a station has completed dialing and received an answer back, it sends the mnemonic code and awaits confirmation. If no confirmation is received within approximately 15 seconds, the send set goes on-hook and the reader steps the tape on in search of the next uncalled DDD number. If the reader senses the EOA sequence marked by the six and seven level control holes with the LF, the tape will be pulled back and the reader will continue to search for an uncalled DDD number. If no confirmation is received after three attempts, the message is sent to intercept (paragraph j).
- j. Intercept Call Initiation and Dialing
 - (1) After the sending station has failed on three attempts to receive an answer back or confirmation, the tape will contain three eight level pierced holes. Following the third dialing attempt, the tape is pulled back again, and the reader senses the three eight level pierced holes. When it senses the eight and zero control holes, the lower notch stepping switch (LNSS) and intercept stepping switch (INSS) effect dialing of intercept, and the logic circuitry transfers the control of distributor contacts from the reader to INSS.
 - (2) The INSS is stepped to position 1, and causes the Data Set 154A1 to go "off-hook". The dialing operation is similar to that covered above in paragraph b. except that the DDD number for the intercept station is presented to the data set from INSS. The INSS stepping switch is stepped once for each digit until all have been dialed. The LNSS is stepped one position each time that intercept is dialed and thus serves to record the intercept dialing attempts. The 15-second timer is started as in other dialing attempts, and the station waits for the intercept answer back.
- k. Answer Back Received (Intercept)
 - (1) When the receiving set at the intercept goes "off-hook", the No. 5 crossbar office causes a polarity reversal at the sending station's data set. Logic then unblinds the monitor, removes the intercept stepping switch (INSS) from under the control of the data set and starts the distributor.
 - (2) For each cycle of the distributor, the INSS codes the distributor contacts which send the intercept mnemonic to the line and monitor. The distributor, through its auxiliary contacts, steps INSS. At the completion of the mnemonic, INSS is at position 20 where it stops the distributor. The sending station awaits confirmation.

1. Confirmation Received (Intercept)

- (1) When the end of its mnemonic code is received by the receiving set at intercept, it returns a confirmation signal to the sending station. Logic causes the lower notch stepping switch (LNSS) to step to its home position and activates the distributor.
- (2) The intercept stepping switch (INSS), which is at position 20, codes the distributor contacts so that FIGS is sent to the Monitor and line. This is required because the reader is at the first digit of the DDD number. The INSS steps to position 21 and then to its home position.
- (3) Logic energizes the clutch magnet of the reader which senses the trouble DDD number and the mnemonic code and sends them to the line and monitor via the translator circuitry and distributor contacts. When SP is sensed at the end of the mnemonic code of the trouble DDD number, logic stops the reader and causes the TD to insert a six level pierced hole with FIGS preceding the DDD number. It then causes the reader to pull the tape back. Operation is then the same as normal message transmission and the complete message is transmitted to the intercept station.
- (4) The message is received at intercept on a reperforator. Intercept makes one attempt to redial and complete the call. If it fails, an attendant checks the message for errors and processes the message through appropriate facilities.

m. Answer Back Not Received (Intercept)

- (1) After the sending station has completed dialing the INTERCEPT DDD number, the INSS is at position 11 and LNSS is at position 1 to record the first dialing attempt. The TD is stopped and the 15-second timer is activated. If no answer back is received within the time limit, the timer causes the data set to go "on-hook" and the INSS to step to its home position. Another dialing attempt is then made.
- (2) If station attempts to dial intercept fail six times, the "Intercept Not Reached" alarm will be activated and the send set will require operator attention.

n. Confirmation Not Received (Intercept)

- (1) After the intercept DDD number has been dialed and the intercept mnemonic code has been transmitted, the sending station awaits confirmation. The lower notch stepping switch (LNSS) is at position 1, 2, or 3 etc. recording whichever dialing attempt has been made. The intercept stepping switch (INSS) is at position 20. The 15-second timer is operating.
- (2) If confirmation is not received within approximately 15 seconds, the timer causes the data set to go "on-hook" and

INSS to step to its home position. From there the INSS initiates another dialing attempt and the dialing operation is repeated. The station will dial intercept up to six times. If no confirmation is received following the sixth attempt, the "Intercept Not Reached" alarm will be activated and the send set will require operator attention.

o. Connecting Pseudomnemonics with CDC's

- (1) Pseudomnemonics are used to gain access to the 83B2 system or similar systems which use CDC's. A pseudomnemonic is for the purpose of confirmation only and is used as the mnemonic code of the access point of the foreign system. It is followed by one or more CDC's. At the point of access to an 83B2 System is a receive station with a stunt box and a reperforator-transmitter (RT) set. Upon receiving the end of its pseudomnemonic, the stunt box generates the confirmation signal and connects the reperforator of the RT set to the line. The CDC's are used for connection purposes and are the first characters received by the reperforator.
- (2) Operation is completed through DDD dialing up to the receipt of an answer back as covered above. The TD, sensing the seven level control holes of the pseudomnemonics, reads the pseudomnemonic (424OWD-D8 and D9) and transmits it to the line and monitor. When it senses space at the end of the pseudomnemonic, logic stops the reader, and the station waits for confirmation.
- (3) When the confirmation is received, the reader is started and it reads the tape immediately following the pseudomnemonic. The CDC's alone which are marked by a six level control hole are transmitted to the line and monitor. The absence of control holes causes logic to blind the line and monitor.
- (4) If the tape contains more than one CDC separated by mnemonic codes, the operation covered in the preceding paragraph is repeated, and so on.
- (5) When transmitting CDC's, the logic is conditioned so that it is looking for and transmitting all characters with a sixth control hole. It continues to look and transmit until it encounters a control permutation other than the sixth. At this time pull back is initiated.
- (6) Logic operates the clutch magnet, and the tape is advanced and all characters without control holes are transmitted up to ECM where the logic circuitry decides whether to pull back for retransmission to an uncalled DDD number or to go on to the next message because all DDD numbers have been processed.

p. Tape with Multiple DDD Numbers

- (1) When a tape contains more than one DDD number, the first address is called and, if connected, the message is sent to it. Then the second station is connected, and the message is sent to it, and so on. If a call attempt is unsuccessful, the message processing format is such that the next successive number will be tried rather than redialing of the first number until all numbers are finally processed. During the transmission of the first message, the monitor copies the complete message including mnemonics of all addresses and the text. During transmission to the rest of the addresses, it will copy the mnemonic of the station being called but will be blinded to the rest of the message because it is the same as for the first transmission.
- (2) Assume that the tape contains more than one DDD number (see 424OWD-D10, Chart 9). Dialing of the first number is accomplished, connection is established, the mnemonic is transmitted, and the tape is pulled back. The reader is activated and advances the tape. The called DDD number is read with the line and monitor blinded.
- (3) When the reader sensed FIGS with the zero control hole preceding the uncalled DDD number, logic causes the distributor to change this character to LTRS, and it blinds the line and monitor.
- (4) When the zero and seven level control holes with the first uncalled DDD digit are sensed, a DDD number memory circuit is activated to indicate that an uncalled number remains and that the tape must be pulled back after this transmission for retransmission to the remaining uncalled number.
- (5) The sensing of LTRS with no control holes following the uncalled DDD number causes logic to unblind the line and monitor. The tape advances, and the mnemonic, EOA, the text and EOM are transmitted to the first called station. (All characters from the address portion of the tape without control level holes will be transmitted.) Then, because the DDD memory circuit has been activated, when the zero and six level control holes with the EOM are sensed, logic causes the tape to be pulled back and the station to go "on-hook".
- (6) The reader starts and advances the tape through the SOM in search of the uncalled DDD number. The called DDD numbers will be blinded out. The sensing of the zero and seven level control holes with the uncalled DDD numbers causes the station to go "off-hook". The second DDD number is dialed and the second mnemonic sent subject to answer back and confirmation. The monitor prints this mnemonic. When confirmation is received, the tape is pulled back and again advanced for message transmission.

- (7) When the station went "on-hook" after the transmission of the EOM, logic was conditioned for blinding the monitor during retransmission of the message. As the tape advances, the sensing of CR and LF in the SOM operates the CR-LF contacts in the monitor. These, in turn, cause the monitor to be blinded throughout the transmission of the message to the second address. The sensing of the EOM removes the blind from the monitor. The above procedure will be repeated until the message is sent to all addresses.

q. Alarms

(1) Message Interrupted

- (a) An audible and visual alarm will be activated at the sending station if, for any reason, transmission to a receiving station is interrupted for approximately 45 seconds. While a message is being transmitted, a line following relay (LFR) monitors the outgoing signals. Should the signals stop, the LFR activates a 45-second timer.
- (b) If this condition prevails for the time limit, the timer through logic operates the message interrupted lamp on the key and lamp panel and a buzzer. It also causes the station to go "on-hook" and steps the lower notch stepping switch (LNSS) to its home position if it is not already there.
- (c) An operator must then manually silence the buzzer and reset the circuitry.

(2) Dialing Failure

- (a) An audible and visual alarm will be activated if, for any reason, the reader stops for approximately 15 seconds during the dialing operation. During dialing, an intermittent shunt is maintained around the 15 second timer.
- (b) Should the reader's clutch magnet be de-energized, logic removes the intermittent shunt. After approximately 15 seconds, the timer through logic operates the buzzer and a dialing failure lamp on the key and lamp panel. It also causes the station to go "on-hook" and steps the lower notch stepping switch (LNSS) to its home position if it is not already there.
- (c) An operator must then silence the buzzer and reset the circuitry.

- (3) Failure During Mnemonic Transmission - An audible and visual alarm will be activated if, for any reason, the transmission

of the mnemonic is interrupted for approximately 15 seconds. When transmission is interrupted for the time limit, the operation that follows is the same as that covered in paragraph (2)(b) above.

(4) Tape Check

- (a) A deviation from the proper tape format will result in an audible and visual alarm.
- (b) Assume, for example, that the end of address (EOA) has been omitted from the tape. Connection is established, and the answer back and confirmation are received. The tape is pulled back and the message transmitted.
- (c) The logic should have been conditioned by the sixth and seventh control holes with LF of the EOA (424OWD-D6). However, since the EOA has been omitted, it was not. When the reader senses the zero and sixth control holes with the end of message (EOM) (424OWD-D6), logic operates the tape-check lamp and the buzzer.

(5) Connection Lost - If the connection is lost while transmission to the receiving station is in progress, an audible and visual alarm will be activated. If the connection is broken or the circuit assurance signals are not received for 500 milliseconds, logic stops the reader and operates the buzzer and connection-lost lamp.

(6) Intercept Not Reached

- (a) After six attempts to dial intercept fails, audible and visual alarms are activated. Following the sixth attempt, the intercept stepping switch (INSS) is at position 11, and the lower notch stepping switch (LNSS) is at position 6 and has prepared a path to the alarm circuit.
- (b) If an answer back is not received in approximately 15 seconds, the timer through logic operates the buzzer and intercept-not-reached lamp. It also causes the station to go "on-hook" and the LNSS and INSS to step their home positions.

r. Reset - When the station alarms, the operator momentarily operates the alarm cut-off key which causes logic to silence the buzzer. He must then attempt to ascertain the cause of the trouble. He then removes the tape from the TD and places the stop-run switch in the "stop" position. He pushed the reset button which restores all logic to normal and causes the reader to undergo one operation to clear the reader contacts of any stored information.

s. Call Telco Key

- (1) Operation of the CALL TELCO key on the Electrical Service Unit (LESU57) is a special test procedure which should be carried out only under direction of the telephone company.
- (2) When the CALL TELCO key is pressed, logic performs the following: conditions circuit to disable all timers on receipt of answer back, disables torn tape alarm, disables circuit assurance circuitry, disables six and eight level magnets, disables tape-check circuit, and conditions the monitor so that it will receive incoming signals from the Serving Test Center.
- (3) When the tests are completed, the sending station's circuitry is restored to normal either by sending a tape containing an EOM or performing the reset function.

t. Timer Disable Key - The timer disable key on the message processing panel is used to prevent an alarm while testing. When it is placed into the disable position, it disables the 15- and 45- second timers and the circuit assurance detector that controls the connection lost alarm.

u. Step Key - The step key on the message processing panel is used to step the transmitter distributor one character at a time for test purposes. When the key is operated, the TD reads and transmits one character and then stops until the key is again operated.

v. Transmission (XMSN) Key - The transmission (XMSN) key on the LESU57 is used to loop the Data Set 154A1 send side back to the receive side for checking transmission from the test room through the data set and back to the test room.

w. Transmitter Switch

- (1) The transmitter switch on the key and lamp panel controls the transmitter distributor. It has four positions as follows:
 - (a) Normal - This position is used for normal operation.
 - (b) Stop for Priority - This position is used to stop the TD and allow transmission of an urgent message. The message in progress is completed to that addressee before the TD stops. When the switch is in this position and the zero and six level control holes with the third N of the EOM are sensed, logic is conditioned to stop the TD after the fourth N is sensed.
 - (c) Hold - This position is used to stop the TD after the message in progress has been transmitted to all addresses. When the switch is in this position and the DDD memory circuit is not activated, the sensing of the EOM causes the TD to stop.

- (d) Monitor - This position is used to check for errors while reading the tape. The intelligence read by the TD is printed by the monitor. The control levels are not checked. In the "Monitor" position, the TD will read the tape only while the reset button is held depressed. This arrangement is provided to guard against accidental activation.

TABLE II-1
AUTOMATIC LINE SWITCHING SYSTEM - INDEX TO PUBLICATIONS

<u>COMPONENT</u>	<u>BSP</u>	<u>6000 S SPEC.</u>	<u>5000 S SPEC.</u>	<u>BULLETIN</u>
Automatic Line Switching System Drive Parts LAAC230 (Send Set Cabinet)	P34.614.1	60325S 60124S	50020S	1169B 1149B 250B 1169B
LAC204 (RO Cabinet) LAC215 (Single Receive Cabinet) LAK20 (Keyboard)	P34.660.1	6363S 60048S	5759S	216B 217B 1149B 250B 1169B
LARP800 (Perforator) LARP801 (Perforator) LB4/146 (RO Base)	P34.662	6837S 60048S 6301S	50014S	1166B 217B 1149B 216B
LBAC226 (Codomat Cabinet) LBAC227 (Multiple Receive Cabinet) LCL1 (Clock)	P31.551 P34.665 P31.552	60134S 60088S 60143S	50023S 50027S 50025S	1149B
LESU7/134 (Electrical Service Unit) LESU56 (Electrical Service Unit) LESU57 (Electrical Service Unit)	P34.622	6364S 60168S 60181S	50022S 50021S	217B 1149B 1169B 1169B
LESU58 (Electrical Service Unit) LESU59 (Electrical Service Unit) LFXB1 (Transmitter Base)	P34.634.1	60184S 60184S	50026S 50026S 50024S	1149B 1149B 242B 1149B 243B 1165B 243B

Table II-1 (Continued)

	<u>BULLETIN</u>	<u>BSP</u>	<u>6000 S SPEC.</u>	<u>5000 S SPEC.</u>	<u>COMPONENT</u>
242B	243B	P34.634.1	60079S	50024S	(Pull Back Transmitter)
216B	217B	P34.609	6256S	50028S	(Motor Unit)
	250B		6672S		(Motor Unit)
216B	217B		60200S		(Motor Unit)
216B	217B		6275S		(Typing Unit)
216B	217B		6275S		(Typing Unit)
216B	217B		6275S		(Typing Unit)
216B	217B		6275S		(Typing Unit)
250B	246B	P31.551	60134S	50023S	(Codomat)
217B	247B	P34.609	60054S	50028S	(Test Set Cabinet)
261B			60196S		(Stroboscopic Test Set)
217B	246B	P34.609	60076S	50028S	(Tape Printer)
217B	246B		60053S	50028S	(Tape Handling Stand)
	120B				(Line Relay)
250B			60048S		(Keyboard Multi-Magnet Perforator)
			60325S	50020S	(Send Set)
			60241S		Modification Kit

Table II-1 (Continued)

<u>COMPONENT</u>	<u>BSP</u>	<u>6000 S SPEC.</u>	<u>5000 S SPEC.</u>	<u>BULLETIN</u>
145890 Modification Kit				
159357 Modification Kit				
159373 Modification Kit			5730S	
164848 Modification Kit		60243S		
165145 (83B2) Modification Kit		6524S		
165343 (83B2) Modification Kit		60059S		1149B 1149B
Printer Universal Contact				
Detached Schematic - 4240WD	P34.612.1	6822S		
Detached Schematic - 4241WD	P97.001			
	P97.002			
Detached Schematic - 4242WD	P97.003			
Detached Schematic - 4243WD	P97.004			
Analysis Chart) 4225WD				
Receiving Only Sets)				
Analysis Chart) 4226WD				
Send Set)				

TABLE II-2

SEND SET RELAYS

<u>Relay Code</u>	<u>Relay Description</u>	<u>Location (Note A)</u>
ABR	Answerback Relay	4240WD-B10
BRR	Blank Reset Relay	4241WD-B8
CAR	Circuit Assurance Relay	4240WD-B10
CDR	Call Directing Code Relay	4241WD-B1
CFR	Confirmation Relay	4240WD-B10
CMR	Codomat Relay	4241WD-B1
CRR	CDC Reset Relay	4241WD-B1
DAR	Distant Area Relay	4241WD-B1
DM	Dial Mode (Subset)	SD70906-01
EAR	End of Address Relay	4241WD-B5
EMR	End of Message Relay	4241WD-B2
FGR	Figures Relay	4241WD-B1
IALR	Intercept Alarm Relay	4240WD-B8
IDSR	Intercept Distributor Stepping Relay	4240WD-B8
ITRA	Intercept Transfer Relay A	4240WD-B8
ITRB	Intercept Transfer Relay B	4240WD-B8
ITRC	Intercept Transfer Relay C	4240WD-B8
LAR	Local Area Relay	4241WD-B1
LBR	Line Blind Relay	4240WD-B9
LFR	Line Following Relay	4240WD-B11
LNМ	Lower Notch Magnet	4240WD-B9
LSR	Line Shunt Relay	4240WD-B4
LUR	Line Unblind Relay	4240WD-B2
LURB	Line Unblind Relay B	4240WD-B9
MBR	Monitor Blind Relay	4240WD-B19
MER	Memory EOM Relay	4240WD-B19
MLR	Monitor Line Relay (Polar)	4240WD-B7
MRR	Monitor Reset Relay	4241WD-B8
NR1	Numbering Relay 1	4240WD-B7
NR2	Numbering Relay 2	4240WD-B7
NR3	Numbering Relay 3	4240WD-B7
NR4	Numbering Relay 4	4240WD-B7
NR5	Numbering Relay 5	4240WD-B7
OH	Off Hook (Relay)	SD70906-01-B2
ONHR	On Hook Relay	4240WD-B5
PBM	Pull Back Magnet	4240WD-B15
PBRA	Pull Back Relay A	4240WD-B14
PBRB	Pull Back Relay B	4240WD-B14
PFR	Pull Forward Relay	4240WD-B14
PMR	Pseudo Mnemonic Relay	4241WD-B1
PNR	Permutation None Relay	4240WD-B4
POR	Permutation Zero Relay	4240WD-B4
PLR	Permutation One Relay	4240WD-B5
P3R	Permutation Three Relay (No. Three Hole of 1 to 5 Group) (Space)	4240WD-B6

(Note A) In Detached Schematics

Send Set Relays (Continued)

<u>Relay Code</u>	<u>Relay Description</u>	<u>Location (Note A)</u>
P7R	Permutation Seven Relay	4240WD-B4
P06R	Permutation Zero and Six Relay	4240WD-B4
P06R2	Permutation Zero and Six Relay 2	4240WD-B18
P068R	Permutation Zero, Six and Eight Relay	4240WD-B4
P07R1	Permutation Zero and Seven Relay 1	4240WD-B4
P07R2	Permutation Zero and Seven Relay 2	4240WD-B4
P07R4	Permutation Zero and Seven Relay 4	4240WD-B18
P67R	Permutation Six and Seven Relay	4240WD-B4
P67R2	Permutation Six and Seven Relay 2	4240WD-B18
REC	Receiving Relay	4240WD-B10
RES	Reset Relay	4240WD-B22
ROM	Run Out Magnet	4240WD-B3
ROR	Rub Out Relay	4241WD-B10
RRR	Rub Out Reset Relay	4241WD-B10
RSR	Reset Relay	4241WD-B8
R0	Recognition Relay for Zero Hole	4240WD-B2
R6	Recognition Relay for Six Hole	4240WD-B2
R6A	Recognition Relay A for Six Hole	4240WD-B2
R7	Recognition Relay for Seven Hole	4240WD-B2
R8A	Recognition Relay A for Eight Pierce	4240WD-B2
R8B	Recognition Relay B for Eight Pierce	4240WD-B2
SALA	Sending Alarm Relay A	4240WD-B22
SALB	Sending Alarm Relay B	4240WD-B22
SLR	Sending Line Relay (255)	4240WD-B7
SMR	Start of Message Relay	4241WD-B2
SMS	Selecting Manual Switch	4240WD-B1, B3 B15
SRR	Stop Run Relay	4240WD-B3
STC	Service Test Center Relay	4240WD-B17
TCFR	Tape Check Format Relay	4240WD-B18
TCR	Tape Clamp Relay	4240WD-B3
TOHA	Transmitter Off Hook Relay A	4240WD-B5
TOHR	Transmitter Off Hook Relay	4240WD-B12
TORA	Time Out Relay A (15 Sec.)	4240WD-B21
TORB	Time Out Relay B (45 Sec.)	4240WD-B21
TOTR	Torn Tape Relay	4240WD-B21
TRR	Timer Reset Relay	4240WD-B9
TSR	Translator Shift Relay	4240WD-B5
TTR	Tight Tape Relay	
UDR	Unsent DDD Number Relay	4240WD-B16
UNM	Upper Notch Magnet	4240WD-B13
UNMR	Upper Notch Memory Relay ⁴⁶	4240WD-B13
<u>Receive Set</u>		
CFR	Confirmation Relay	4242WD-B2, 4243WD-B2

(Note A) In Detached Schematics

Receive Set (Continued)

<u>Relay Code</u>	<u>Relay Description</u>	<u>Locations (Note A)</u>
PSR	Printer Switch	4243WD-B3
RLR	Receiving Line Relay	4242WD-B1, 4243WD-B1
ROH	Receiver Off-Hook Relay	4242WD-B2, 4243WD-B2
SLR	Sending Line Relay	4242WD-B2, 4243WD-B2

TABLE II-3
STEPPING SWITCHES

<u>Switch</u>	<u>Description</u>	<u>Locations*</u>
CCSS	Control (Punch) Circuit Stepping Switch arc 1 arc 2 not used arc 3 - 6	4241WD-B1 4241WD-B1 4241WD-B1
EASS	End of Address Stepping Switch arc 1 arc 2 - 3 not used arc 4 arc 5 - 11 arc 12 not used	4241WD-B5 4241WD-B5 4241WD-B5 4241WD-B6
INSS	Intercept Stepping Switch arc 1 arc 2 arc 3 arc 4 not used arc 5 arc 6 - 10	4240WD-B1 4240WD-B1 4240WD-B4 4240WD-B2, B9 4240WD-B6 4240WD-B7
INSS	Lower Notch Stepping Switch arc 1 - 2 arc 3 - 4 arc 5	4240WD-B9 4240WD-B9 4240WD-B8 4240WD-B18
SESS	Start of Message and End of Message Stepping Switch arc 1 - 4 arc 5 - 12	4241WD-B2 4241WD-B2 4241WD-B3

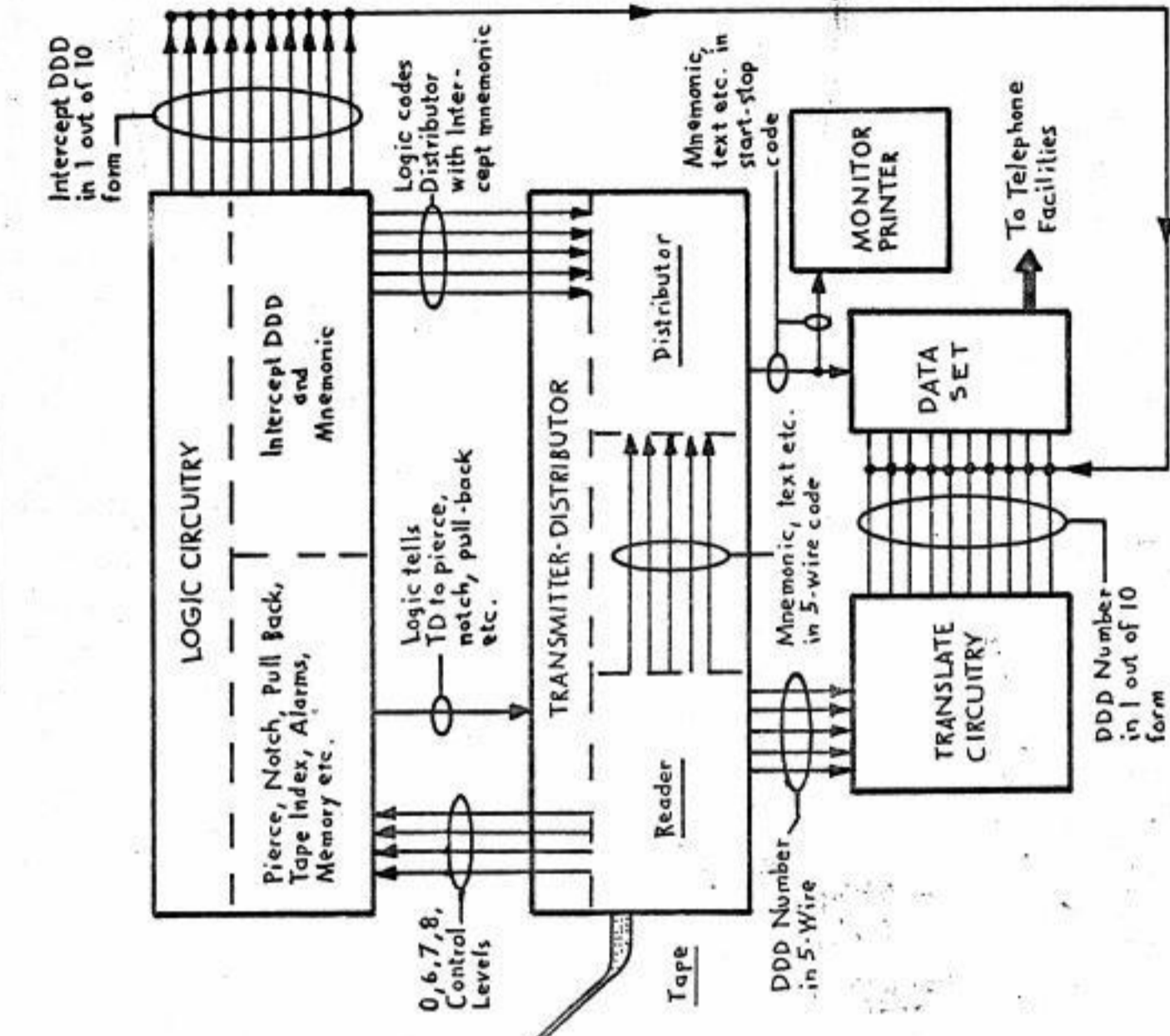
(Note A) In Detached Schematics

TABLE II-4

ACTUAL WIRING DIAGRAMS OF UNITS

<u>Description and Teletype Code</u>	<u>WD Number</u>
Electrical Service Unit, LESU56	4205WD
Electrical Service Unit, LESU58/256 & 58/257	4206WD
Electrical Service Unit, LESU57	4211WD
Keyboard, LAK20 (See LARP801)	4213WD
Pull Back Transmitter Distributor, LFXD1	4215WD
Pull Back Transmitter Distributor Base, LFXB1	4216WD
LCL1 24 Hour Timer	4218WD
Pivoted Head Card Reader, IRL	4222WD
TU LP18RA Stunt Box AGN	4227WD
TU LP80RA, 81 RA Stunt Box AGR, AGP, AGQ	4228WD
145486 Base Assembly, LBAC227	4229WD
144970 and 144980 S.O.P.	4230WD
Tape Printer Keyboard, LTPK1	4231WD
Page Printer Cabinet, LAC215	4234WD
Tape Printer, LTP	4235WD
Electrical Service Unit, LESU59/256 & 59/257	4219WD
LARP801 (See LAK20)	4136WD

MESSAGE PROCESSING



TAPE PREPARATION

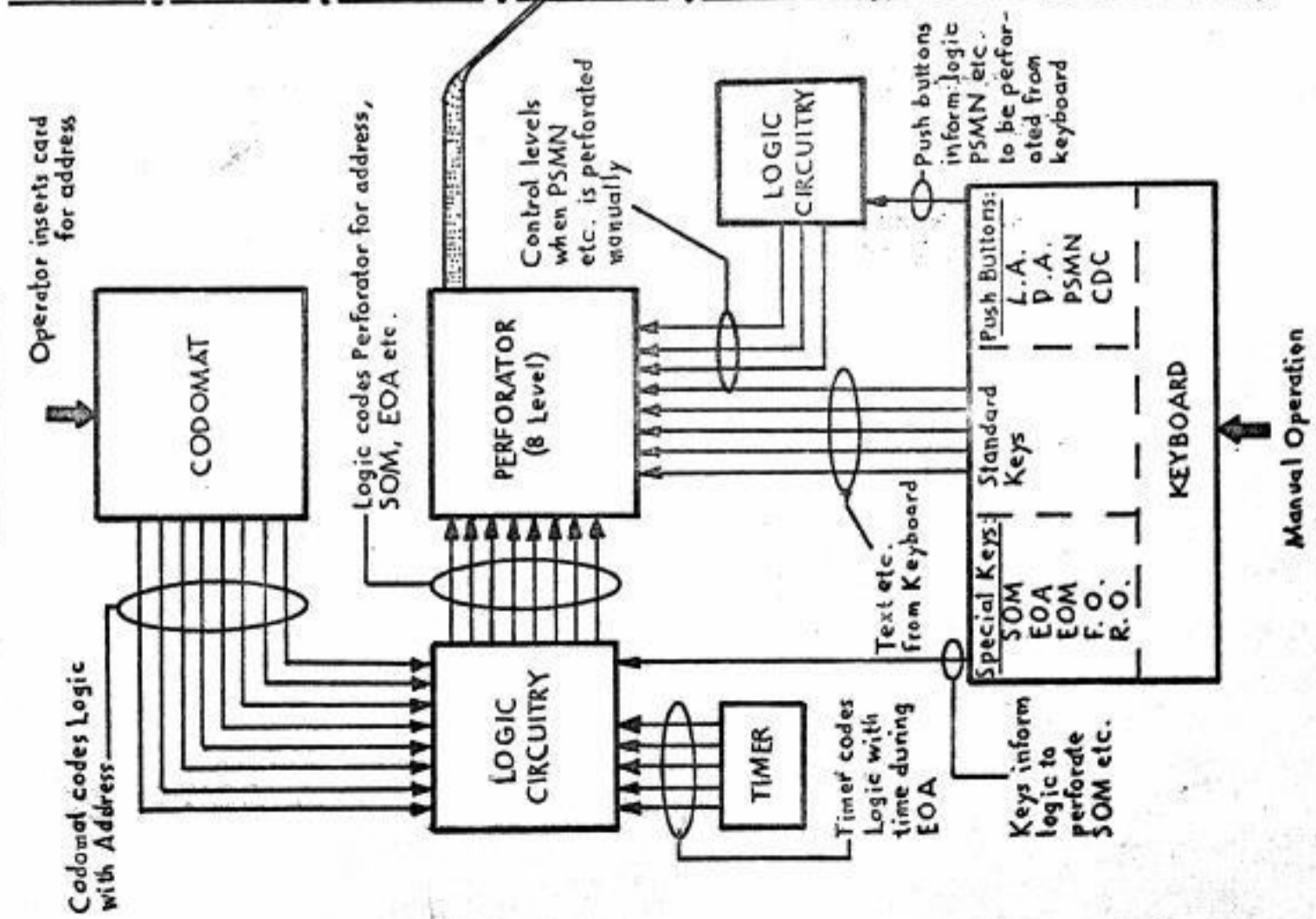


FIGURE II-1. BLOCK DIAGRAM - SENDING STATION

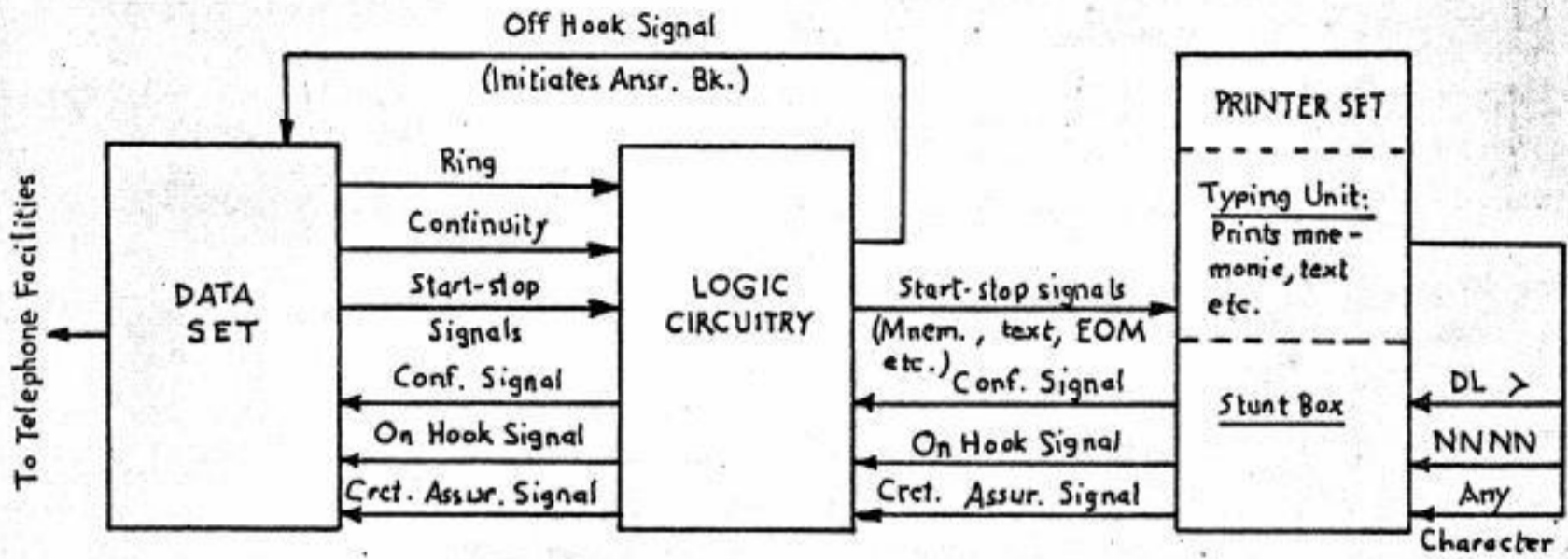


FIGURE II-2, BLOCK DIAGRAM - RECEIVING STATION

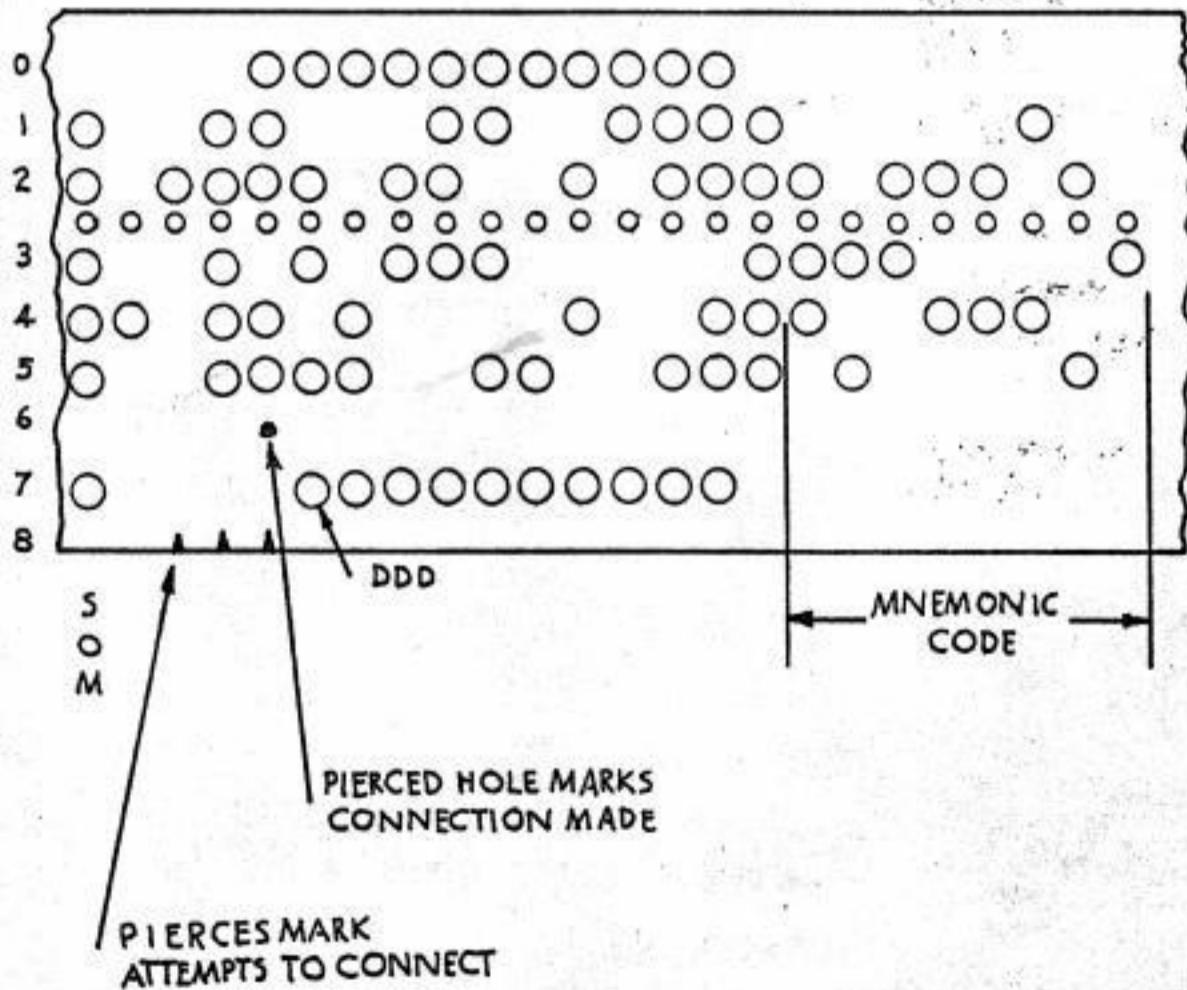


FIGURE II-3, TAPE

SECTION III

ADJUSTMENTS, SPECIAL REQUIREMENTS, AND LUBRICATION

A. ADJUSTMENTS

1. The adjustment procedure for the individual components in the send and receive sets is described in their respective specifications and bulletins listed in Table II-1. All components shall be properly adjusted and lubricated and shall conform to all the special requirements as specified in the individual publications before assembly into their respective cabinets. All standard Teletype adjustment procedures such as positioning of the keyboard, transmitter, printer, and reperforator; alignment of shafts; engagement of gears; fitting of cabinet parts; etc. shall be conducted for all Automatic Line Switching System equipment.

B. SPECIAL REQUIREMENTS

1. The following special adjustments must be met to insure optimum operation of the Automatic Line Switching System:
 - a. Printer Universal Contact Timing Adjustment
 - (1) The normally closed universal contact on the printers used in the Automatic Line Switching System shall have a spacing pulse length of 48 to 52 milliseconds at 100 WPM operation (356 to 386 DXD divisions at 100 WPM). The normally closed side of the universal contact Modification Kit 163146 is the side mounted toward the front of the printer.
 - (2) Adjustment procedure to cover the above requirement is described in Specification 6822S.
 - b. Alarm Panel (145250) See 4240WD
 - (1) The alarm panel includes a 45 second delay timer for message interruption alarms and an 11 second timer for dialing failure alarms. Setting the one potentiometer on the alarm panel will adjust both parts of the timing circuit.
 - (2) The timer adjustment shall be made as follows:
 - (a) Rotate the potentiometer shaft clockwise as far as it will go.
 - (b) Start a sample message tape correctly prepared with SQM, address, EOA, text, and EOM through the LFXD in the standard manner.
 - (c) Stop the LFXD on some number in the address. The time lapse between stopping the LFXD and the sound of the Dialing Failure Alarm should be greater than 15 seconds.

- (d) Reduce this time lapse by rotating the potentiometer shaft in the counter-clockwise direction until an 11 to 13 second time lag is obtained when the LFXD is stopped during dialing of a telephone number. The 11 and 45 second timers are now set.

c. Circuit Assurance - See 4240WD

- (1) The circuit assurance detector in the send set shall look for a nominal 50 millisecond incoming spacing pulse from the receive set during message transmission. The detector shall be adjusted to accept these incoming spacing signals from the receive set without setting off an alarm only if they fall within the limits of 35 to 65 milliseconds in length and are received at least once every 500 milliseconds. The alarm contacts in the dry reed relay pack (a part of the circuit assurance detector) shall close to initiate an alarm if the signal to the send set does not comply.
- (2) The adjustment procedure covering the above requirement is described in Specification 60,181S.

d. Transmitter Distributor

- (1) The oil reservoir on the transmitter distributor LFXD1 and LFXD2 must be filled upon installation of the unit on its base in the LAAC230.

2. Detailed Check Procedure

- a. This section contains test procedures for checking the operation of Automatic Line Switching System send and receive sets. The test procedures are arranged in the sequence to be followed if complete testing is to be performed. The following sub-paragraphs contain notes and precautions which apply throughout this section.

- (1) When clearing an alarm condition, the RESET push button shall be operated with the LFXD stop-run switch in the stop position and the tape either removed or in a blank position so that all circuits will be properly conditioned for transmission. (This is an operating precaution only.) After RESET, all red lamps on the key and lamp panel will be extinguished.
- (2) When placing a tape in the LFXD or repositioning the tape after an alarm condition, the blank leader or SOM control hole of the message tape must be placed over the sensing pins of the transmitter. If this is not done, the tape check alarm may be actuated.
- (3) The TIMER DISABLE key in the Alarm Panel shall be in the NORMAL position so that the 11 and 45 second timers will be effective in all checks (unless otherwise instructed).
- (4) The TRANSMITTER key on the key and lamp panel shall be in the NORMAL position for all tests (unless otherwise instructed).
- (5) The send set circuitry normally resets automatically after a message has been processed. Operation of the RESET push button is required to clear an alarm condition.

- (6) After each test is completed, return the STOP-RUN lever on the LFXD to the STOP position. Discard the used tape unless otherwise instructed.
- (7) The pierced holes made by the LFXD in the message tape shall be checked to insure that they have been properly inserted and sensed. The location of the pierced holes is indicated in Figures IV-1 and IV-2.
- (8) Throughout this section references are made to a correctly prepared test tape. See sample tapes illustrated in 4241WD. These are representative of the tape format only. For actual operation, the field maintenance man will have to prepare his own tape. The number and type of addresses and text to be used will have to be decided upon for the particular test and location of the equipment. To call a receive set located in the immediate area of the send set will be of help in servicing the equipment. The printer copies shown in 4241WD-D section are for the illustrated tapes. Since the field maintenance man's tape will not be punched identically with the illustrated tapes, only the printer copy formats should be compared. The results given in this section are for normal equipment operation.

b. Tape Preparation Test

(1) Equipment Tested

- (a) Codomat, LRL
- (b) Clock, LCL
- (c) Keyboard, LAK20
- (d) Reperforator, LARP801
- (e) Tape Preparation Panel

- (2) Operate the master power switch on the LESU56 and the power switch at the front of the send cabinet to the "ON" position.
- (3) Keyboard Push Button Function Checks - Prepare tapes as directed and compare with corresponding segments of 4241WD-D6 and D7.

- (a) Local area telephone number (compare control levels only - 0,6,7)

1. Depress Local Area button.
2. Depress Figures Key 1 time.
3. Depress Blanks Key 10 times.
4. Depress Letters Key 1 time.

- (b) Distant area telephone number (compare control levels only - 0,6,7)

1. Depress Distant Area button.

2. Depress Figures Key 1 time.
 3. Depress Blanks Key 10 times.
 4. Depress Letters Key 1 time.
- (c) Pseudomnemonic (compare control levels only - 0,6,7)
1. Depress PSMN button.
 2. Depress Blanks Key 10 times. (Only 8 holes will be punched in the eighth level of the tape).
 3. Depress PSMN button.
 4. Depress Letters Key. (Only 1 hole will be punched in the seventh level of the tape until the PSMN button is reoperated).
- (d) Call Directing Code (compare control levels only - 0,6,7)
1. Depress CDC button.
 2. Depress Blank Key 3 to 10 times.
 3. Depress Letters Key
- (e) Start of Message
1. Depress SOM Key.
- (f) End of Address
1. Depress EOA Key.

NOTE: The mnemonic code will vary per the station on test and the time will vary per the setting of the clock.

- (g) End of Message

1. Depress the EOM Key.

NOTE: Depending respectively whether the tape preparation panel is wired per the "P" or "N" options, EOM will be either letters, CR, six LF, and four N's or CR, LF, Figures, V, letters CR, six LF, and four N's. The accompanying control level code holes are indicated in 4241WD-D6 and D7.

(h) Rubout and Backspace

1. Depress Rubout key approximately 30 times.
2. Depress Backspace key 30 times.
3. Depress Rubout key approximately 10 times.
4. Check to see that the first two characters reperfored do not have an elongation of greater than $\pm .010$.
(See Specification 60,048S).

(i) Local Carriage Return

1. Depress Local CR key and check to see that the typing unit resets to the left margin.

(j) Local Line Feed

1. Depress Local LF key and check to see that the typing unit feed paper out.

(4) Preparation of a Standard Message Using the Codomat

- (a) Depress the feed out key until about 8" of tape is fed out.
- (b) Depress SOM key.
- (c) Select one or more Codomat cards with distant or local telephone numbers and pull them successively down into the reading head of the Codomat. (Pull only one card into the reader at a time and wait for its automatic ejection before pulling down another card or operating the keyboard).
- (d) After all addresses have been punched in the tape, depress the EOA key.

NOTE: The time punched in the tape must agree with the time shown in the clock windows.

- (e) Perforate the Text from the keyboard. The text will always be started off by keyboarding carriage return and line feed into the tape immediately after EOA.
- (f) Depress the EOM key.
- (g) Feed the tape out of the punch by depressing the feed out key.
- (h) Check the tape prepared with the samples tapes illustrated in 4241WD-D6 and D7.

- (1) Run the prepared tape through the LFXD and check the monitor and receiving printers copies. The monitor copy will be the same as the receive copy on the first transmission and will contain only the called address mnemonic code on each successive transmission of the message after the first.
- (5) Depress any one of the four red push buttons on the keyboard - Local Area, Distant Area, PSMN or CDC. This will disable the remaining three push buttons and also the SOM, EOA, EOM, Feed-Out, and Rubout keys on the keyboard. Repeat for all three push buttons.

c. Message Processing Test

- (1) Operate the master power switch on the LESU56 and the power switch at the front of the send set cabinet to the "ON" position.
- (2) The timer switch in the Message Processing Panel shall be thrown to the "Normal" position.
- (3) With the LFXD Stop-Run switch in the "stop" position, press the "Reset" button on the send set key and lamp panel.
- (4) Insert a test message tape correctly prepared with SOM, addresses, EOA, TEXT, and EOM into the LFXD by placing its leader under both tape lids. Move the ST-Run switch on the LFXD to the "Run" position.
- (5) The tape will be advanced until the first "letters" combination is read in SOM. The lower feed wheel will then be stopped and the excess leader tape will be run out of the transmitter by the upper feed wheel activated by the run-out magnet until the tape becomes taut between the upper and lower feed wheels. The taut tape trips off the tight-tape lever on the upper tape lid de-energizing the run out magnet. The upper feed wheel will then be latched due to the de-energization of the run out magnet. In the latched position, the carriage return character of the SOM sequence will be directly over LFXD sensing pins.
- (6) The tape will be advanced in normal fashion while searching for the first unsent address. When detected, the sending station will go off-hook and present the address to the Data Set 154A1 one digit at a time to establish a connection. While presenting the complete telephone number, the tape will be marked (edge pierced) in line with the Figures character immediately preceding the dialed number to record the attempt.
- (7) Upon receiving the answer back to the phone number, the LFXD will read and transmit the mnemonic of the dialed number. After the Space character of the transmitted mnemonic, transmission will be stopped while the send set awaits confirmation of the sent mnemonic code from the terminating station. A terminating station will confirm only mnemonic code which contains the

customer designation set up in the receiving printer stunt box, therefore receipt of confirmation indicates that a station with the correct customer designation has been reached. The monitor printer as well as the receiving printer will have printed the sent mnemonic code. Confirmation is recorded in the tape by piercing a hole at the sixth level.

- (8) The tape will be pulled back to the reference position after confirmation is recorded, and the LFXD will transmit all five level coded information without control codes in the zero, six or seven levels including all regular mnemonics, EOA, Text and EOM. When dialing addresses containing pseudo-mnemonic codes and CDC's, pull-back will not occur immediately after confirmation to the pseudomnemonic code. In this case the tape will be stepped along immediately after confirmation, and all five level coded information which has a six level control code will be transmitted until either a new addressee's telephone number or EOA is read. The CDC's which are marked by the six level code holes are thus transmitted at this time and then the tape will be pulled back as indicated above for transmission of all regular mnemonics, EOA, Text and EOM.
- (9) In a multiple address tape, the tape will be pulled back after transmission of the four N's of the EOM until either all addressees have been successfully reached and received the entire message within three attempts or the message has been delivered to intercept within six attempts. Upon this pull back operation immediately following EOM, operation reverts to paragraph c.(6) above.
- (10) On the last pass through the tape, the storage circuitry of the send set which records that there is or is not an uncalled address remaining in the tape, will find a six level pierce with each address indicating that confirmation has been received from all addressees. The tape will not be pulled back when EOM is reached. The message processing circuitry, having recorded that there are no more uncalled numbers will cause the transmitter to step the tape on, in search of a new message and operation reverts to paragraph c.(5). If instead an end of tape is sensed, the torn tape light will come on and the LFXD will be stopped. Similarly, if the tape becomes taut between the punch and transmitter and actuates the tight-tape lever, the transmitter will be stopped.
- (11) Move the ST-RUN switch on the LFXD to STOP. This will extinguish the torn tape light, if lighted. Remove the tape from the transmitter.
- (12) For a multiple address tape, the send set printer will copy the complete message on the first transmission only. On succeeding calls, only the called station mnemonic (and related

CDC's if it is a pseudomnemonic) will be printed in the send set copy.

(13) Check complete operation per 4241WD.

d. Intercept Dialing Test (No Confirmation)

- (1) Block the CFR relay in the Message Processing Panel in the unoperated position. This will prevent piercing of the tape in the six level which normally occurs upon confirmation.
- (2) The timer switch in the Message Processing Panel shall be operated to the "Normal" position.
- (3) With the master power switch on the LESU56 and the power switch at the front of the send set cabinet in the "ON" position and with the LFXD switch in the "Stop" position, press the "Reset" button on the send set key and lamp panel.
- (4) Insert a standard message tape under both lids of the LFXD and move the LFXD "ST-RUN" switch to the "RUN" position. The tape will be advanced until the first "letters" combination is read in SOM. The lower feed wheel will then be stopped and the excess leader tape will be run out of the transmitter by the upper feed wheel activated by the run out magnet until the tape becomes taut between the upper and lower feed wheels. The taut tape trips off the tight-tape lever on the upper tape lid de-energizing the run out magnet. The upper feed wheel will then be latched due to the de-energization of the run out magnet. In the latched position, the carriage return character of the SOM sequence will be directly over the LFXD sensing pins.
- (5) In processing the tape, the LFXD will advance the tape in search of the first unsent address. When detected, the station will go off-hook, and present the dial number to the Data Set 154A1 one digit at a time to establish the connection. The tape is pierced in the eighth level to record the first attempt.
- (6) Upon receiving answer back, the LFXD will read and transmit the mnemonic code of the dialed number. After the "space" character at the end of the mnemonic, transmission will stop and the send set will await confirmation from the terminating station. Due to the block on the CFR relay, the tape will not be pierced to indicate that the correct connection was made. Also the send set circuitry will not be able to respond to the receipt of confirmation.
- (7) The 11 second timer will time out, the sending station will go "on-hook", and the LFXD will step the tape on in search of the next address. Operation will be the same and confirmation will not be recognized. When EOA is sensed, the tape will be pulled back and stepped along by the LFXD in search of a new

un-confirmed address. The process of calling and not recognizing confirmation will continue until each addressee is marked with three edge pierces indicating three attempts to call. The second and third pierces at the edge of the tape in response to the second and third answer back to the same address will be one and two characters respectively to the left of the first edge pierce.

- (8) On the fourth (through the ninth) attempt to process a message for the same address, the send set will dial the number of Intercept. The monitor and receiving printers will copy INCPTAB (the AB is substituted for the customer designation. i.e., DL - Delta Airlines, UA - United Airlines, etc.) Since the CFR relay remains blocked, confirmation will not be recognized and the 11 second timer will time out.
- (9) Intercept will be dialed a total of six times and after the last 11 second time out, the "Intercept Not Reached" alarm lamp will light; the buzzer will sound; and the transmitter will be stopped. After this test, return the LFXD switch to the stop position. Remove the block from the CFR relay. Press the reset button with tape removed from the LFXD to clear the alarm condition. Save the tape for the next test procedure.

e. Intercept Dialing Test (No Answer Back)

- (1) Block the ABR relay in the unoperated position.
- (2) Send the tape saved from the above test (containing three (3) eight level pierces per addressee, but no six level pierces) through the LFXD.
- (3) The Intercept station will be dialed but the send set will not recognize answer back due to the ABR relay block.
- (4) The 11 second timer will subsequently cycle the INSS rotary switch in an unsuccessful attempt to reach intercept. After six attempts, the alarm buzzer will sound; the intercept not reached lamp will go on; and the LFXD will be stepped.
- (5) Return the LFXD switch to the stop position. Remove the ABR relay block. Press the reset button with the tape removed to clear the alarm condition. Save the tape for the next test procedure.
- (6) During this part of the Intercept Test, the monitor and receiving printers will print nothing, and the tape will not receive any additional pierce holes.

f. Intercept Dialing Test (Completion)

- (1) With no relays blocked, send the tape saved from above through the LFXD.

- (2) The monitor will print INCPTAB, the number of the trouble addressee, and the mnemonic code of the trouble addressee. The tape will be pulled back and the mnemonic codes of all addressees will be printed followed by EOA, the text, and EOM. If other addresses are included on the tape, it will be pulled back for retransmission. The group of mnemonics, EOA, text, and EOM will not appear in the monitor copy after the first connection, but the INCPTAB, trouble number and associated mnemonic code will be printed on the monitor copy each time Intercept is called.
- (3) Remove the processed tape upon completion of the test.

g. Alarms and Special Functions

- (1) Message Interrupted (45 second delay timer)

To Check: Start a correctly prepared test message tape using the procedure outlined in the Message Processing Test. Stop the message transmission during the text by moving the LFXD switch to the Stop position. After about 10 seconds move the switch back to the Run position. Transmission will resume with no misprint. Move the LFXD switch back to Stop again. After 45 to 60 seconds, the Message Interrupted Lamp will light and the alarm buzzer will sound.

- (2) Dialing Failure Test (11 second timer)

To Check: Start a correctly prepared test message through the LFXD and stop the LFXD by moving its switch to the Stop position during sensing of the telephone number. The Dialing Failure alarm lamp and the alarm buzzer will come on after 11 to 13 seconds time out. Actuate the Alarm Cut-Off key. Open the tape lid and press the Reset button. The Dialing Failure lamp will be extinguished but the Tape Check lamp may light. Press the Reset button again. There will be no print out on either the monitor or receiving printers. (Note the Dialing Failure alarm may arise only during the dialing procedure). The 11 to 13 second time delay length may be varied as described in Section III by adjusting a potentiometer in the Alarm Panel of the send set. Adjustment to 11 to 13 seconds also adjusts the 45 to 60 second timer.

- (3) Tape Check Tests

- (a) Omission of SOM - Start a test tape correctly prepared except for the omission of SOM through the LFXD. The transmitter will stop after reading the first 0-7 control hole combination, and the Tape Check lamp and alarm buzzer will come on. Operate the Alarm Cut-Off key. The monitor and receiving typing units will not print. Open the tape lid and press the Reset button. The Tape Check lamp and alarm buzzer may come on again. Press the reset button again.
- (b) Omission of Address - Start a test tape correctly prepared except for the omission of all addresses through the LFXD. The transmitter will stop after reading the EOM; and the Tape Check alarm lamp and the alarm buzzer will come on. The monitor and receiving printers will not print.

- (c) Omission of EOA - Start a test tape correctly prepared except for omission of EOA through the LFXD. The Tape Check lamp and alarm buzzer will come on at EOM and the LFXD will stop. The monitor and receiving printers will print the address and the message text only.
- (d) Reinsertion of Sent Tape - Start a correctly prepared tape which has been completely processed through the LFXD. The monitor and receiving printers will not print and the LFXD will stop on EOM. The Tape Check lamp and alarm buzzer will come on.
- (e) Omission of EOM - Start a test tape correctly prepared except for the omission of EOM through the LFXD. The LFXD will stop and a combination of Tape Check and Connection Lost or Torn Tape lamps and the alarm buzzer will come on when any of the following is sensed.

1. End of tape.
2. SOM of next message.

The monitor and receiving printers will print the entire message except EOM.

(4) Miscellaneous DDD Errors

- (a) Less Than Ten Digits - Start a test tape which has a nine digit phone number instead of ten through the LFXD. The transmitter will stop after reading the letters character immediately following the phone number, and the Tape Check lamp and buzzer will come on. The monitor and receiving printers will not print.
- (b) More Than Ten Digits - Start a test tape which has an eleven digit phone number instead of ten through the LFXD. If the first ten digits are a legitimate number, the operation will be normal through dialing, answer back, confirmation and tape pull-back, but during transmission of mnemonic codes after this first pull back, the sixth level confirmation pierce misplaced due to the eleventh digit will be read in the wrong position. The LFXD will stop and the Tape Check and Connection Lost lamps and the alarm buzzer will come on.
- (c) Nine Character Mnemonic Code - A tape having a nine character mnemonic code will result in the same failure as above for the eleven digit telephone number if the last three characters conform to the customer designation - i.e., DL>, UA>, AA> etc.
- (d) Seven Character Mnemonic Code - Start a test tape which has a seven character mnemonic code instead of eight through the LFXD. The tape will be processed in the normal manner and will be pulled back after EOM. On the

second pass, the LFXD will dial, pull back and stop after reading the 6 and 8 level pierce holes without a \emptyset level pierce. The 6 level confirmation pierce was misplaced as a result of omitting the eighth character of the mnemonic code. The Tape Check and Connection Lost lamps and buzzer will come on. The monitor and receiving printers will print out the message and show the short mnemonic code.

(5) Connection Lost Tests

(a) Circuit Assurance Alarm - Start a correctly prepared test tape through the LFXD. During transmission of the message test, remove the plastic cover of the REC relay of the LESU57. Block the relay in either position. After a 500 millisecond ($\frac{1}{2}$ second) time lapse, the Connection Lost lamp and buzzer will come on. Printing on the monitor and receiver will be normal up to the time of failure.

(b) Loss of Answer Back - Start a correctly prepared test tape through the LFXD. After the dialing operation is completed and answer back is received manually move the ABR relay swinger to the unoperated position. The Connection Lost lamp and buzzer will come on.

(6) Torn Tape

(a) On Hook Condition - Run a blank tape through the LFXD. The LFXD will continue to operate until the length of tape has cleared the tape out pin, at which time the LFXD will stop and the Torn Tape lamp will come on. The buzzer will not sound.

(b) Off Hook Condition - Run a correctly prepared test tape with the EOM torn off through the LFXD. When the tape out pin senses the tear, the LFXD will stop; the Torn Tape, Connection Lost, and Tape Checks lamps, and the buzzer will come on.

(7) Transmitter Step Switch (Used for trouble shooting only)

(a) This switch, located in the Message Processing Panel, will step the LFXD one character at a time after the circuitry has been Reset, and with the Stop-Run switch of the LFXD in the Stop position.

(8) Timer Disable Switch (Used for trouble shooting only)

(a) This switch, located in the Message Processing Panel, disables the 11 and 45 second timers and circuit assurance. It is placed in the disable position only when trouble shooting. Its action shall be checked by

running tests g(1), g(2), and g(5)(a) above with the Timer Disable switch in the disable position.

- (b) In test g(1), the message will be continued without any error after the Stop-Run switch has been returned to the Run position after a 75 second wait.
- (c) In test g(2), the LFXD will stop immediately after sensing the error, but the Dialing Failure lamp and the buzzer will not be actuated after a 15 second wait.
- (d) In test g(5)(a), circuit assurance is inoperative and the set will operate normally.
- (e) Upon completion of the test, return the Timer Disable switch to the Normal position.

(9) Transmitter Key

- (a) This key, located on the send set key and lamp panel, has four positions with functions as listed below.
 - 1. Normal - Used for standard sending operations.
 - 2. Stop For Priority - If moved to this position during the sending operation, the LFXD will stop after sensing the last character of the EOM code. No pull back in search of a new address will occur. If moved to this position before transmission has started, delivery of the message will be made to one destination only.
 - 3. Hold - In this position the LFXD will stop on EOM after delivery of the message to all addresses.
 - 4. Monitor - In this position the monitor prints the five level Baudot coded intelligence read by the LFXD as long as the "Reset" key is held depressed. This is a tape intelligence checking device which does not transmit the information to the line, and does not check control code holes. The Reset button must be held down during this check.

(10) Call Telco

- (a) To call the serving test center (STC), the Call Telco key will be operated.
- (b) Operation of this key will cause all timers to be disabled on receipt of answer back. Operation of the key will also disable the torn tape alarm #6 and #8 level piercing magnets, and circuit assurance. Operation of the key also connects the typing unit of the send set

to the receiving loop of the sending station until the station goes "on-hook".

- (c) Place a test message tape correctly prepared except for omission of EOM into the LFXD. This tape must contain the DDD number of the STC station.
- (d) Operate the Stop-Run switch of the LFXD to the Run position.
- (e) The LFXD will handle the tape in the normal manner. It will keep redialing the number until it receives an answer back at which time the timers will be disabled.
- (f) The LFXD will automatically send the mnemonic code of STC and will stop for confirmation. The LFXD will then wait indefinitely for receipt of confirmation since all timers are disabled.
- (g) STC send back confirmation.
- (h) The send set sends the message to STC until tight tape or end of tape is reached or until the send set operator moves the LFXD switch to the Stop position.
- (i) STC may instruct the operator to operate the XMSN test key to "loop back" the Data Sets 154A1. Under this condition, the send set printer is conditioned to receive a message from the serving test center. This feature may be tested by instructing the STC to transmit "figures" and "S" characters causing the send set bell to operate.
- (j) STC instructs the sending station being tested to restore XMSN key to normal.
- (k) Send set operator inserts the tape with EOM into the LFXD and as the LFXD reads and transmits EOM, it causes the send set circuitry to go back "on-hook".
- (l) The EOM or operation of the Reset button shall cause the Call Telco relay to release and return the logic circuitry to normal.

(11) No Answer Back Test (11 second timer)

- (a) Block the ABR relay in the unoperated position. Run a correctly prepared test message tape through the LFXD in the normal manner. The first address will be dialed, but because answer back cannot be recognized, the send set will wait for the 11 second timer to time out and it will then step the tape to the second address. This procedure will repeat for the entire number of addresses on the

tape. After several dialing attempts, remove the ABR relay block and the tape will then be processed normally.

(12) No Confirmation Test (11 second timer)

- (a) Block the CFR relay in the unoperated position. Run a test message tape through the LFXD in the normal manner. During the course of normal operation, the LFXD will pause immediately after sending the dialed address' mnemonic code. Since the send set circuitry cannot respond to confirmation, the 11 second timer will time out; the send set will go back "on-hook"; and the LFXD will step the tape on in search of the next address. The called station mnemonic code will be printed on the monitor copy. After several attempts, unblock the CFR relay and allow the tape to be processed in the normal manner.

(13) Tight Tape Operation Test

- (a) Prepare a test tape according to the standard format with only one address and using the keyboard of the send set on test. Do not tear the tape off the LARP after EOM is punched and do not depress the feed out key.
- (b) Start the tape through the LFXD. The tape will be processed until the tight-tape between the LARP and the LFXD has lifted the Tight-Tape Arm of the LFXD causing it to stop. No alarm will be actuated unless the condition is maintained for a sufficient length of time to actuate the 45 second message interrupted timer. Operate the keyboard one character at a time to feed out enough tape for EOM of the tape to clear the LFXD sensing pins. The print out on the monitor and receiving set printers will be normal with no error introduced as a result of the low speed operation.

(14) Reset Button (Located on the Send Set Key and Lamp Panel)

- (a) Since the send set is reset preceding and following all tests, it is not necessary to test this operation separately.
- (b) Proper operation of the Reset key requires that the Stop - Run switch of the LFXD is in the Stop position and that either no tape is in the reader or a blank will be read.

(15) Manual Resend Test

- (a) Prepare a tape with two separate test messages.
- (b) With the send set circuitry Reset, place the tape under the two tape lids of the LFXD such that the text portion

of the first message is over the transmitter's sensing pins. Close the lids.

- (c) With the Stop-Run switch of the transmitter remaining in the Stop position, push the Manual Resend button on the Key and Lamp Panel and hold it depressed until the LFXD stops. The transmitter will step the tape past the EOM of the first message and continue until SOM of the second message is read. Then the LFXD will stop. Release the Manual Resend button. No alarm will sound.
- (d) Open the tape lid over the LFXD sensing pins and reposition the tape to the address that is to be called again. In repositioning the tape, make certain that the first character of the address, not the figures character is placed over the sensing pins. Close the lid and move the Stop-Run switch to the Run position. The LFXD will then function normally to dial and send the message to the address in question. If there are unsent addresses on the tape, these will be dialed and sent in the usual manner. The monitor and receiving set printers will follow the normal pattern.

(16) XMSN Test

- (a) The transmission test key located on the LESU57 of the send set is operated to apply a ground to terminal A-36 of the send station and pull up the T relay in the sending portion of the Data Set 154A1. The XMSN test key is to be operated only upon direction of the serving test center (STC).

(17) Bell Signal

- (a) Prepare a test tape according to the standard format with some upper case S's ("figures", SSS... etc.) in the message text.
- (b) When this tape is transmitted, the bell on the Main Distribution Panel of the send set and the bell on the shelf of the receive set will sound during the time the upper case "S's" are being read. The printers do not print while the bell is ringing.
- (c) Operation of the send set signal bell alone may be checked by running a tape with upper case S's through the LFXD with the transmitter switch in the monitor position and the Reset button depressed. The bell will sound whenever an upper case S is read.

(18) TU Interchange (Option)

- (a) By operating the TU Interchange key in the receive set, the receive set printer will be electrically replaced by

an associated send set printer. The PS cable must be connected from the send to the receive set. This will allow an operation such as replacing paper in the receive set without turning away incoming traffic.

(19) Paper Out Switch

- (a) Remove the paper from a receiving set printer. The yellow busy lamp will go on in the receiving cabinet and no new messages will be received. A message in process will be received through EOM (NNNN) before the busy lamp comes on. Replacing the paper will extinguish the busy lamp and the receive set will accept incoming messages again.
- (b) In stations containing the typing unit interchange option, removal of the paper from the send set printer which is accepting the incoming messages of a receive set will also cause the yellow lamp in the receive set to light immediately or upon completion of a message in process. No new messages will be accepted and operation can be restored to normal by replacing paper.

(20) Busy Lamp (Receive Set)

- (a) With the power on and with no incoming message, operate the Busy key in the receive set. This will cause the yellow Busy lamp on the receiver to light. The receive station is made busy and no traffic will be received. Return the busy key to the normal position.
- (b) While the receive set is receiving a message, operate the Busy key. The incoming message will be received through EOM. As soon as the receive set goes "on-hook", the Busy lamp will light and the station will not accept new incoming traffic.

(21) XMSN Test

- (a) The transmission test key in the receive station provides a ground to terminal A-32 of the receive set and pulls up the T relay in the receive portion of the Data Set 154A1. The XMSN Test Key will be operated only upon direction of the serving test center (STC).

(22) Maintenance Switch Test (Receive Set)

- (a) With the maintenance switch in the "Normal position, the copylights will be operated by the receive set, Off-On switch at the front of the cabinet.
- (b) With the maintenance switch in the "Off" position, the copylights will not light.

- (c) With the maintenance switch in the "Maintenance On" position, the copy lights will light and remain on as long as the cabinet A.C. power cable is plugged into a live outlet.

c. Lubrication

1. The specifications and bulletins listed in Figure II-1 include lubrication of the various components of Automatic Line Switching System. All units shall be lubricated in conformance with these specifications.
2. Special lubrication points are indicated below:
 - a. Stepping Switches
 - (1) The relay panels mounted in the lower compartment of the send set contain a total of five stepping switches. These stepping switches (LNSS in the Message Processing Panel, INSS in the Intercept Panel, CCSS and EASS and SESS in the Tape Preparation Panel) require periodic lubrication due to their mechanical operation. Failure to lubricate these switches could result in their destruction.
 - (2) Lubrication Bulletins, number 11 and 15, issued by Automatic Electric Company; Northlake, Illinois; U.S.A., supply the necessary lubrication information.
 - (3) Parts and lubrication information on stepping switches is available in BSP 026-720-701 and BSP 026-720-801.

SECTION IV

MANUFACTURING INFORMATION

A. GENERAL

1. All units shall be manufactured in accordance with released prints, bills of material, wiring diagrams, engineering specifications, and bulletins.
2. The units shall withstand a 500 volt DC breakdown test between their respective terminals and frame.
3. All screws and nuts shall be tight and free from burrs. Springs shall be securely anchored.
4. All parts shall be free from corrosion.
5. All soldered connections shall be tight and free from corrosion.
6. All moving parts shall be free of binds.
7. The wiring shall conform to applicable wiring diagrams.

B. DETAILED

1. Assembly

- a. Refer to Bulletin 250B for assembly of Automatic Line Switching System send set components into their respective cabinets.
- b. Assembly of the Automatic Line Switching System single receive only set is not complex and is similar to assembly of other RO sets. Refer to Bulletin 217B.
- c. Assembly of the three level receive only cabinet and equipment used in the Automatic Line Switching System is described in 60088S. A pictorial description of Automatic Line Switching System RO components and their arrangements in the single and three level cabinets is given in 4242WD and 4243WD.

C. TEST REQUIREMENTS

1. Standard

- a. Perform the regular factory inspection procedure of lamping out wiring, checking wiring color codes, and determining that the quality is in accordance with Teletype standards.
- b. Since Teletype is acting as the Western Electric Distributing House for the Automatic Line Switching System Teletypewriter Equipment, functional tests in all phases of operation should be made to determine that operation is consistent with its description in the Wiring Diagrams 4240WD, 4241WD, 4242WD and 4243WD. The

specifications and bulletins applicable to the system components are listed in Table II-1.

2. General Test Information

- a. In the functional tests indicated below, it is important to note that the "RESET" push button must be actuated every time a tape is repositioned in the LFXD so that all circuits will be properly conditioned for transmission. This is an operating precaution only. After "RESET", all red lamps on the key and lamp panel will be out.
- b. When placing a tape in the LFXD or repositioning the tape after an alarm condition, the blank leader of the message must be placed over the sensing pins of the transmitter. If this is not done, the tape check alarm may be actuated.
- c. The "TIMER DISABLE" key shall be positioned to "Normal" so that the 11 second and 45 second timers will be effective in all checks, unless otherwise instructed.
- d. The "TRANSMITTER" key shall be positioned on "NORMAL" for all tests, unless otherwise instructed.
- e. The Send Station circuitry normally resets automatically after a message has been processed. Operation of the "RESET" push button is required to clear out an alarm condition. Reset shall be accomplished with no tape in the reader and with the Stop-Run lever of the LFXD in the "STOP" position. Tape can then be placed in the reader.
- f. After each test has been completed, the Stop-Run lever of the LFXD shall be moved to "STOP" and the used tape discarded unless otherwise instructed.
- g. This test procedure has been written for operation with a minimum table top test set up which includes an Originating Station, a Simulator for a data set and #5 central office, and a terminating station. When a data set and its associated equipment is used in the test set up, the results of certain test phases may vary in accordance with explanatory notes in the procedure. In particular, it should be remembered that when the data set and #5 central office simulator is conditioned to recognize only distant area dial numbers for transmission, local area dial numbers will be sent to intercept. Unless otherwise noted in this procedure, set the simulator to operate on local area dialing. Changes in procedure to accommodate testing with a Data Set 154A1 and a #5 central office simulator are designated by a (#) sign.
- h. Piercing of the tape by the LFXD shall be observed to insure that all pierces are properly inserted and sensed. The location of the pierces is indicated on drawings on Test Tape No. 1. The sixth

level pierce is shown as a square with a 6 marked in it. The eighth level pierce is shown as a half square with an 8 marked in it. For satisfactory operation, test tapes must be accurate with respect to the ten characters - per-inch requirement.

- i. Special test equipment which is used in the various tests is indicated below:
 - (1) Simulator TT-1746 - Used for local transmission testing. Simulates the functions of the data set and #5 central office equipment.
 - (2) Codomat Simulator XT-1762 - A special connector permitting use of a send set without a codomat. The send set will not prepare message tape if it does not have a codomat or a codomat simulating connector connected into its circuitry.
 - (3) Clock Simulator XT-1763 - A special connector which will simulate the clock operation. The send set will operate without either a clock or its simulator, but four blanks will be left in the end of address function where the time of day would normally appear.
 - (4) Western Electric, #166A1 Station Test Set.
- j. The send set shall be finally tested with a Data Set 154A1 and a #5 central office simulator. The following functional tests are required in this phase of testing:
 - (1) Ten Holes to the Inch
 - (2) Message Processing Test
 - (3) Intercept Alarm Test (See No Confirmation Test)
 - (4) Message Interrupted
 - (5) Dialing Failure (See Call Telco Test)
 - (6) Transmitter Key, Stop for Priority
 - (7) Transmitter Key, Monitor
 - (8) Busy Lamp
 - (9) No Confirm Test
 - (10) Circuit Assurance Failure
 - (11) Miscellaneous DDD Errors (11 Digit Phone Number)
 - (12) XMSN Test
 - (13) Manual Resend
 - (14) TU Interchange (PS) Test (When applicable)
 - (15) Call Telco Test

3. Detailed Test Information

- a. This section contains test procedures for checking Automatic Line Switching System outlying station teletypewriter equipment. The test procedures are arranged in the sequence to be followed if complete testing is to be performed. A directory to the alarms and special functions covered is indicated below:

NOTE: The customer designation (DL shown in this specification) must be replaced in actual testing with the two letter designation coded into the units being tested.

(1) Directory to Alarms and Special Functions

- (a) Message Interrupted (45 second delay timer)
- (b) Dialing Failure Test (11 second delay timer)
- (c) Tape Check (EOA omitted)
- (d) Connection Lost (Loss of Answer Back)
- (e) Intercept Alarm Test (Intercept not reached)
- (f) Torn Tape

- 1. On-hook
- 2. Off-hook

- (g) Transmitter Step Switch
- (h) Timer Disable Switch
- (i) Transmitter Key
- (j) Call Telco (See Item No. 26)
- (k) Busy Lamp
- (l) Bell Signal
- (m) No Confirm Test (11 second delay timer)
- (n) No Answer Test (11 second delay timer)
- (o) Circuit Assurance Failure
- (p) Miscellaneous DDD Errors

- 1. 9 digit phone number
- 2. 11 digit phone number
- 3. 9 character mnemonic
- 4. 7 character mnemonic

(q) Miscellaneous Format Errors

- 1. SOM omitted
- 2. DDD omitted
- 3. EOA omitted
- 4. ECM omitted

- (r) 11 Second Delay Timer Adjustment
- (s) No Paper Switch Test
- (t) Tight Tape Test
- (u) Reset Button
- (v) XMSN Test

- 1. Without data set
- 2. With data set

- (w) Manual Resend
- (x) Maintenance Switch Test
- (y) PS Test
- (z) "Call Telco" Test

b. Tape Preparation Test

(1) Equipment TESTED

- (a) CODOMAT, LRL
- (b) CLOCK, LCL
- (c) LAK20
- (d) LARP801
- (e) Tape Preparation Panel

(2) Power Switch On
Motor Switch On

(3) Keyboard Push Button Function Checks. Compare Tapes.

- (a) Depress Local Area and Figs. Button and repeat "Blanks". Clear with "Letters". See Figure IV-la.
- (b) Depress Distant Area and Figs. Buttons and repeat "Blanks". Clear with "Letters". See Figure IV-lb.
- (c) Depress PSMN (Pseudomnemonic) Button and repeat "Blanks". Clears automatically after Eight characters are perforated. See Figure IV-lc.
- (d) Depress CDC (Call Directing Code) Button and repeat "Blanks". Clear with "Letters". See Figure IV-ld
- (e) Depress SOM (Start of Message) Button. See Figure IV-le.
- (f) Depress EOA (End of Address) Button. NOTE: The mnemonic Will vary per requirements and The time will vary as the clock Changes. See Figure IV-lf.
- (g) Depress EOM (End of Message) Button. See Figure IV-lg.
- (h) Depress Rub-Out Button. (One "rub-out" for each Depression) See Figure IV-lh.
- (i) Depress Backspace Button after Feeding out tape. Operate at Least 10 times.

- (j) Depress local carriage return button. Carriage return must operate in normal manner.
 - (k) Depress local line feed button. Line feed must function in normal manner.
- (4) Preparation of a standard message using the Codomat (LR)
- (a) Depress Feed Out Button
And Feed Out about 8"
Of Tape.
 - (b) Depress SOM button.
 - (c) Select Codomat Card for
Given distant area and
Insert.
 - (d) Select Codomat Card for
Given local area and
Insert.
 - (e) Select Codomat Card for
Broadcast circuit and
Insert.
 - (f) Select Codomat Card for
Station on the broadcast
Circuit and insert.
Repeat for second station.
 - (g) Depress EOA button.
NOTE: Time punched in
Tape must agree with the
Time shown on the clock
Windows).
 - (h) Perforate TEXT from
Keyboard.
 - (i) Depress EOM button.
 - (j) Feed tape out with feed
Out button. NOTE: Refer
To Test Tape No. 1 for
Representative tape.
- (5) Run the prepared tape through the LFXD and check the receiving printer copy.
- (6) Depress any one of the four red push buttons on the keyboard, Local Area, Distant Area, PSMN or CDC switches. This will disable the remaining three switches and also the SOM, EOA, SOM FEED-OUT and RUB-OUT switches on the keyboard. Repeat this procedure for each of the other three switches.

- (7) Punch In Use Light - The indicator light on the left side of the ASR cover door shall light during the punching of SOM, EOA, EOM, and Codomat operation. The light shall extinguish after the tape punching of the above information is complete.
- (8) End of Line Light - The indicator light on the right side of the send set cover door shall light when the margin indicator reaches 65 + 2 - 2 margin mark, and shall extinguish when carriage return is depressed.
- (9) Ten-Holes-to-the-Inch Test - The ten-hole-to-the-inch requirement must be met in the completely assembled send set.
 - (a) Depress Rub-Out key.
 - (b) Depress Blank key 9 times.
 - (c) Repeat (a) and (b) a total of 5 times.
 - (d) Check this tape with the ten-holes-to-the-inch gauge 95960. The lead hole of the tape shall be placed over the small hole at one end of the gauge. The hole 5" away shall fall completely within the large gauge hole.

c. Message Processing Test

- (1) Power switch on.
Motor switches on.
Timer switch on "NORMAL" (on Message Processing Panel)
LFXD ST-RUN Lever on Stop. (Middle position)
Press "Reset" button. (On key and Lamp Panel)
INSERT TEST TAPE NO. 1 (Standard message) with blank leader under both lids. When a #5 central office simulator is used, operate switch to "Local Area" unless otherwise noted.
- (2) Move ST-RUN Lever on LFXD to "run". The tape will be advanced until the first letters combination is read in the SOM. The lower feed wheel will be stopped and the tape will be run out by the upper feed wheel until it is taut. The upper feed wheel will then be clamped by the action of de-energizing the run-out magnet. In the clamped position, the carriage return character of the SOM sequence will be directly over the LFXD sensing pins.
- (3) The tape will be advanced in normal fashion while searching for the first unsent address. When detected, the sending station will go off hook, and present the address to the data set, one digit at a time to establish the connection. In the process of presenting the digits the first time, the tape will be marked (edge notched) in line with the Figures Character immediately preceding the dial number, to record the attempt.
- (4) Upon receiving the answer to the phone number, the LFXD will read and transmit the mnemonic of the dialed number. At the "Space" character of the transmitted mnemonic, it will stop and await confirmation from the terminating station, to

indicate the correct station has been reached. The monitor will copy the station mnemonic. Confirmation is recorded in the tape by piercing a hole at the sixth level and in line with the first edge pierce.

- (5) The tape will be pulled back to the clamped position after confirmation is recorded, and the LFXD will transmit all mnemonics, EOA, TEXT, and EOM. The monitor will copy all mnemonics, EOA, TEXT, and EOM on the first address only. On succeeding calls, only the station mnemonic will be printed on the monitor. Pseudomnemonics and CDC's will not be printed as part of the message on the monitor or on the receiver.
- (6) The tape will be pulled back after reading the four N's of the EOM, and the next unsend address will be sought. The procedures of operations 3, 4, and 5 will be repeated for any unsend address on the tape. The mnemonics CDEFGDL, and DEFGHDL, the pseudomnemonic QCASTDL, and the CDC's, ABBC, will be printed on the monitor and on the address portion of the message at the receiving station.
- (7) After all addresses have been confirmed, the tape will feed out after the last message scan, and if torn, will actuate the tape out pin to stop the LFXD. (NOTE: If a new SOM is found, the reader will process the new message tape as described above). The torn tape light will come on when the tape out pin is actuated.
- (8) Move the ST-RUN Lever of the LFXD to "stop". This will extinguish the torn tape light. Remove the tape from the transmitter.
- (9) When the data set and #5 central office simulator is used in the test set up with the "Distant Area" switch operated, the local address will not be connected, but will be sent to intercept. This will show up on the monitor and receiving printers as indicated in paragraph 10d and 10e below.
- (10) The monitor and receiving copies which should be obtained from the above procedures are shown below:

(a) Test Tape No. 1 - Monitor Printer Only

ABCDEDL
ABCDEDL BCDEFDL CDEFGDL DEFGHDL
.1627 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNBCDEFDL
QCASTDL ABBC

(b) Receiving Printer Copy

ABCDEDL
ABCDEDL BCDEFDL CDEFGDL DEFGHDL
.1627 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNBCDEFDL
ABCDEDL BCDEFDL CDEFGDL DEFGHDL
.1627 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNQCASTDL ABBC
ABCDEDL BCDEFDL CDEFGDL DEFGHDL
.1627 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNN

(c) Test Tape No. 1 - Monitor Printer Copy - When Data Set is used and #5 central office simulator is set for Distant area operation.

ABCDEDL
ABCDEDL BCDEFDL CDEFGDL DEFGHDL
.1106 ATLFFDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNQCASTDL ABBC
INCPTDL 1234567890BCDEFDL

(d) Receiving Printer Copy - When Data Set 154A1 is used and #5 central office simulator is set for Distant area operation.

ABCDEDL
ABCDEDL BCDEFDL CDEFGDL DEFGHDL

.1106 ATLFFDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNQCASTDL ABBC
ABCDEDL BCDEFDL CDEFGDL DEFHDL
.1106 ATLFFDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNINCP TDL 1234567890BCDEFDL
ABCDEDL BCDEFDL CDEFGDL DEFHDL
.1106 ATLFFDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNN

- (e) Note that the semicolon (;) in the Monitor and Receiving copy is optional and may not appear in some equipment as designated by the customer. (See 4240WD and 4241WD - Options N and P).

(11) LFXD #6 and #8 Piercing and Reading Requirements

- (a) The LFXD shall pierce the #8 perforations in the location shown on Test Tape No. 1 (Figure IV-1). The #8 punch shall pierce each position once and only once when confirmation is not received. That is, three passes of an unconfirmed address shall perforate three pierces in the #8 position.
- (b) A #6 position pierce shall be perforated as shown on Test Tape No. 1 (Figure IV-1) only when an address is confirmed and the message is sent to a receiving station. No confirmed (connected) address shall be sent a second time except through the operation of the Manual Resend key (paragraph (e)(23) below).

d. Intercept Test

- (1) Power switch on.
Motor switches on.

Timer switch on "NORMAL" (on Message Processing Panel).
LFXD ST-RUN Lever on "Stop".
Press the "Reset" button. (On Key and Lamp Panel)
Insert Test Tape No. 1 (Standard Message) with blank lead
under both lids.
Block sixth position notching magnet with spacer. (Left hand
solenoid)

- (2) Move the ST-RUN Lever on LFXD to "Run". The tape will be advanced until the first letters combination is read in the SOM, the lower feed wheel will be stopped and the tape will be run out by the upper feed wheel until it is held taut. The upper feed wheel will then be clamped by de-energizing the run out magnet.
- (3) The tape will be advanced in normal fashion, searching for the first unsent address. When detected, the station will go off-hook, and present the address to the data set, one digit at a time, to establish the connection. In the process of presenting the digits, the tape will be marked (edge notched) in line with the figures character immediately preceding the dial number, to record the attempt.
- (4) Upon receiving the answer to the phone number, the LFXD will read and transmit the mnemonic of the dialed number. At the "space" character of the transmitted mnemonic, it will stop and await confirmation from the terminating station to indicate delivery. However, due to the BLOCK on the sixth position notching magnet, the tape will not be notched although the connection was made. The monitor will copy the station mnemonic.
- (5) The tape will be pulled back to clamp and the LFXD will transmit all mnemonics, EOA, Text and EOM. The monitor will copy all mnemonics, EOA, Text and EOM on the first address only. On the succeeding calls, the station mnemonic will be printed on the monitor.
- (6) The tape will be pulled back after reading the four N's of the EOM and on the next search, the same address will be connected. The procedure of Operations 3, 4, and 5 will repeat until three edge notches have been punched. The second and third edge notches will be to the left of the first edge pierce.
- (7) On the fourth attempt to send this same address, it will be sent to "Intercept". The monitor will copy "INCPIDL", the station address and the station mnemonic. The receiver will copy the same, plus all mnemonics, the EOA, Text and EOM as usual. Because the sixth level pierce is still blocked, no confirming notch is received.
- (8) Intercept Alarm Test (No Answer Back) - Immediately after the four N's of the message tape is sensed, move the ST-RUN Lever

of the LFXD to "STOP", turn the receiver motor switch to "OFF" and then reposition the ST-RUN Lever to "RUN". This will actuate the 11 second timer which will subsequently cycle the INSS Rotary Switch in an unsuccessful attempt to reach "INTERCEPT". After six attempts, the alarm buzzer will sound, and the INTERCEPT NOT REACHED light will go on. Actuate the alarm cut-off key to silence the alarm buzzer.

- (9) Start the receiver and reset the tape in the LFXD as in Operation 1. Remove the sixth position pierce block.
- (10) The first message attempt to send will go to INTERCEPT, and the monitor will print "INCPTDL", message address mnemonic, EOA, Text, and EOM. The receiver will do likewise. The message will then be processed normally for the balance of the unsent addresses due to the receipt and recognition of the sixth level pierce. Move the ST-RUN Lever on the LFXD to "Stop". Remove and discard the tape. Press the reset button. When the data set is used, the copy will be similar to that in paragraph C10(c) & (d) because of the way the local area address is handled.
- (11) Intercept Alarm Test (No Confirmation) - Block the CFR relay on the Message Processing Panel in its unoperated condition. Insert Test Tape No. 1 in the LFXD and start it. The first number will be dialed, the tape edge notched, and the mnemonic printed out on the Monitor and Receiving Printers. Because no confirmation is received, the sixth position notch cannot be inserted, and the tape will not pull back to send the message. Instead, after the 11 second time out interval, the tape will be stepped to the next address and the cycle repeated. After Attempting to call the three stations, the tape will be pulled back and the three stations will be called again. If the second attempt is unsuccessful, the tape will be pulled back again and a third call attempt will be made. Manually operate the CR and LF buttons on the monitor and receiving printers. On the fourth attempt to send, the INSS Rotary Switch will be cycled by the 11 second timer and after six successful attempts to reach Intercept, the "INTERCEPT NOT REACHED" light will go on and the alarm will sound. Actuate the alarm cut-off key. The monitor and receiving printers will have printed in successive order as follows:

```
ABCDEDL BCDEFDL QCASTDL ABCDEDL BCDEFDL QCASTDL  
ABCDEDL BCDEGDL QCASTDL INCPTDL INCPTDL INCPTDL  
INCPTDL INCPTDL INCPTDL.
```

Unless the local carriage return and line feed keys on the keyboard and receiving printer are operated, the print-out will start to pile up at the end of a line as the printers used do not have automatic carriage return and line feed. Stop the LFXD, remove the CFR block, and tape, press the reset button, and reposition the tape. Start the LFXD and send all three of the addresses to Intercept. When the data

set is included in the set-up, station BCEFDL, which is a local area station, will not be recognized and will therefore not be printed out.

(12) The monitor and receiving copies which should be received from the above operation are shown below:

(a) Test Tape No. 1 - Monitor Printer Copy - Operations 1 through 7

ABCDEDL
ABCDEDL BCDEFDL CDEFGDL DEFHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNABCDEDL
ABCDEDL
INCPTDL 1234567890ABCDEDL

(b) Receiving Printer Copy - Operations 1 through 7

ABCDEDL
ABCDEDL BCDEFDL CEDFGDL DEFHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNABCDEDL
ABCDEDL BCDEFDL CEDFGDL DEFHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNABCDEDL
ABCDEDL BCDEFDL CEDFGDL DEFHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNINCPDL 1234567890ABCDEDL
ABCDEDL BCDEFDL CEDFGDL DEFGHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNN

- (c) Monitor Printer Copy - Operations 9 and 10

INCPDL 1234567890ABCDEDL
ABCDEDL BCDEFDL CEDFGDL DEFGHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNBCDEFDL
QCASTDL ABBC

- (d) Receiving Printer Copy - Operations 9 and 10

INCPDL 1234567890ABCDEDL
ABCDEDL BCDEFDL CEDFGDL DEFGHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNBCDEFDL
ABCDEDL BCDEFDL CEDFGDL DEFGHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNQCASTDL ABBC
ABCDEDL BCDEFDL CEDFGDL DEFGHDL
.1901 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

To Check: Start a sample of Test Tape No. 1, using the procedure outlined in the Message Processing Test. Cut-off the receiver by actuating the "On-Off" switch on the cabinet during the sending of the text. This will actuate the Connection Lost Lamp and Alarm. Actuate the Alarm cut-off key to still the buzzer.

(5) Intercept Alarm Test (Intercept Not Reached)

This check is made as a part of the INTERCEPT TEST, Operation 8 and 11.

(6) Torn Tape - Use Test Tape No. 1

To Check: The "On-Hook" condition, run a sample of Test Tape No. 1 through the LFXD. The LFXD will continue to operate until the length of tape has cleared the tape out pin at which time it will stop and the Torn Tape Light will come on. The alarm will not sound. Move the ST-RUN Lever on the LFXD to "Stop", to extinguish the light. This test is normally done as part of the Message Processing Test and need not be repeated.

To Check: The "Off-Hook" condition, run a sample of Test Tape No. 1, with the EOM torn off, through the LFXD. When the tape out pin senses the tear, the LFXD will be stopped, the torn tape, connection lost, and tape check lamps will light and the alarm will sound. Actuate the alarm cut-off key.

(7) Transmitter Step Switch (Used for trouble shooting only).

This switch steps the LFXD one character at a time after the circuitry has been "RESET", and with the ST-RUN Lever of the LFXD in "Stop" position. The switch is located on the Message Processing Panel.

(8) Timer Disable Switch (Used for trouble shooting only)

This switch disables the 11 second and 45 second timers and circuit assurance card. It is placed in the disable position only when trouble shooting. Its action shall be checked by running tests 1 and 2 above with the timer switch operated to the disable position, and Test 15 following. This switch is located on the Message Processing Panel.

In Test 1, the message will be continued without any error after the ST-STOP Lever has been returned to "RUN", after a 75 second wait.

In Test 2, the LFXD will stop immediately, but the Dial Failure Lamp and Alarm will not be actuated after a 15 second wait.

In Test 15, the receiving printer will print out the message normally. (The alarm will be inactive). Return the timer disable switch to the NORMAL position.

(9) Transmitter Key

This key has four positions with functions as follows:

- a - NORMAL Used for standard sending operations.
- b - STOP
FOR
PRIORITY If moved to this position during the sending operation, it will cause the LFXD to stop at the end of message of the message currently being sent to the address just dialed. If moved to this position before transmission has started, delivery of the message will be made to one destination only.
- c - HOLD In this position, the LFXD will be stopped at the EOM after the delivery of the message to all addresses has been made.
- d - MONITOR In this position, the monitor printer will read output of the LFXD. This is a tape intelligence checking device and does not transmit the information on the line. The reset button must be held down during this check and the ST-RUN Lever of the LFXD must be in the run position.

(10) Call Telco - See paragraph 26 below.

(11) Busy Lamp (Receiving Cabinet) (Use Test Tape No. 1)

With power on, and with no transmission taking place from the sending station, operate the busy lamp key on the LESU59 in the receiver cabinet. This will cause the yellow busy lamp on the receiver cabinet to glow and the inner most indicator lamp on the simulator to go out. Run a sample of Test Tape No. 1 through the LFXD in the normal manner. The busy lamp will be extinguished immediately after a number is dialed and it will remain extinguished during transmission. It will go on again immediately after the EOM, and will stay on until the next number is dialed when it will be extinguished again. The busy lamp has no effect on transmission in this particular factory test.

NOTE: When the receiver lamp is on, the simulator lamp is out.
With the data set in the circuit, the set will perform the same as in the "No Answer" test, paragraph 14, after the receiver goes "ON-HOOK". Restoring the busy lamp key will permit sending to take place.

(12) Bell Signal (Using Test Tape No. 4)

Run a sample of Test Tape No. 4 through the LFXD in the normal manner. The bell on the distribution panel assembly of the send set will sound during the time the monitor printer is copying the entire message. The bell on the receiver will also sound while copying the message.

(13) No Confirm Test (11 second delay timer) Use Test Tape No. 5

Run a sample of Test Tape No. 5 through the LFXD in the normal manner. The copy should appear as on the sample printer copies shown below. During the course of the operation it will be noted that the LFXD will pause immediately after the mnemonic of the foreign airline station and that after the 11 second time out, it will automatically step to the next address to try it. This operation is to be expected as no confirmation was received from the receiving station, which in this case is not made to respond to an "AA SPACE" call.

NOTE: That on the copy, the "AA" stations print horizontally due to confirmations not being received. The "AA" stations will be sent to # "INTERCEPT" after three attempts. With the data set, after the third attempt and pull back occurs, operate the ST-RUN switch to "Stop." Turn off the receiver, and start the LFXD again. The send set will attempt to connect to Intercept six times. On the seventh attempt, the "Intercept Not Reached" alarm will operate. The intercept mnemonic "Incpt" will not be printed.

(a) Monitor Printer Copy

```
ABCDEDL
ABCDEDL ABCDEAA BCDEF AA BCDEFDL
.1744 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;
```

```
NNNNABCDEAA BCDEF AA BCDEFDL
ABCDEAA BCDEF AA ABCDEAA BCDEF AA INCPTDL 1234567890ABCDEAA
INCPTDL 1234567890BCDEF AA
```

(b) No Confirm Test - Continued Receiving Printer Copy

```
ABCDEDL
ABCDEDL ABCDEAA BCDEF AA BCDEFDL
.1744 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;
```

NNNNABCDEAA BCDEFDAA BCDEFDL
ABCDEDL ABCDEAA BCDEFDAA BCDEFDL
.1744 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNABCDEAA BCDEFDAA ABCDEAA BCDEFDAA INCPTDL 1234567890ABCDEAA
ABCDEDL ABCDEAA BCDEFDAA BCDEFDL
.1744 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNNINCPTDL 1234567890BCDEFDAA
ABCDEDL ABCDEAA BCDEFDAA BCDEFDL
.1744 ATLOPDL
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF
THEIR PARTY
;

NNNN

- (c) Note that the semicolon (;) in the monitor and receiving copies is optional and may not appear in some equipment as designated by the customer. (See 424OWD and 424LWD - options N and P).

(14) No Answer Test (11 second timer) (Use Test Tape No. 1)

Run a sample of Test Tape No. 1 through the LFXD in the normal manner except that the receiving printer should be shut off by means of its power switch, before the LFXD is activated. The LFXD will dial the first address and edge notch, but because no answer back is given, it will wait for the 11 second timer to time out and it will then step the tape to the second address. This procedure will repeat for the entire number of addresses on the tape. After the first "READING" of the tape, turn the receiving printer on and the tape will then be processed normally. There will be no print-out on the monitor or receiving printers until the receiving printer is turned on.

(15) Circuit Assurance Failure (Use Test Tape No. 1)

To Check: Start a sample of Test Tape No. 1 using the

standard procedure. During the message sending portion of the sending operation, remove the cover of the REC, relay of the LESU57. Block the tongue of the relay against either side of the relay. After a 500 millisecond, ($\frac{1}{2}$ second), time lapse the connection lost lamp and alarm will come on. Actuate the alarm cut-off key. Printing on the monitor and receiver will be normal up to the time of failure.

(16) Miscellaneous DDD Errors (Use Test Tapes Nos. 6 thru 9)

(a) #If the #5 central office simulator is used, position the switch in accordance with the area dialed.

- (1) To Check: Use a sample of Test Tape No. 6 which has a 9 digit phone number instead of 10. Start the tape thru the LFXD in the standard manner. The LFXD will stop after reading the letters character immediately following the phone number, and the tape check light and alarm will come on. Actuate the alarm cut-off key. There will be no print-out on the monitor or receiving printers.
- (2) To Check: Use a sample of Test Tape No. 7 which has an 11 digit phone number instead of 10. Start the tape in the standard manner. The tape will pass thru the LFXD normally and will pull back after the EOM. On the second pass, the LFXD will stop after reading the sixth position notch, which was misplaced as a result of the 11th digit, and the tape check light and alarm will come on. Actuate the alarm cut-off key.
- (3) To Check: Use a sample of Test Tape No. 8 which has a 9 character mnemonic instead of 8. The procedure and results will be the same as in paragraph (16)(a) (2) above.
- (4) To Check: Use a sample of Test Tape No. 9 which has a 7 character mnemonic instead of 8. Start the tape in the standard manner. The tape will pass through the LFXD in the standard manner, and will be pulled back after the EOM. On the second pass, the LFXD will dial pull back and stop after reading the sixth and eighth position notch, which was misplaced as a result of omitting the 8th character of the mnemonic, and the tape check and connection lost lamps and alarm will come on. Actuate the alarm cut-off key. The monitor and receiving printers will print out the message and show the shortened mnemonic.
- (5) To Check: Use a sample Test Tape No. 2 and a data set

simulator. This tape has a dialing error in the fifth digit of the phone number. When the data set simulator is used in place of the Data set, the tape will advance thru the fifth digit, and after sensing the error, will wait 11 seconds and then actuate the "Dialing Failure Alarm". The test procedure under paragraph 18 below can be performed in lieu of this paragraph.

(b) #Use Test Tape No. 2 and a Data Set 154A1

When the actual data set and a #5 central office simulator are used with either AC or DC supervision, the following shall occur:

The tape will advance to the end of the dialing digits. It will then stop and wait for "Answer Back" from the #5 central office since the #5 central office will receive only 9 dialing tones. The 5 second timer in the #5 central office simulator will prevent the return of "Answer Back" to the send set (ASR).

After an 11 second time out, the LFXD will step thru the End-Of-Address, pull back, and redial. This will be repeated a total of three times. Then the unsent address will be sent to "Intercept". The transmission to Intercept will display the error in the dialed phone number.

(17) Miscellaneous Format Errors (Use Test Tapes Nos. 10 thru 12)

- (a) To Check: Use a sample of Test Tape No. 10 which omits the SOM section. Start the tape in the standard manner. The LFXD will stop after reading the first 0-7 control combination, and the tape check lamp and alarm will come on. Actuate the alarm cut-off key. The monitor and receiving printers will not print. Open the tape lid, move the ST-RUN Lever to stop, and press the reset button. The tape check lamp and alarm will come up again. Press the reset button again.
- (b) To Check: Use a sample of Test Tape No. 11 which omits the DDD number. Start the tape in the standard manner. The LFXD will stop after reading the EOM and the tape check lamp and alarm will come on. The monitor and receiving printers will not print. Actuate the alarm cut-off key to silence the buzzer.
- (c) To Check: Use a sample of Test Tape No. 12 which omits the EOM. Start the tape in the standard manner. The LFXD will stop when the tape clears the tape out pin at which time the tape check, connection lost and torn tape lights and the alarm will come on. Actuate the alarm cut-off key. The monitor and receiving printers will

print out the address, EOA, and Text, but not the EOM.

(18) 11 Second Delay Timer Adjustment (Use Test Tape No. 2)

Use a sample of Test Tape No. 2 which has one of the ten dial numbers an alphabetical character. The potentiometer which is to be adjusted, is located on the Alarm Panel. Move the shaft clockwise as far as it will go. Start the message through the LFXD in the standard manner. The LFXD will stop immediately upon detection of the error. Time the lapse between stopping of the LFXD and the sound of the dial failure alarm. It shall be greater than 15 seconds. Turn the shaft counterclockwise as far as it will go and repeat the procedure. The time lapse between stopping of the LFXD and the alarm shall be less # than 10 seconds. Now set the potentiometer shaft to give an 11 to 13 second time lag, and recheck. With the data set in the circuit, the dialing operation must be interrupted to cause the 11 second timer to operate.

(19) No Paper Switch Test (Power on to Send and Receive Sets)

Remove the paper from the receiving printer. The yellow busy lamp will go on, in the receiving cabinet. Replace the paper. The lamp will go out. Turn the printer switch key in the receiving cabinet to "On". Remove the paper from the monitor printer. The yellow busy lamp will go on, in the receiving cabinet. Replace the paper. The lamp will go out. With the data set in the circuit, the removal of the paper will operate the receiver in the same manner as operating the busy lamp switch, paragraph 11 above.

(20) Tight Tape Test

To Check: Make up a standard format tape with a single distant area address using the keyboard on the originating set. Do not tear the tape off the LARP after the EOM has been punched. Start the lead end of the tape through the LFXD and run the LFXD until the tape is tight, at which moment it has lifted the tight tape arm of the LFXD and caused it to stop. No alarm will be actuated unless the condition is maintained for a sufficient length of time to actuate the 45 second timer. Press the feed out key on the keyboard and feed out enough tape so that the EOM of the tape will clear the LFXD sensing pins. The print-out on the monitor and receiving printers will be normal with no error introduced as result of the start-stop operation.

(21) Reset Button (Located on the key and lamp panel of the send set)

It is not necessary to test this operation of itself as it is

performed regularly as a preliminary to each test. Proper operation of the RESET switch requires that the ST-RUN switch of the LFXD be in the "Stop" position and that the tape lid be open.

(22) XMSN Test (Switch located in the receiving cabinet)

(a) To Check: START A SAMPLE of Test Tape No. 1 using the procedure outlined in the message processing test. Operate the XMSN TEST switch on the key panel of the receiving set during the sending of the Text. This will actuate the connection lost lamp and alarm. Actuate the alarm cut-off key. The red lamp on the receiving cabinet and the outer most lamp of the simulator will go on when the XMSN switch is operated. Restore the XMSN key. The red lamp and the simulator lamp will go out.

#(b) The XMSN Key located on the LESU-57 of the send set will operate the "T" relay of the originating portion of the data set when turned to XMSN.

(23) Manual Resend Test (Use Double Length of Test Tape No. 1 having at least one sent address in the second length.)

With the circuitry Reset, place the tape in the LFXD so that the text portion of the first message is over the sensing pins of the transmitter. Close the lid. The ST-RUN Lever of the transmitter should remain in the "Stop" position. Push the manual resend button on the key and lamp panel. The transmitter will step the tape past the EOM of the first message until the letters - 7 combination of the SOM of the second message has been read and will then stop. No alarm will be actuated. Open the tape lid and reposition the tape to the address that is to be RESENT. In repositioning the tape, make certain that the first character of the address, not the figures character, is placed over the sensing pins. Close the lid and move the ST-RUN Lever to "Start". The LFXD will then function normally to dial and send the message to the address in question. If there are unsent addresses on the tape, these will be dialed and sent to in the usual manner. Print-out on the monitor and receiving printers will follow the normal pattern.

(24) Maintenance Switch Test

With the receive cabinet power switch on, the lamps will be on when the maintenance switch is thrown to the upper most or lowest positions. The lamps will be off with the switch in the mid-position with the cabinet power switch off. The lamps will go on only when the maintenance switch is in the lowest position.

(25) Typing Unit Interchange

(a) TU Interchange (PS) Test with Data Set Simulator

Connect two send-receive stations in the standard manner with the PS cables connected and with simulators for the data set and #5 central office in the circuit. Interchange the AS connectors of the two simulators. Of the two sets, one shall be called Set I - Local and the other Set II - Distant.

#(b) TU Interchange (PS) Test with Data Set and Associated Equipment

On receivers having a TU interchange switch, the following requirements are to be met when Data Sets with DC or AC supervision are used.

DC SUPERVISION

Reconnect the terminating data set and #5 central office simulator reconnecting the leads to the terminating data sets, maintaining Tip (T) and ring to the correct terminations. If not connected, connect the PS cable from Station II "ASR" to Station II "RO".

#AC SUPERVISION

Reconnect the converters and the terminating converter and #5 central office simulator by reconnecting the lead to the terminating converters, maintaining Tip (T) and ring connections to the correct terminations. If not connected, connect the PS cable from Station II "ASR" to Station II "RO". The PS cable from Station I "ASR" to Station I "RO" is optional in checking Station II TU Interchange.

1. Start the #1 or #5 tape thru the Station "I" transmitter. Normal copy shall appear on Station "II" receiver.
2. At the end-of-message (NNNN) of the first address, switch the TU Interchange Switch on the Station "II" RO to "TU Interchange". The second connected message will appear on the send set printer of Station II as if it were the receiving printer.
3. At any point in the text, the TU Interchange may be switched to Normal and the remaining copy will appear on the receiver.
4. Optional
 - a. Station II may be used as the originating station, and Station I as the receiving station.
 - b. The CALL TELCO TEST should be made with the TU Interchange switch operated as above.

(26) Call Telco Test (Use Test Tape No. 5)

#The Call Telco Test with Sub Set Simulator is performed in the same manner as when a data set and #5 central office simulator is used.

The Call Telco Key performs the following functions thru the operation of the STC relay:

1. Disables the upper and lower notching magnets.
2. After receiving "Answer Back" disables all timing circuits.
3. Also disables torn tape and tape out alarm circuits.
4. Disables "Circuit Assurance Connection Lost Alarm".
5. Disables pull back after transmission of End-of-Message.
6. Connects the send set Monitor Line Relay (MLR) directly thru the Receiving Relay (REC) so that information on the receive loop will be monitored.
7. STC Relay drops out automatically at the End-of-Message (NNNN).

Operation of Test

Press RESET KEY. Place the tape into the LFXD head and close the tape lid and cover. Depress the CALL TELCO KEY and release. Move the ST-RUN switch to RUN. Allow the tape to advance thru dialing, answer back, confirmation, and pull back. A series of O's or M's will appear on the monitor printer as controlled by the timing of universal contacts of the receiving printer. No other character should appear except at the end of message (NNNN) when a spurious character may appear. The carriage return and line feed of the monitor printer will be operated manually by the test operator to prevent overprinting at the end of the printer line.

- I. After the O's and M's appear, but before the end of message:
 - a. Move the ST-RUN switch to "STOP" and wait a minimum of 70 seconds. No alarm shall operate. The monitor will stop printing.
 - b. Lift the tape cover over the sensing pins. No alarm shall operate. Lower the tape cover again.
 - c. Move the ST-RUN switch to "RUN". The O's and M's will continue as before.

- d. Manually operate the REC relay (on the LESU57) to "MARK" and hold the relay arm to this contact for at least two seconds. The monitor printer will stop printing during this period, but the "Connection Lost Alarm" shall not sound.

NOTE:

The "Mark" contact is made if the operator moves the relay arm toward the front of the send set. The "Space" contact is made if the operator moves relay arm toward the rear of the send set. The monitor printer will run open when the REC relay is operated to "Space".

- e. At the end of message (NNNN), the STC relay will drop out, and the tape will advance to the next message. No pull back for an unsent address will occur.
- f. Move the ST-RUN switch to "STOP", and remove the tape from the LFXD. No lower or upper (#6 or #8) pierce shall be perforated.

II. Turn the receiving printer off. Reposition the tape in the LFXD. Depress the CALL TELCO KEY. Move the ST-RUN switch to "RUN".

- a. The tape shall advance thru the reader to each address, in turn, wait 11 seconds and advance to the next address. Since no "Answer Back" is received, the timers are operative.
- b. While the tape is advancing thru the last address on the tape, operate the ST-RUN switch to "STOP" and/or open the tape cover. The "Dialing Error" alarm will operate in the first operation, or the "Tape Check" and "Torn Tape" alarm will operate in the second. Remove the tape from the LFXD and RESET, twice.

III. Turn the receiving printer on. Reposition the tape in the LFXD. Start the tape thru the LFXD and allow the first address to be confirmed. After the end of message (NNNN) and pull back, quickly operate the ST-RUN switch to "STOP".

- a. Press the "CALL TELCO KEY" and start the LFXD. The tape shall advance to the second (foreign airline) address, and after dialing this address, and answer-back is received, the tape will advance to the end of the mnemonic address. No confirmation will be received. The LFXD will stop and wait indefinitely without an alarm operating since the timers are disabled.

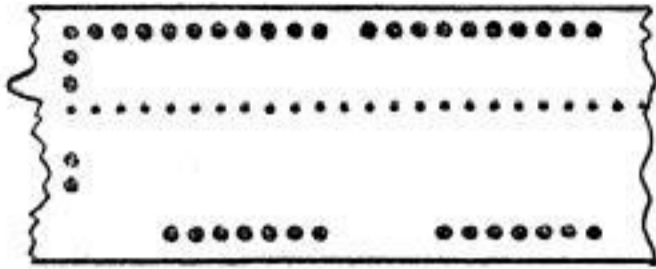


Figure IV-1a

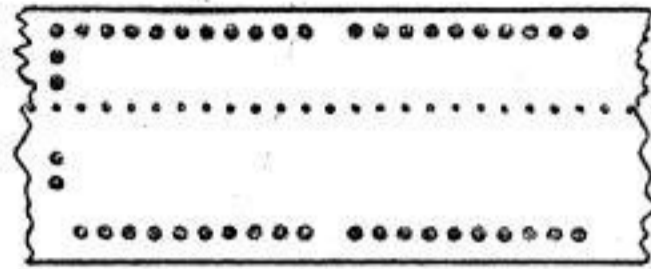


Figure IV-1b

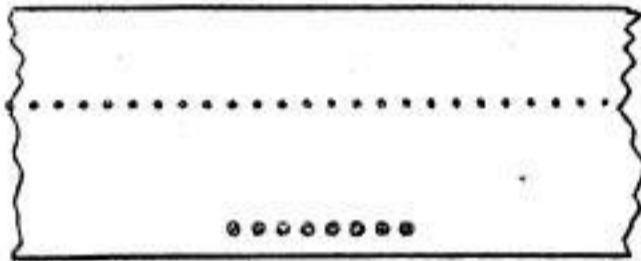


Figure IV-1c

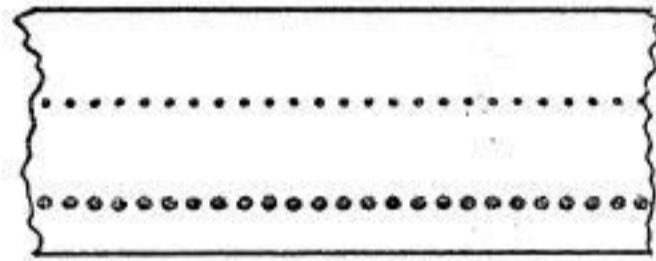


Figure IV-1d

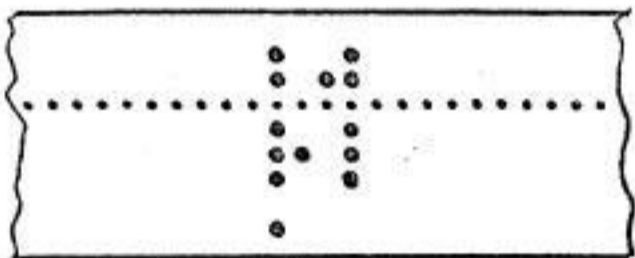


Figure IV-1e

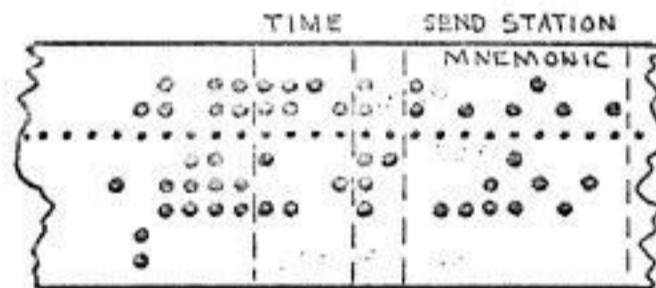


Figure IV-1f

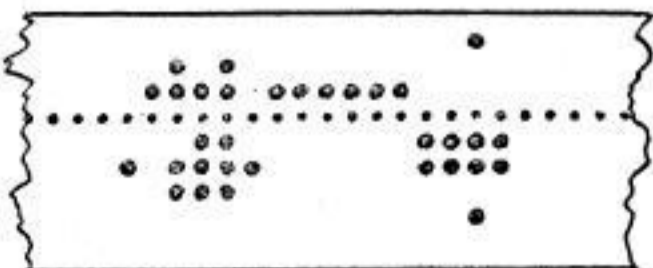


Figure IV-1g

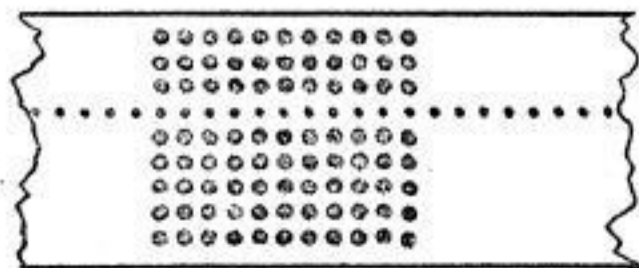
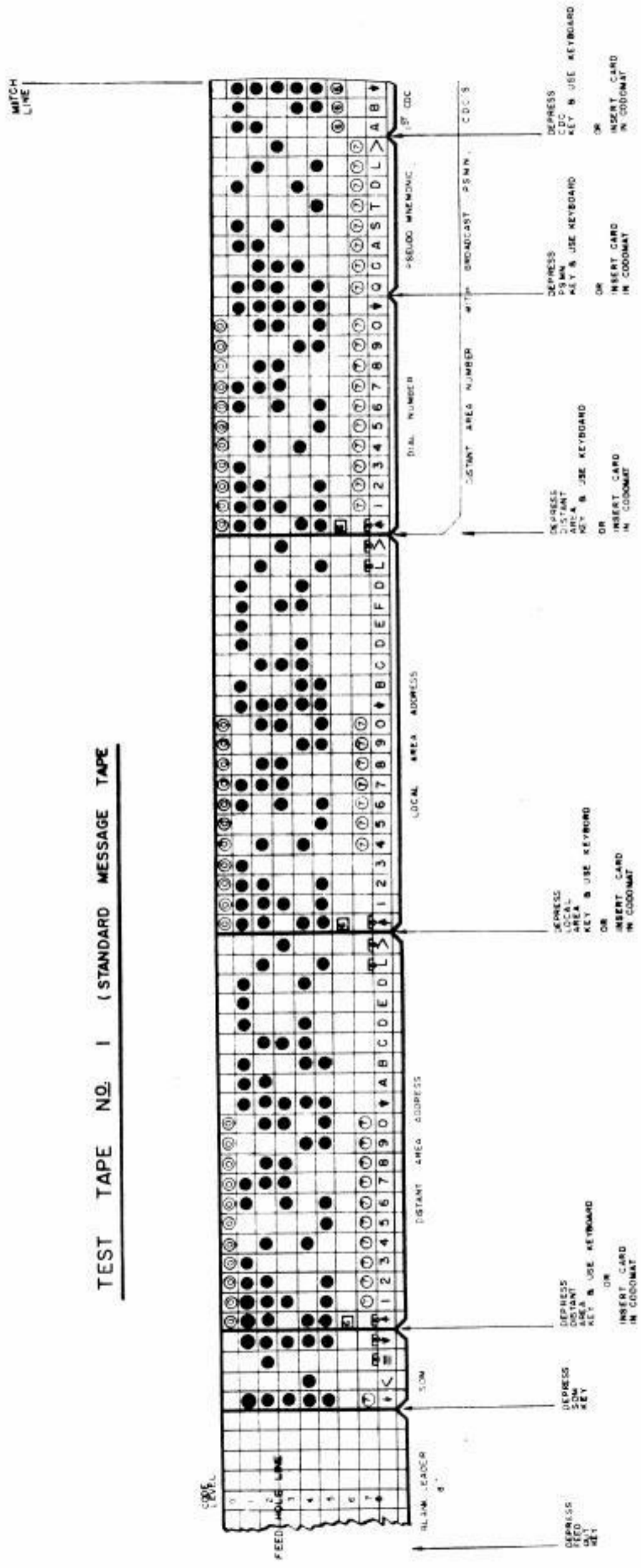


Figure IV-1h

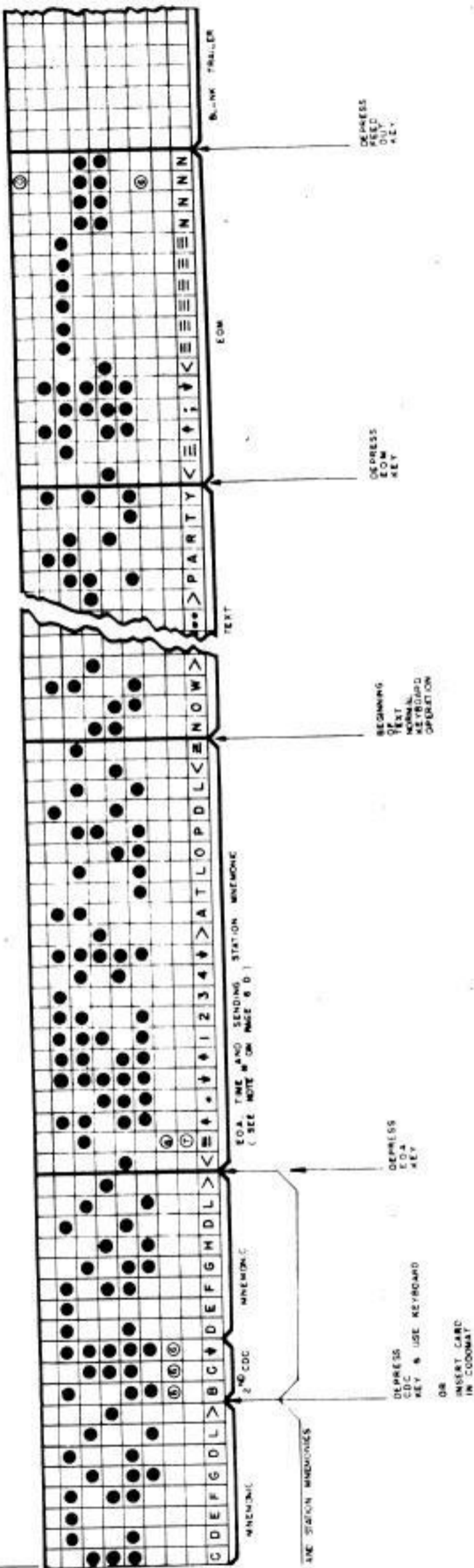
TEST TAPE NO. 1 (STANDARD MESSAGE TAPE)



June 1, 1952

MATCH LINE

TEST TAPE NO. 1 (CONTINUED)



* SEE NOTE ON PAGE

TEST TAPE NO 2 (DIAL NUMBER ERROR)

SOM DISTANT AREA ADDRESS
↓ < 1 2 3 4 B 6 7 8 9 0 ↓ A B C D E D L > EOA
↓ < 1 2 3 4 1 2 3 4 ↓ A T L O P D L < (TEXT AND EOM NOT REQUIRED)
LETTER ERROR

TEST TAPE NO 3 (FORMAT ERROR - EOA OMITTED)

SOM DISTANT AREA ADDRESS
↓ < 1 2 3 4 5 6 7 8 9 0 ↓ A B C D E D L > NOW > PARTY Y < ; ↓ < EOM
TEXT

TEST TAPE NO 4 (*BELL* FUNCTION)

SOM DISTANT AREA ADDRESS
↓ < 1 2 3 4 5 6 7 8 9 0 ↓ A B C D E D L > < ; ↓ T S S S S 9 9 S S S ↓ < EOM
TEXT

TEST TAPE NO 5 (FOREIGN AIRLINE ADDRESS)

SOM DISTANT AREA ADDRESS (DELTA) DISTANT AREA ADDRESS (FOREIGN) DISTANT AREA ADDRESS (DELTA)
↓ < 1 2 3 4 5 6 7 8 9 0 ↓ A B C D E D L > T 1 2 3 4 5 6 7 8 9 0 ↓ A B D E A A > T 1 2 3 4 5 6 7 8 9 0 ↓ B C D E F A A > T 1 2 3 4 5 6 7 8 9 0 ↓ B C D E F D L >
EOA TEXT EOM
↓ < 1 2 3 4 ↓ A T L O P D L < NOW > ; ↓ < PARTY Y < ; ↓ < EOM
TEXT
CONTINUED ←

June 1, 1962
PL. IV-

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R B D ORGANIZATION

IV-31

TEST TAPE NO. 6 (DIAL NUMBER ERROR - 9 DIGITS INSTEAD OF 10)

SOM ↓<=↑ 1 2 3 4 5 6 7 8 9 ↓ A B C D E D L > <=↑ . ↓ ↑ 1 2 3 4 ↓ A T L O P D L <=↑ (TEXT AND EOM NOT REQUIRED) EOA *

TEST TAPE NO. 7 (DIAL NUMBER ERROR - 11 DIGITS INSTEAD OF 10)

SOM ↓<=↑ 1 2 3 4 5 6 7 8 9 0 0 ↓ A B C D E D L > <=↑ . ↓ ↑ 1 2 3 4 ↓ A T L O P D L <=↑ P A R T Y <=↑ ; ↓ <=↑ E E E E E E N N N N EOM

TEST TAPE NO. 8 (DIAL NUMBER ERROR - 9 CHARACTER MNEMONIC INSTEAD OF 8)

SOM ↓<=↑ 1 2 3 4 5 6 7 8 9 0 ↓ A B C D E F D L > <=↑ . ↓ ↑ 1 2 3 4 ↓ A T L O P D L <=↑ (EOA, TEXT AND EOM AS IN NO 7) EOA *

TEST TAPE NO. 9 (DIAL NUMBER ERROR - 7 CHARACTER MNEMONIC INSTEAD OF 8)

SOM ↓<=↑ 1 2 3 4 5 6 7 8 9 0 ↓ A B C D D L > <=↑ . ↓ ↑ 1 2 3 4 ↓ A T L O P D L <=↑ (EOA, TEXT AND EOM AS IN NO 7) EOA *

TEST TAPE NO. 10 (FORMAT ERROR - SOM OMITTED)

SOM ↓<=↑ 1 2 3 4 5 6 7 8 9 0 ↓ A B C D E D L > <=↑ . ↓ ↑ 1 2 3 4 ↓ A T L O P D L <=↑ (EOA, TEXT AND EOM AS IN NO 7) EOA *

TEST TAPE NO. 11 (FORMAT ERROR - DDD NUMBER OMITTED)

SOM ↓<=↑ (EOA, TEXT AND EOM AS IN NO 7)

TEST TAPE NO. 12 (FORMAT ERROR - EOM OMITTED)

SOM ↓<=↑ (DDD, EOA, AND TEXT AS IN NO 7) EOM OMITTED

NOTE : *

THE EOA SHOWN INDICATES THE TIME (24 HR SYSTEM WHICH IS INSERTED BY A CLOCK (LCL) AND THE SEND STATION MNEMONIC, WHICH WILL VARY IN ACCORDANCE WITH THE WIRING IN THE TAPE PREPARATION PANEL ROTARY SWITCH EASS. THE TIME SHOWN IS NOT NECESSARILY THE TIME USED ON THE TEST TAPE.

SECTION V

INSTALLATION AND SERVICING INSTRUCTION

A. INSTALLATION

1. For detailed information on the installation of individual components of the Automatic Line Switching System Send and Receive sets, refer to the Specifications listed in Section II.
2. Outline dimensions of originating and terminating station Teletype-writer equipment are given in Figures V-1, V-2, and V-3.
3. The send set has the following external cables which must be connected upon installation:
 - a. AC power cable to 115V, 60 cycle, outlet.
 - b. "A" cable to Data Set 154A1 receptacle.
 - c. "AA" cable to Data Set 154A1 receptacle.
 - d. "Codomat" AC cable to Codomat receptacle.
 - e. "V" cable to Codomat receptacle.
 - f. "Clock" AC cable to clock receptacle
 - g. "N" cable to clock receptacle.
4. The receive set has the following external cables which must be connected upon installation:
 - a. AC power cable to 115V, 60 cycle, outlet.
 - b. "A" cable to Data Set 154A1 receptacle.
 - c. "AA" cable to Data Set 154A1 receptacle.
 - d. "PS" cable to send set distribution panel receptacle when the printer switch option is included.
5. The tri-level receive cabinet (LBAC227) will have only one input AC power cable and will have an "A", "AA", and "PS" cable for each level being used. Installation of the LBAC227 is covered in Specification 60088S.
6. Upon installation and complete connection, the Automatic Line Switching System, send and receive sets shall be capable of performing all the functional tests outlined in Section IV.

B. SERVICING INSTRUCTIONS

1. When trouble shooting the send and receive set equipment, analyze their operation with respect to 424OWD, 4241WD, 4242WD, and 4243WD, and the bulletins and specifications related to the components in trouble. Do not start bending, manipulating or otherwise conducting random adjustments until the nature of a trouble and its solution is realized, for a haphazard approach will very likely result in further complications.
2. A check of all operational functions is outlined in Section IV.

3. Convenience outlets with 115V, 60 cycle, power are located in the LESU56 of the send set and the LESU58 and LESU59 of the receive set. Power is available from these outlets as long as the AC power cable to the respective cabinets are connected to a live AC outlet.
4. In the send set, fuses are located in the master distribution panel in the lower section of the cabinet, in the 48 volt power supply in the lower portion of the cabinet, in the LESU56 and in the power supply on the LESU57.
5. Receive set fuses are located in the 48 volt power supply in the lower portion of the cabinet and on the LESU58 and LESU59. The LBAC227 Cabinet also has a master fuse panel in the key and lamp panel. All input AC power to the cabinet is thereby fused.

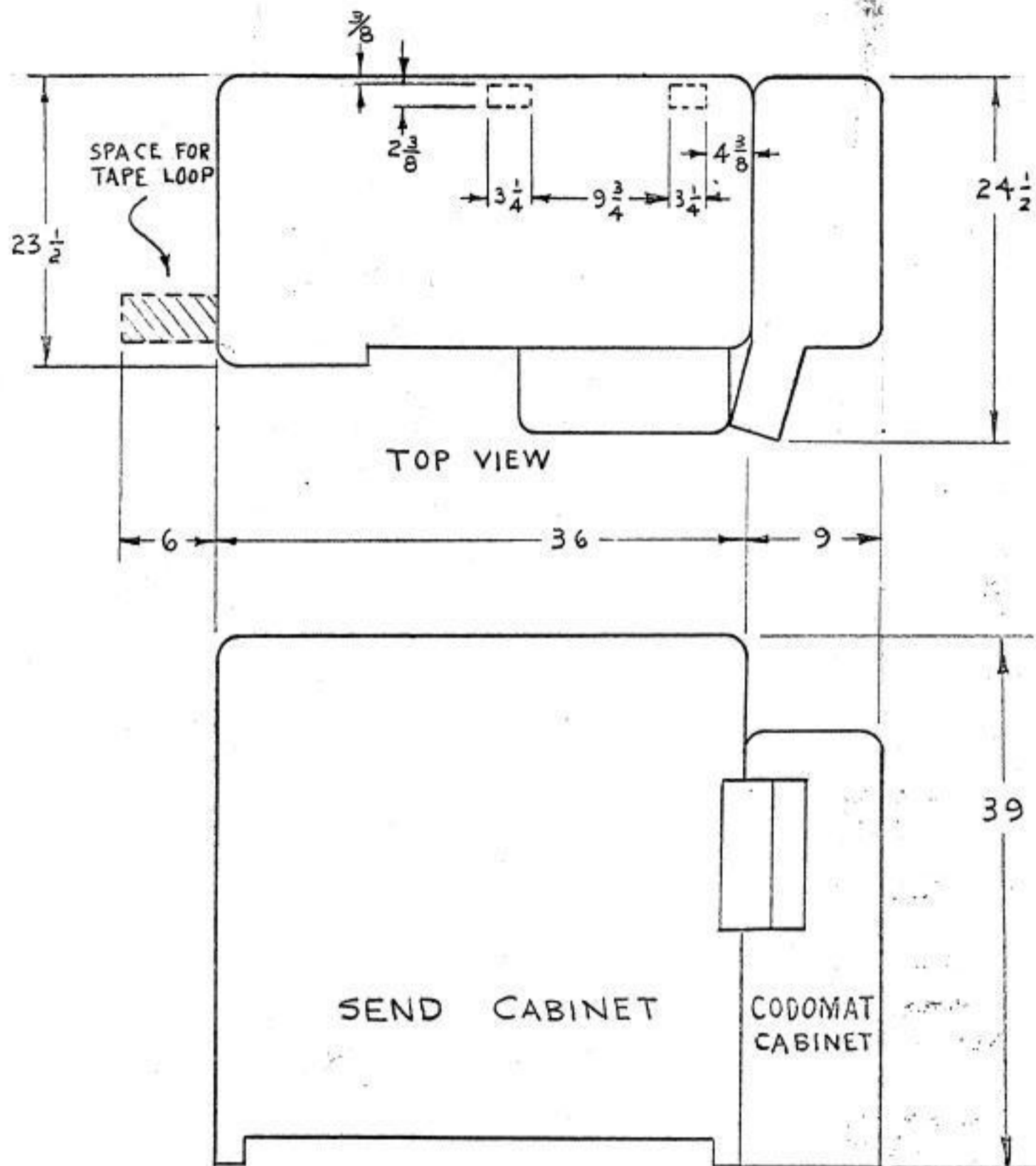


FIGURE V-1

1. DIMENSIONS SHOWN IN INCHES.
2. FULLY EQUIPPED SET WEIGHS APPROX. 460 LBS.
3. A.C. POWER REQUIREMENT: AT 117 V. AC -
APPROX. 5.5 AMPS MAX. AT APPROX .45 P.F.
4. CABLE ENTRIES IN REAR OF BOTTOM SHELF OF SEND SET. CABLES ENTER REAR OF BOTH CABINETS.
5. OPTIONAL PAPER WINDER NOT SHOWN.

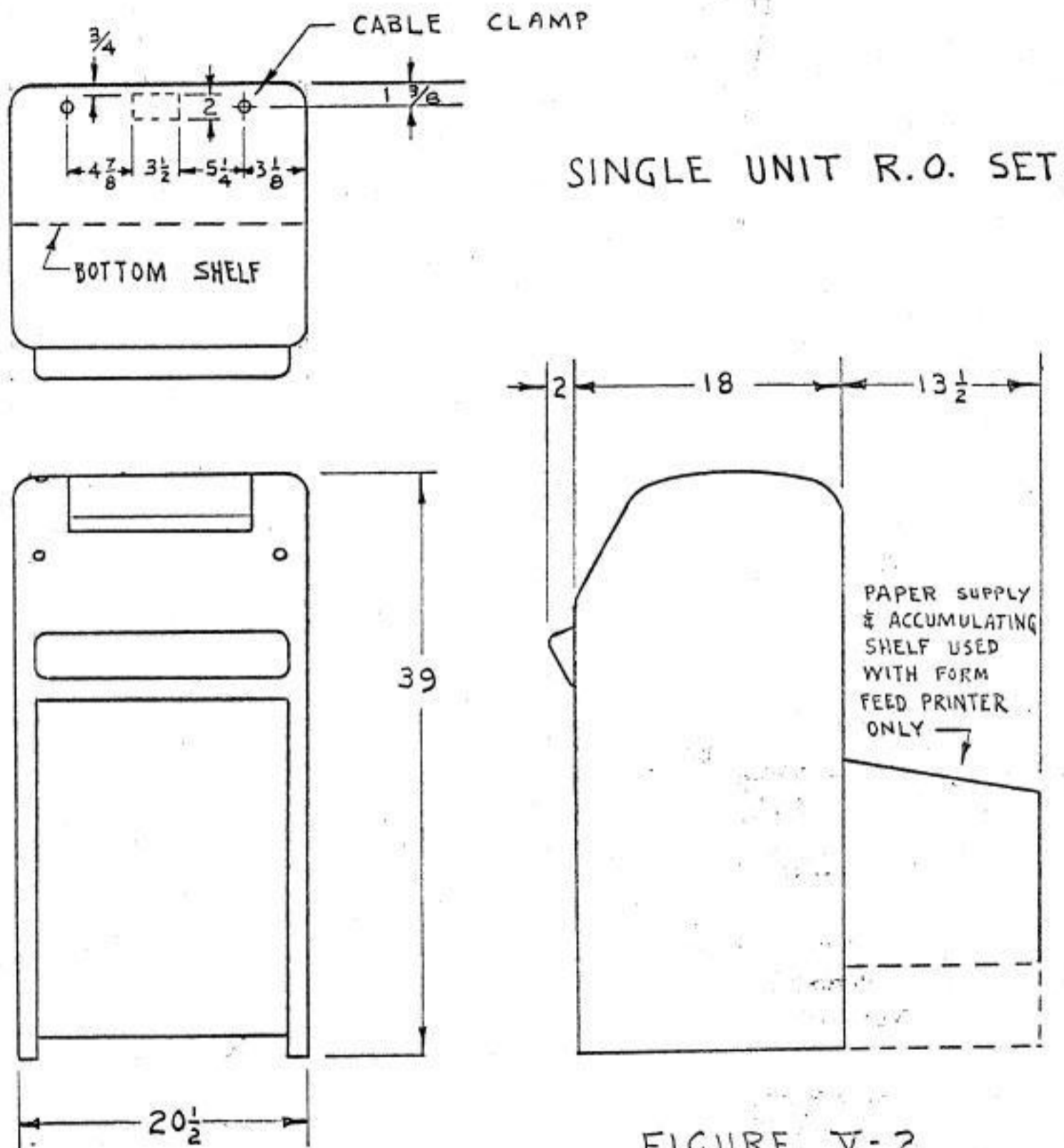


FIGURE V-2

1. DIMENSIONS IN INCHES.
2. FULLY EQUIPPED CABINET WEIGHS APPROX. 180 LBS..
3. A.C. POWER REQUIREMENT: AT 117V. A.C - APPROX. 2.4 AMPS.
AT APPROX .4 P.F..
4. CABLE ENTRIES THRU BOTTOM SHELF.
5. ADDITIONAL 4 FEET PER CABLE REQUIRED
WITHIN CABINET.
6. OPTIONAL PAPER WINDER NOT SHOWN.

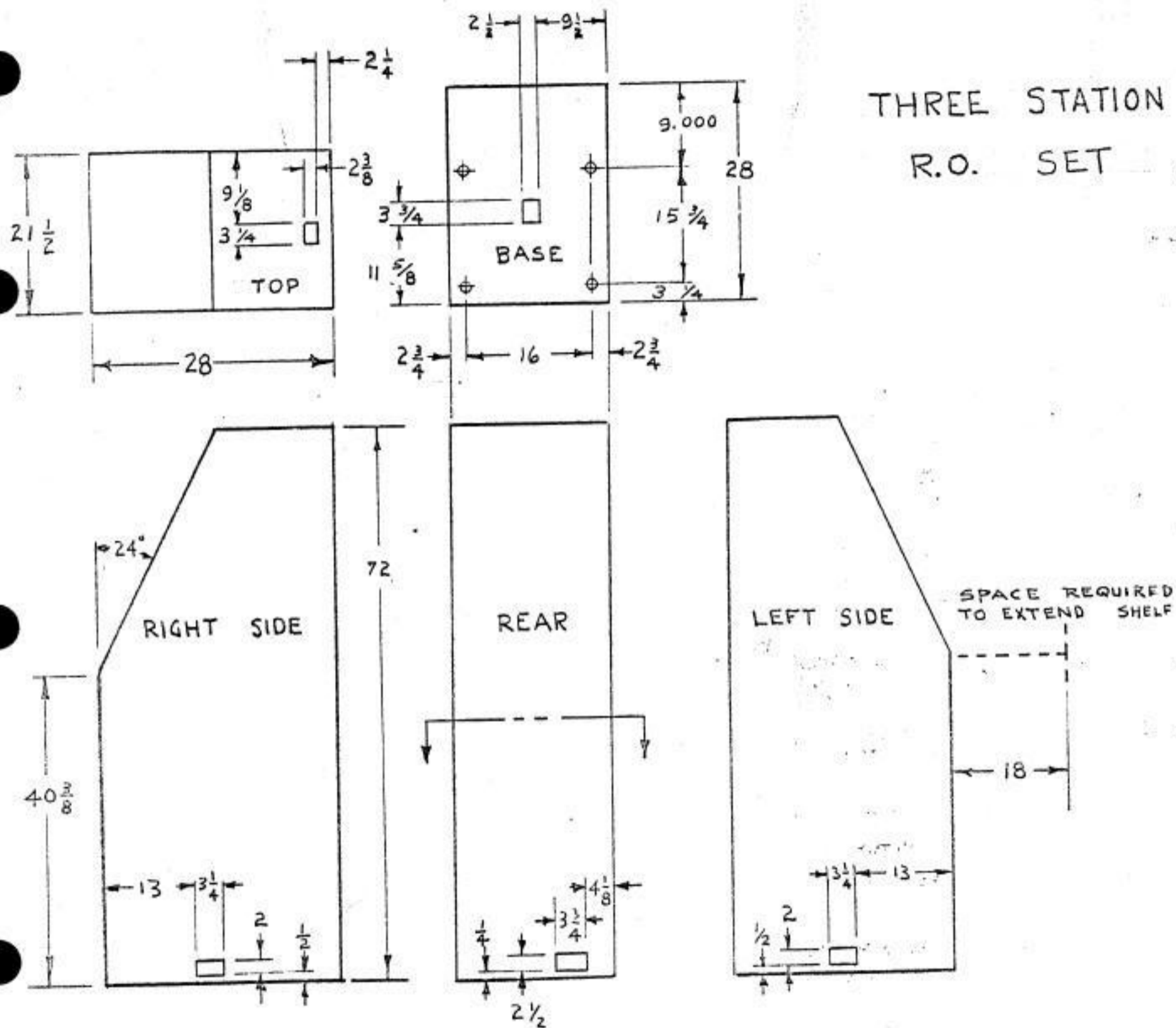


FIGURE V-3

1. DIMENSIONS SHOWN IN INCHES.
2. FULLY EQUIPPED SET WEIGHS APPROX. 575 LBS.
3. AC POWER REQUIREMENT: AT 117V. AC - APPROX 7.5 AMPS AT APPROX .4 P.F.
4. CABLE ENTRIES SHOWN.
5. ADDITIONAL CABLE LENGTH REQUIRED WITHIN CABINET: TEN FEET FOR TOP ENTRY, EIGHT FEET FOR BOTTOM ENTRY.
6. ADD 1 AMP TO AC. INPUT REQUIREMENT IF ANY SHELF MOUNTS AN 83B2 LINE.
7. POWER REQUIREMENTS FOR OPTIONAL PAPER WINDERS NOT INCLUDED.

OPERATOR INSTRUCTIONS

SECTION VI

A. MESSAGE CONSTRUCTION

1. General

- a. All messages must be prepared in tape form and transmitted from the LFXD of the send set. Continuous tape or torn tape operation may be used. A five-inch leader of tape is required at the beginning of a tape. A five-inch trailer of tape is required at the end of a sequence of messages, if continuous tape operation is used. These are required to bridge the gap between the perforator and the transmitter. Tape is fed out by the operation of the "feed out" key on the ASR keyboard. Messages which are performed in a sequence do not require this separation between them. Messages prepared for individual torn tape transmission do.

2. Component Parts of a Message

- a. Start of Message (SOM) code - LTRS, CR, LF, LTRS: Placed at the beginning of all messages. Causes tape to be pulled forward to start message processing.
- b. Direct Distance Dialing (DDD) code - provides a means whereby an address is reached through telephone switching facilities.
- c. Mnemonic code - a seven letter combination which serves as the address of a station. Example: MKCRRDL.
- d. Pseudomnemonic code - is used to gain access to the broadcast network or to the system of an interconnected carrier.
- e. Call Directing codes (CDC's) - presently consist of two letters, followed by a LTRS character, usually followed by a mnemonic. The system will operate with any number of characters in place of the two letters indicated but present call letter systems require only two. CDC's serve as addresses for stations on the broadcast circuit and on the systems of other carriers.
- f. End of Address (EOA) code - CR, LF, FIGS, M, LTRS, 4-digit time group, sending station's identity. Separates address and text of message.
- g. CARRIAGE RETURN, LINE FEED, text - prepared from ASR keyboard. Signature is optional, since the identity of the sending station was injected automatically by the operation of the EOA key.
- h. End of Message (EOM) code - CR, LF, FIGS, V LTRS, CR, 6 LF's, NNNN. Returns all machines to left margin; provides separation between messages; and causes connection to be released. The "FIGS, V" code included is optional and results in a semicolon being printed between messages.

3. Identity/Signature

The information generated by the operation of the EOA key includes the IDENTITY OF THE SENDING STATION. This seven-letter group serves to identify the originating station and will, by industry-wide agreement, serve as the signature of the message. Of course, if a signature by proper name is desired, this may be added after the identity group - but before CR, LF, and text.

It will be noted that some machines generate the full seven-letter group, while others generate only the three-letter city designator. Those generating the three-letter identity group are usually combined stations (i.e. reservations and operations). Those generating the full identity are exclusively reservations or exclusively operations etc. At combined stations, operators will add by keyboard, the last four characters of the identity. The correct procedure is:

Operate the EOA key. This generates CR, LF, FIGS, M, LTRS, a four-digit time group, IDENTITY (three letters). During the generation of this sequence, a GUARD lamp is lighted to indicate to the operator that the punch is in automatic use. After the GUARD lamp has been extinguished, the operator should, by keyboard, add the final four letters of the identity (i.e. RRDL to identify a reservation office of Delta Airlines).

4. The Use of Special Keys on the Send Set Keyboard

- a. The special keys provided on the send set keyboard have been described in Section II of this specification. These keys, especially the ones in the fourth row of the keyboard will be used frequently in preparation of message tapes. Care should be exercised to guard against interference from the keyboard while an automatically punched sequence is in progress. The use and function of these special keys is described below. See Figure VI-2.

- (1) SOM Key (Start-of-Message)

One operation of this key causes LTRS, CAR RET, LINE FEED, LTRS, (and certain control codes) to be performed into the tape.

- (2) EOA Key (End-of-Address)

Operation of this key causes CAR RET, LINE FEED, FIGS, M, LTRS, a 4-digit time group, and an identity code (and control codes) to be perforated into the tape.

- (3) ECM Key (End-of-Message)

Operation of this key causes the following characters to be perforated into the tape: CAR RET, LINE FEED, FIGS, V, LTRS, CAR RET, 6 LINE FEEDS, NNNN. The "FIGS, V" code is optional and is included in some equipment to give a semicolon between messages.

(4) Local Line Feed Key

Feeds the paper up automatically on the local machine only, as long as the key is depressed.

(5) Feed-Out Key

Operation of this key causes BLANK tape to be fed out of the perforator. Tape will be fed out as long as the key is depressed.

(6) Rub-Out Key

This key is used to perforate all levels (zero through seventh) when an error occurs. The tape is backspaced to a point where the error was made and these characters in error are "over-perforated" by use of the Rub-Out key. When an error is made in the text, the use of the LTRS key is recommended, as has been the practice in the past. In using the Rub-Out key to make corrections in the address portion of a message tape, it should be remembered that the entire "block" of DDD and mnemonic characters must be rubbed out, or the dialing attempt and confirmation holes will not be inserted in the proper position. Following the use of the Rub-Out key, perforate two LTRS characters into the tape.

(7) Tape Backspace Key

Operation of this key moves the tape back one character at a time into the tape punch so that an error may be corrected.

(8) REPT (Repeat) Key

To repeat a character, depress the character key and the REPT key, then release the character key, continuing to hold the REPT key down for as long as it is desired to repeat the character. The character will be repeated automatically at the 100-word per minute rate as long as the REPT key is held down.

(9) LOC C.R. (Local Carriage Return) Key

When depressed, returns the type box to the left margin on the local machine only.

- b. Near the keyboard are mounted four special purpose push buttons which are described below. These are: LOCAL AREA, DISTANT AREA, PSMN (Pseudomnemonic), CDC (Call Directing Code). These keys are provided to permit operators to manually prepare messages where either codomat cards or a codomat is not available for perforating address functions.

(1) Local Area Key

This push button is used to provide control holes when a local-area DDD number is perforated manually from the keyboard. When the sending and the receiving machines are served by the same Telephone Company Number 5 Switching Office, the first three numerals (number plan area code) are not transmitted. For this reason, these three numerals are marked with control holes that will cause the TD to skip over them. Operation of this "Local Area" button causes it to become illuminated and disables the Distant Area, PSMN, and CDC keys. Depression of the FIGS key causes that character to be perforated, together with a zero control hole. Of the ten numerals which are to follow, the first three will be marked with only a zero control hole. The final seven numerals will be marked with zero and seventh level control holes. Operation of the LTRS key extinguishes the local Area lamp, reactivates the three control keys, and restores this equipment to normal.

(2) Distant Area Key

This push button is used to provide control holes when a DDD number is perforated manually from the keyboard. When the sending and receiving machines are served by different Telephone Company Number 5 Switching Office, operation of the Distant Area button causes it to become illuminated, disables the Local Area, PSMN, and CDC keys, and causes the zero control hole to accompany the FIGS character. All ten numerals which follow will be marked with zero and seventh level control holes. Operation of the LTRS key extinguishes the Distant Area Lamp, reactivates the three control keys, and restores the equipment to normal.

(3) PSMN (Pseudomnemonic) Key

This push button is used to provide control holes when a pseudomnemonic sequence is perforated manually from the keyboard. (A pseudomnemonic code is required when sending messages from any originating station into a Broadcast Network or into another Teletypewriter system). Operation of the PSMN button causes it to become illuminated and deactivates the Local Area, Distant Area and CDC keys. As the operator inserts the alphabetic character of the pseudomnemonic code, each character is marked with a seven level control hole. After perforation of the entire sequence - seven letters and space - the PSMN lamp is automatically extinguished, the three control keys are reactivated, and the equipment is restored to normal.

(4) CDC (Call Directing Code) Key

This push button is used to provide control holes when CDC's are perforated manually from the keyboard. Operation of the CDC button causes it to become illuminated and disables the Local Area, Distant Area and PSMN keys. When the operator types the CDC characters, they are marked with sixth level

control holes. Operation of the LTRS key will cause this character to be marked with a sixth level control hole, will extinguish the CDC lamp, will reactivate the other three control keys, and will restore the equipment to normal.

B. TAPE PREPARATION

Message structure and the order in which characters are to be perforated in the message tapes are shown below. All operations are to be performed at the send set.

NOTE: Throughout the instructions covering preparation of tape, the first and last steps are to "operate Feed-Out key" to secure a 5 inch leader (or trailer) of tape to permit proper processing by the transmitter.

This is necessary only if the tape is an isolated message not preceded nor followed by another. When operating by the usual procedure of preparing several messages on a continuous tape, the 5 inch leader is required only on the first message, while the 5 inch trailer is necessary only for the last.

1. Messages with one or more - but fewer than six - addresses:

<u>OPERATION</u>	<u>RESULTS</u>
(a) Operate the FEED-OUT key until a 5 inch leader of tape has been produced.	Five inches of BLANK tape
(b) Operate the SOM key. The GUARD lamp lights. (#)	LTRS, CR, LF, LTRS
(c) Keyboard the address or select and operate codomat card(s) of the destination station(s). Operation consists of selecting the card between the thumb and forefinger, and swinging the top of the card to the right and into the reader of the codomat.	FIGS 1234567890 ATLRCDL SP
NOTE: As many codomat cards as are needed may be operated in sequence. No separation is required. The codomat returns each card to file. (#)	
(d) Depress the EOA key. The GUARD lamp lights. (#)	CR, LF, FIGS, M, LTRS, INDRDL
(e) Insert CR, LF, and TEXT by keyboard.	TEXT

OPERATION

RESULTS

(f) Depress the EOM key. The
GUARD lamp lights. "FIGS, V"
is optional. (#)

CR, LF, FIGS, V, LTRS,
CR, 6 LF's, NNNN

(g) Operate the FEED-OUT key.

NOTE: (#) The GUARD lamp
lights during these
periods of automatic
transmission to warn the
operator that garbling
will occur if any other
keys are operated.

2. Sending Multi-Addressed Messages to Combined Offices.

It will be noted that at some stations, the same line switching Teletypewriter equipment may be used to receive messages for two offices. Codomat card addresses for these stations will have the last part of the mnemonic code missing. This code will be inserted by the operator from the keyboard. If the entire address is keyboarded, the normal procedure will be used.

3. Messages Directed to Six or More Individually Addressed Locations:

OPERATION

RESULTS

(a) Operate the FEED-OUT key.

(b) Operate the SOM key. The
GUARD lamp lights.

LTRS, CR, LF, LTRS

(c) Operate the BCST codomat
card for access to the
broadcast network.

FIGS 1234567890
EBCSTDL SP

(d) Select and operate one
individual broadcast
station codomat card for
each station addressed.
(The cards are marked with
a heavy black horizontal
line). When more than
eight codomat cards are
required, CR, LF should
be entered (by keyboard)
to prevent pileup at the
end of the line.

(One or two CDC's
followed by a mnemonic
code will be generated
for each card operated.)

(e) Depress the EOA key. The
GUARD lamp lights.

CR, LF, FIGS, M, LTRS,
time, NYCRRDL

OPERATION

RESULTS

- | | |
|---|---|
| (f) Insert CR, LF, and text by keyboard. | TEXT |
| (g) Depress the EOM key. The GUARD lamp lights. "FIGS,V" is optional. | CR, LF, FIGS, V, LTRS,
CR, 6 LF's, NNNN |
| (h) Operate the FEED-OUT key. | |
| 4. Messages Directed to All Stations, All Reservations, or All Operations Stations: | |
| (a) Operate the FEED-OUT key. | |
| (b) Operate the SOM key. The GUARD lamp lights. | LTRS, CR, LF, LTRS |
| (c) Operate the BCST codomat card for access to the broadcast network. | FIGS 1234567890
EBCSTDL SP |
| (d) Operate the ALL RES (or ALL OP or ALL STN) codomat card. These cards are the first three in the broadcast deck. | (Five three-character CDC's followed by a mnemonic code will be generated.) |
| (e) Depress the EOA key. The GUARD lamp lights. | CR, LF, FIGS, M, LTRS,
1332, ATLRRDL |
| (f) Insert CR, LF, and Text by keyboard. | TEXT |
| (g) Depress the EOM key. The GUARD lamp lights. "FIGS, V" is optional. | CR, LF, FIGS, V, LTRS,
CR, 6 LF's, NNNN |
| (h) Operate the FEED-OUT key. | |

C. TRANSMISSION OF THE MESSAGE

1. Inserting the Tape into the Transmitter

Operate the STOP-RUN switch to the STOP position. The tape is held in place in the Transmitter by a reader gate and a clamping head gate. Both must be released before inserting the tape. Each has its own release lever. With both gates released and in a raised position, insert the tape leader (five inches of BLANK tape) into the transmitter so that the sensing pins will sense the last few blanks of the leader. The tape must be fed below the two overhanging pierce guide plates which are to pierce the sixth and eighth levels. After aligning the teeth of the feed wheel with the feed holes of the tape, close the

reader gate. With the left hand forming an "S" loop in the tape as it passes from the lower level of the transmitter to the raised portion, engage the tape in the secondary (forward) feed wheel. Making certain that the tape has passed below the two pierce guide plates, close the clamping head gate.

2. Message Transmission

Set the TRANSMITTER switch (on the key and lamp panel) at NORMAL position. After inserting the tape in the transmitter, operate the STOP-RUN SWITCH to the RUN position. The sensing of the tape begins immediately, searching for the control code which accompanies the Start-Of-Message Code. When this control code is sensed, the tape is run out until taut, and the tape is locked at the forward feed wheel. Processing of each message tape will be accomplished with the tape locked at the forward feed wheel.

It should be noted that a multiple-addressed message is sent as an individual transmission to each addressee in turn, a process which requires that the tape be rapidly pulled back and rerun past the sensing pins for each transmission. A summary of operation during message processing is indicated below:

- (a) Recognize the presence of tape to be handled.
- (b) Advance the tape, searching for the control code accompanying SOM.
- (c) Detect SOM control code, stop, run out the previously sent tape with forward feed mechanism until taut, and clamp forward feed wheel.
- (d) Advance the tape, searching for the first DDD code that has not been marked as delivered. (A pierce in the vicinity of the sixth level indicates delivery).
- (e) Detect DDD code and read the number of attempts as recorded by the number of slashes at the lower edge of the tape:
 - (1) If the number of attempts is three, attempt to send to Intercept.
 - (2) If the number of attempts is two or less, mark a call attempt on the tape, send the DDD number (via the Data Set). Transmitter stops after sending the DDD number and awaits receipt of answer back which is generated by the receiving location data set.
- (f) Receipt of the answer back causes the transmitter to start sending the mnemonic (or pseudomnemonic) code until the first space is detected, then stop and wait for confirmation from the called station.
- (g) When confirmation is received, mark the tape by piercing it in the

vicinity of the sixth level to indicate delivery.

- (h) If the characters sent in Step (f) were a mnemonic code, proceed to Step (i). If the characters sent in Step (f) were a pseudo-mnemonic code, search the tape for the next DDD number or the end-of-address code, in the process transmitting CDC's, if present, until EOA is detected, then proceed to Step (i).
- (i) Pull back the tape to taut condition and transmit the SOM, all mnemonics, the EOA, the text, and the EOM codes. During this process, examine the tape to determine if any unhandled addresses are present for use in Step (j).
- (j) After transmitting the EOM code.
 - (1) If the message has been delivered to all addresses, proceed to the next tape (Step a).
 - (2) If the message has not been delivered to all addresses, pull back the tape to the clamp and repeat from Step (d). As indicated in Step (e)(1), above, when three attempts to reach an addressee have been unsuccessful, six attempts shall then be made to deliver the message to the "Intercept" position located in the Communications Center. Six unsuccessful attempts to deliver the message to "Intercept" will cause a visual and audible alarm at the send set.

In processing a tape, the logic equipment of the send set makes three automatic attempts to send a message to each addressee. After three failures, the send set automatically dials the DDD number Intercept and transmits the entire message to this equipment for further processing. The send set will make six attempts to reach the intercept equipment before operating audible and visual alarms. It is unlikely that nine unsuccessful attempts to send a message will be experienced, but the possibility does exist. Should this happen, the MANUAL RESEND key may be used to make additional attempts.

D. MANUAL RESEND PROCEDURE

When, for any reason, a tape which has been pierced at the sixth level, indicating delivery, must be RESENT, the following procedure should be used:

1. Operate the STOP-RUN switch to the "STOP" position.
2. Load the tape into the transmitter in the normal manner except that the sensing pins should engage the text of the preceding message.
3. Depress and hold operated the non-locking MANUAL RESEND key.
4. The transmitter feeds tape, detects the SOM, runs out the tape of the preceding message, and stops. This establishes the point at which the tape is clamped.

5. Release the MANUAL RESEND key.
6. Without disturbing the tape as it is clamped by the upper tape gate, release the lower TAPE GATE only and reposition the tape in the transmitter so that the sensing pins engage the first numeral of the DDD number (as indicated by the control holes).

NOTE: DO NOT SET THE TAPE ON FIGS WHICH PRECEDES THE DDD NUMBER.

7. Operate the STOP-RUN switch to the "RUN" position.
8. Transmission is then accomplished in the usual way, complete with answer back, confirmation, etc.

E. ALARMS AND CONTROL KEYS

A key and lamp panel has been provided on the front cover of the send set within easy reach and visibility of the operator. These alarms, when activated, call attention to operating errors. Appropriate controls have been included in the panel to: silence and restore alarms; permit manual resending of tapes; and control transmitter-distributor action. A more detailed explanation of these alarms and controls follows:

1. Message Interrupted (Red)

Operated when the transmitter has been stopped for 45 seconds due to tangled or taut tape, or for any other reason. (Buzzer also operates.)

2. Dialing Failure (Red)

May operate at any time after start of transmission until confirmation of mnemonic code is received, to indicate an error in dialing which is not cleared within eleven seconds. (Buzzer also operated.)

3. Tape Check (Red)

Operates if the format sequence is not valid either because of an error in tape preparation, an error in loading the transmitter, or because a tear in the tape prevented the message from being handled in its entirety. (Buzzer also operates.)

4. Connection Lost (Red)

Operates whenever the circuit assurance is not received from the destination station. (Buzzer also operates.)

5. Intercept Not Reached (Red)

Operates when six attempts to reach Intercept have failed. (Buzzer also operates.)

6. Torn Tape (Red)

- (a) When an individual message tape has been transmitted completely and the connection broken, with the transmitter switch in the "RUN"

position, this alarm (No Buzzer) will be initiated. Operation of the transmitter switch to "STOP" position will extinguish the lamp.

- (b) When transmission is in progress and the tape is stopped due to a tear, both audible and visual alarms will be operated. The Tape Check and the Connection Lost lamps also are initiated.

7. Manual Resend (Push-Button, Non-Locking)

This key is used for resending a message to a station to which it has already been sent. For operating procedure, refer to paragraph (D) above.

8. Alarm Cut-Off (Twist Key - Locking)

Momentary operation and restoral of this key will silence the buzzer for any alarmed condition. If the key is left in the "cut-off" position, the buzzer is disabled.

9. Reset (Push Button - Non-Locking)

Following an alarmed condition, the operator must correct the condition, operate the stop-run switch to stop, remove the tape from the transmitter, and operate the RESET key to extinguish the alarm lamps. Operation of the RESET key with tape in the transmitter causes the TD to step the tape one position regardless of the position of the transmitter STOP-RUN switch.

10. Transmitter (Four-Position Switch)

(a) Normal

Normal sending station operation.

(b) Stop for Priority

Stops transmission after current delivery, if in progress.

(c) Hold

Stops transmission after all deliveries of the message being currently handled.

(d) Monitor

In the monitor position, the transmitter will run only while the RESET key is held operated. (Transmitter STOP-RUN switch must be in "RUN" position, and tape not taut.)

F. TWENTY-FOUR-HOUR TIMER

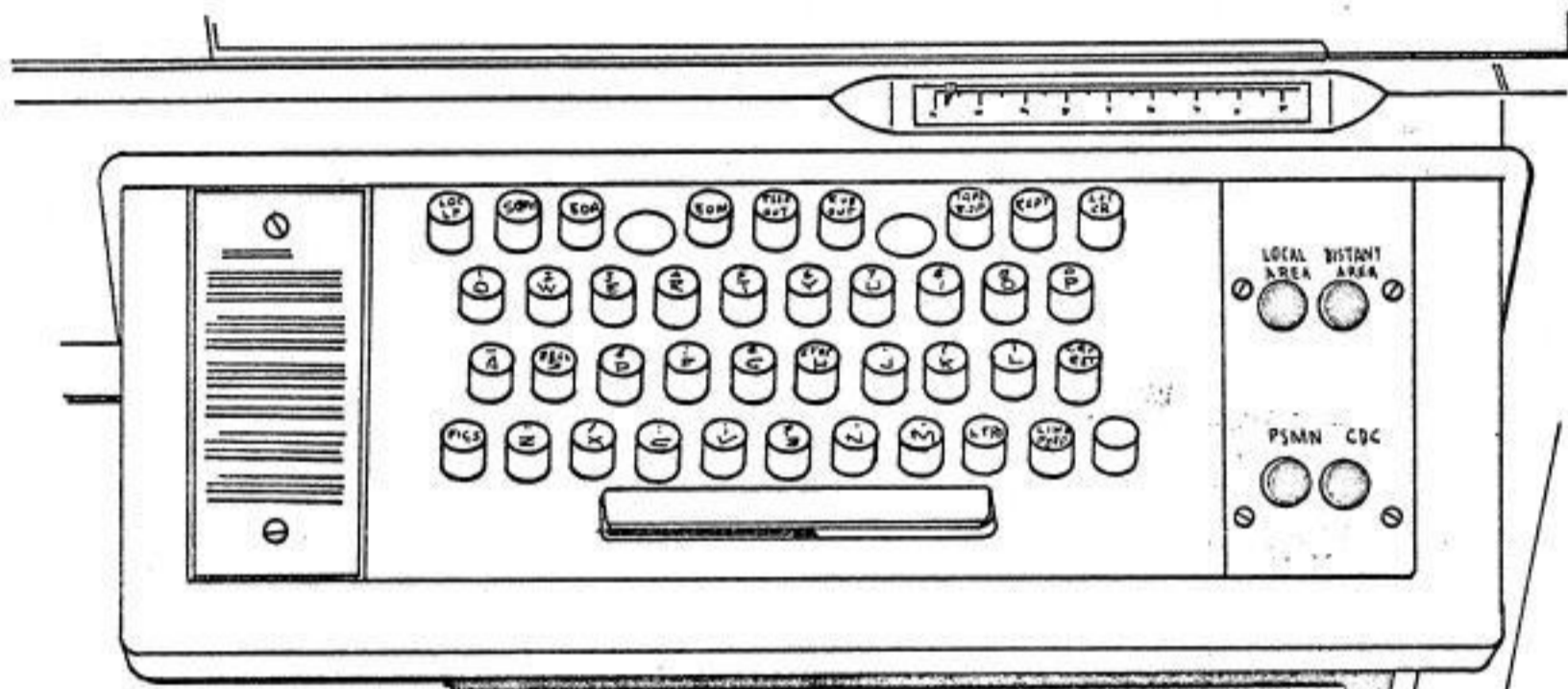
All send sets on the Automatic Line Switching System have been equipped with twenty-four-hour clocks whose purpose is to record the time of each

message tape preparation. The action of the clock is completely automatic. The operation of the EOA key causes a four-digit time group to be perforated into the message tape following the CR, LF, FIGS, M, LTRS.

Following an AC power failure, etc., it is the responsibility of the operator to reset this clock, so that all transmissions bear the correct filing time. The unit is located beneath the top cover of the codomat - to the rear of the cards.

In order to gain access to the time-recording unit, it is necessary to slide the codomat away from the send set some four or five inches, to loosen three knurled thumb screws (two on the right side, one on the left) that fasten the top cover to the codomat base, and to lift off the cover. Removal of the cover makes the clock completely accessible for resetting. Standing in front of the codomat, proceed as follows:

The unit contains three black plastic knurled wheels. The left wheel indicates the two "hour" digits. The middle wheel and the right wheel indicate "minutes," one digit each. Start with the right wheel (fourth digit) and work backwards - toward the left. Push the top of the wheel toward the front, watching the number being displayed in the small window near the wheel. After correctly setting this one, proceed to the middle wheel and repeat the operation, finishing with the left. Replace the codomat cover, tighten the thumb screws, and reposition the codomat against the send set.



KEYBOARD ARRANGEMENT

FIGURE VI-1

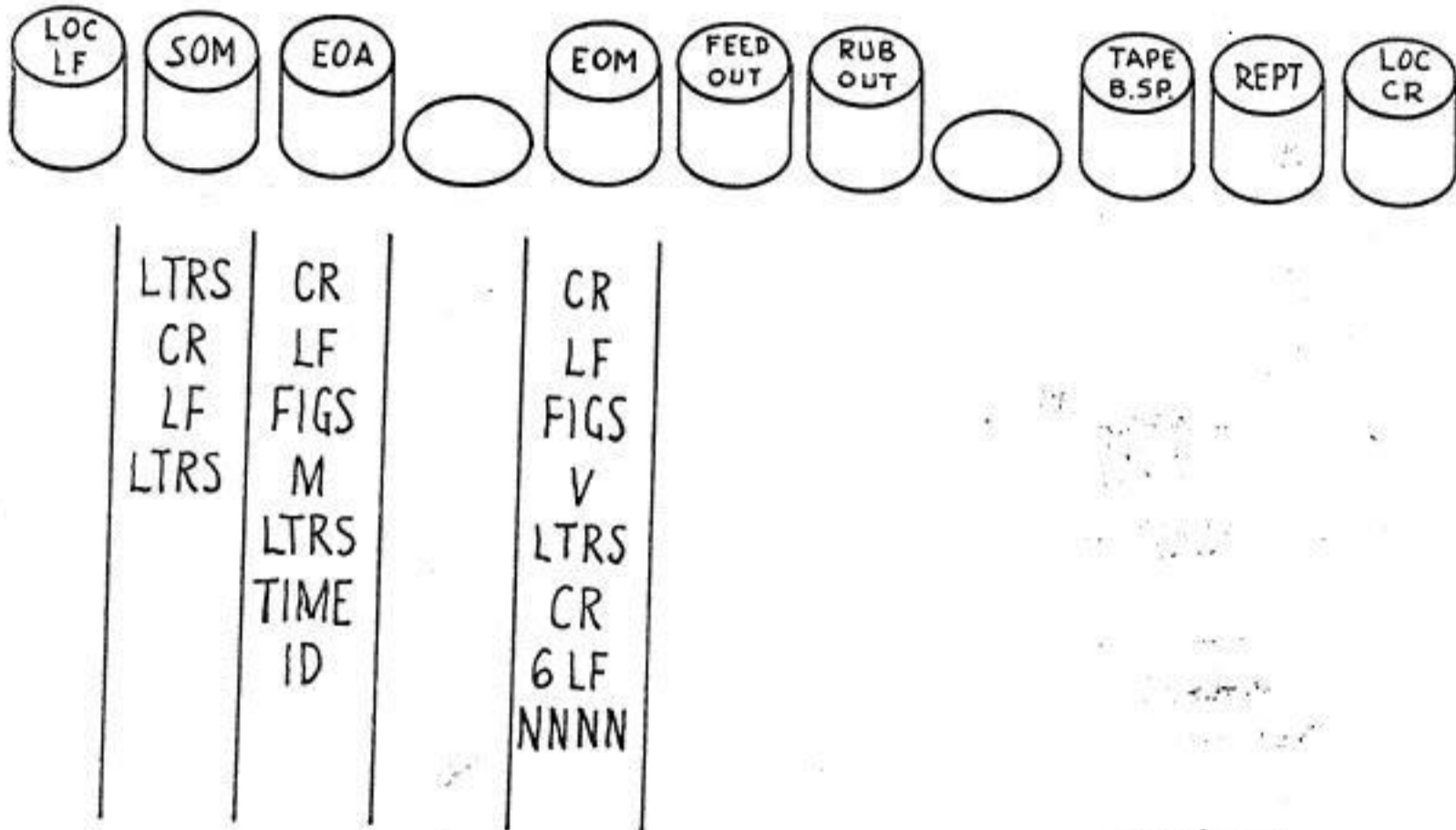


FIGURE VI-2