35 CONTROLMATIC TELETYPEWRITER DATA STATION ARRANGED FOR PRIVATE LINE SERVICE DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL 1
2. PHYSICAL DESCRIPTION 2
3. FUNCTIONAL DESCRIPTION 2
4. REFERENCES 18

1. GENERAL

1.01 This section describes the CONTROLMATIC teletypewriter (TTY) data station arranged for private line service as shown in Fig. 1. It provides information concerning the physical description, functional description, control functions, and method of operation of the station.

Purpose of Station

1.02 The private line station is an automatic send and receive (ASR) TTY with a second reader and additional logic and control circuitry integrated into the set. Operation is at 100-word per minute speed utilizing 8-level ASCII codes.

1.03 The station functions in two distinct modes of operation: an on-line mode and a format mode. The on-line mode permits the station to operate as a 35-type TTY with the added ability to transmit and receive both data and control signals which position the type box and horizontal tabulation mechanism to specific locations. When used in the format mode, the station is switched off line and allows the operator to program the station for data and format transmission.

On-Line Operation

1.04 The station may be used in the same manner as a conventional 35 ASR TTY equipped with a Data Auxiliary Set 820D2 equipped with a Data Set 108A, 108C, or 109A. When used in conjunction with other private line stations, previously formatted tape information is transmitted and recognized causing automatic horizontal and vertical tabulation of the receiving station. This controls positioning of data on complicated business forms. In addition, previously programmed variable and repetitive data, such as business addresses and company names, may be included in a by-product tape and transmitted as a complete message.

1.05 In many instances, the most efficient transmission will be realized by preparing a by-product tape when the station is receiving traffic in the T mode. The by-product tape contains any combination of input information plus the format instructions. The by-product tape can be inserted in the format reader and transmitted at the full 100-word per minute rate. A block diagram showing station operation in an on-line condition is shown in Fig. 2.

Format Mode

1.06 This mode allows the station to be used as a format control device. Program instructions are prepared from the keyboard by using special control codes. Logic circuits accept the program information and translate the control codes into machine functions. These functions allow the TTY to respond to such functions as call-in of optional input devices such as an edge punch, stepping switch, etc.

1.07 The station may also be used in the format mode to prepare a by-product tape containing all data and format information. This tape is a combination of inputs from the format tape and the variable data sources and contains all information necessary for a complete message transmission. This tape may be transmitted at a 100-word per minute speed as explained in 1.05. A block diagram showing station operation in the format condition is shown in Fig. 3.

1.08 When absolute accuracy is required, a tape verifier circuit is available on an optional basis which makes a character-by-character comparison of two tapes which are prepared from the same source information.

2. PHYSICAL DESCRIPTION

2.01 The private line TTY station is a self-contained unit which is completely assembled by the distributing house prior to delivery. A typical station and location of the subassemblies discussed in this section are shown in Fig. 1.

2.02 The complete station weighs approximately 200 pounds and all components are contained in a 35F cabinet. Maximum cabinet dimensions are as follows: height 38.5 inches, width 40.0 inches, depth 24.0 inches. Specific TTY components coded for private line application are listed in Table A.

2.03 All teletypewriter components except the format logic panel and Data Auxiliary Set 820D2 are mounted under the lower cover in a conventional manner (similar to the 35 ASR TTY). Detailed theory of operation, maintenance, and adjustment of these components are covered in applicable BSP Sections 574-YYY-ZZZ and will not be discussed in this text. The Data Set 820D2 and format logic panel are rack mounted behind the front panel. The method of access to all components is covered in Section 591-806-200.

3. FUNCTIONAL DESCRIPTION

3.01 A brief functional description of the main TTY components in the CONTROLMATIC station is provided in 3.02 through 3.06. Since their use and operation is common to conventional TTY application, a detailed discussion will not be used in this text.

3.02 ***Tape Readers:*** The private line TTY data station is equipped with two paper tape readers. The rear (inboard) reader is the format program reader which supplies format control and repetitive data for the message to be transmitted. The front (outboard) reader furnishes variable data information. Reader hold circuits provide momentary delay after a format control code is read.

3.03 ***Keyboard:*** The keyboard provides the operator with a means of entering data. The page printer, format logic panel, reperforator, or external receivers may be connected to the keyboard as required. The keyboard generates all upper case alphabet, the Arabic numerals, space, 24 punctuation marks, special symbols, and control (nonprinting) characters. An even parity is generated with every character. Refer to Fig. 4 for keytop disignations.

3.04 ***Page Printer:*** The page printer is an electromechanical receiving device which converts serial electrical signals into mechanical motion which types data on single or multiple copies on continuous business forms. Typing signals can originate from the keyboard, tape readers, optional external input sources, and the signal line. The page printer can print all lower case graphic characters in the ASCII code.

3.05 ***Reperforator:*** The reperforator is an electromechanical receiving device which connects serial electrical signals and combines into one paper tape all data coming from the keyboard, tape readers, and the signal line. The tape is one inch wide and will contain an eight level punched code and an optional corresponding printing character which is typed between the feed holes. Operation of the punch is controlled by local mode or by remote code transmission.

1	Data Tape Reader	Reads data (information) tape.
2	Format Tape Reader	Reads format (program) tape containing control codes and fixed information and transmits by-product tape.
3	Local Control Panel	Provides control for on-line transmission, receiving modes, and special format operations.
4	Reperforator	Prepares a composite tape for transmission under control of tape readers, keyboard, and optional input device. Reperforates tape of received message.
5	Page Printer	Types local copy under control of tape readers and keyboard. Types copy of received message.
6	Break Release and Message Waiting	Provides a method of signaling over the line and an indication of an incoming call.
7	Main Control Panel	Controls on-line and format modes.
8	Keyboard	Used to prepare tape for data transmission, format control, and on-line variable data transmission.
9	Data Set	Converts serial and parallel information for transmission and receiving functions.
10	Format Logic Panel	Controls format under control of keyboard and tape readers.

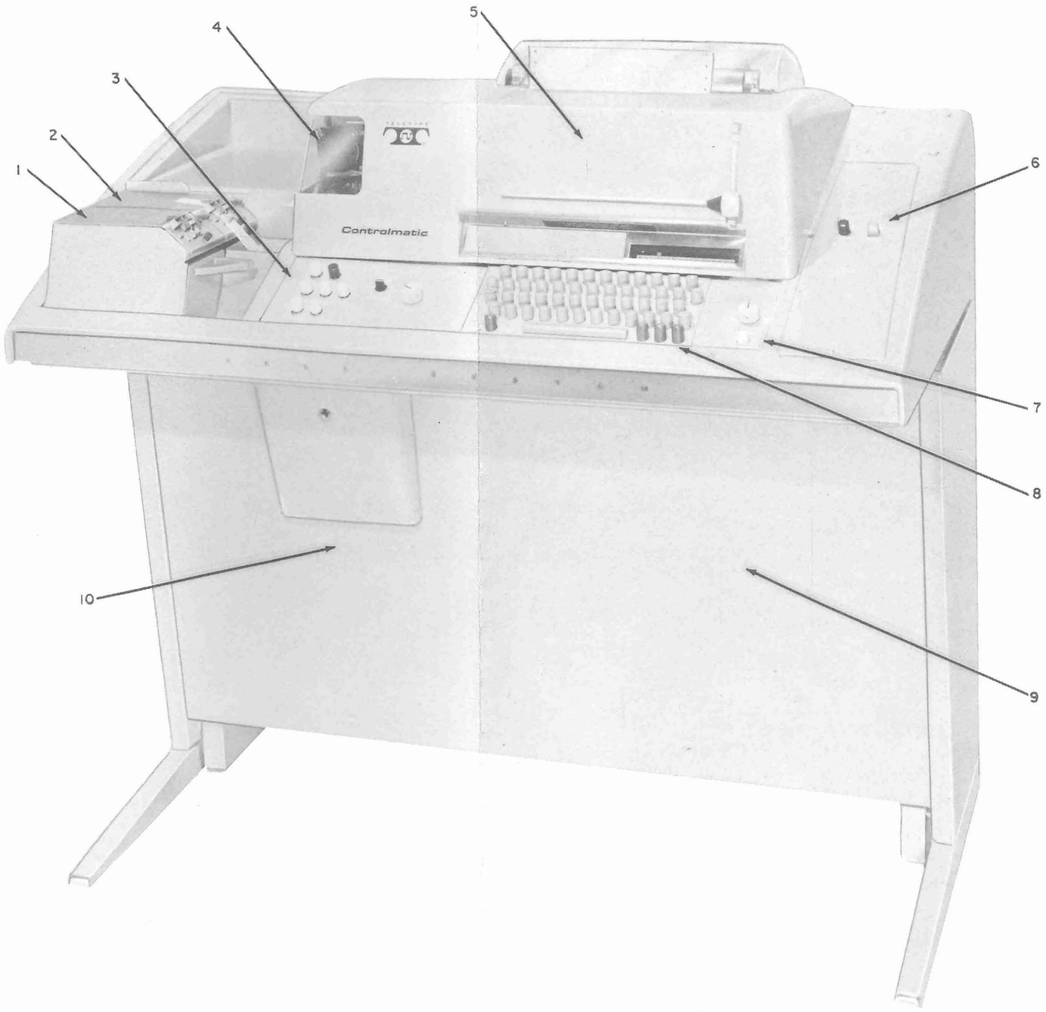

Fig. 1—CONTROLMATIC Data Station Arranged for Private Line

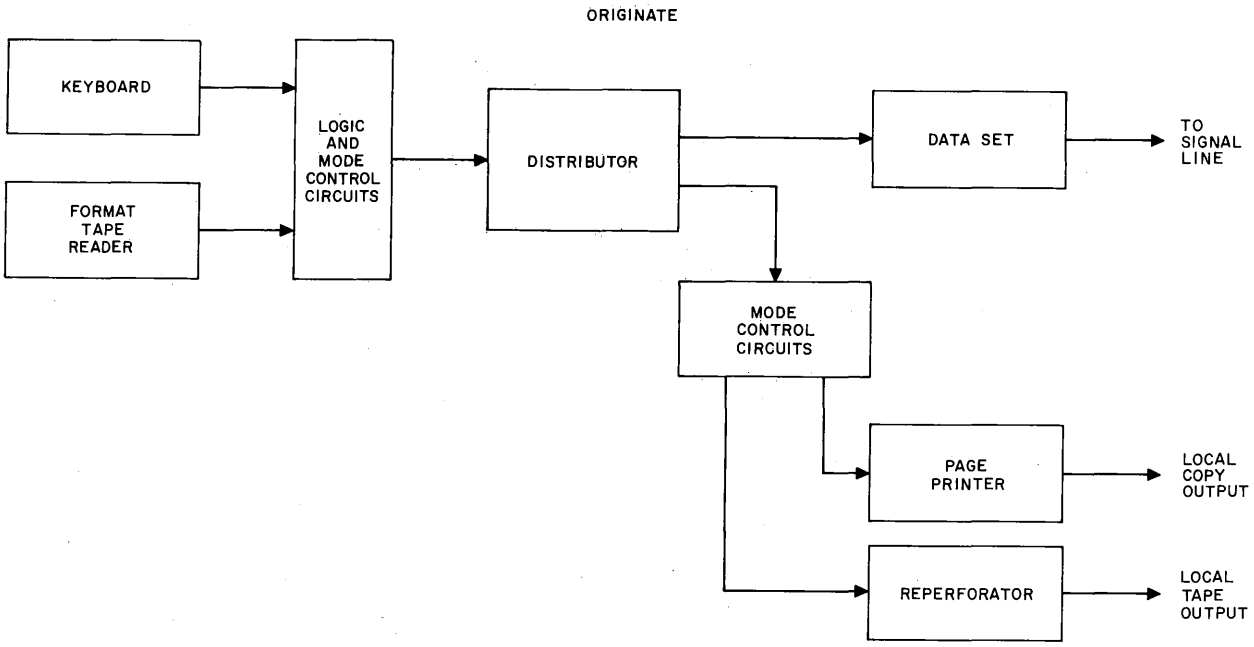

Fig. 2—On-Line Mode

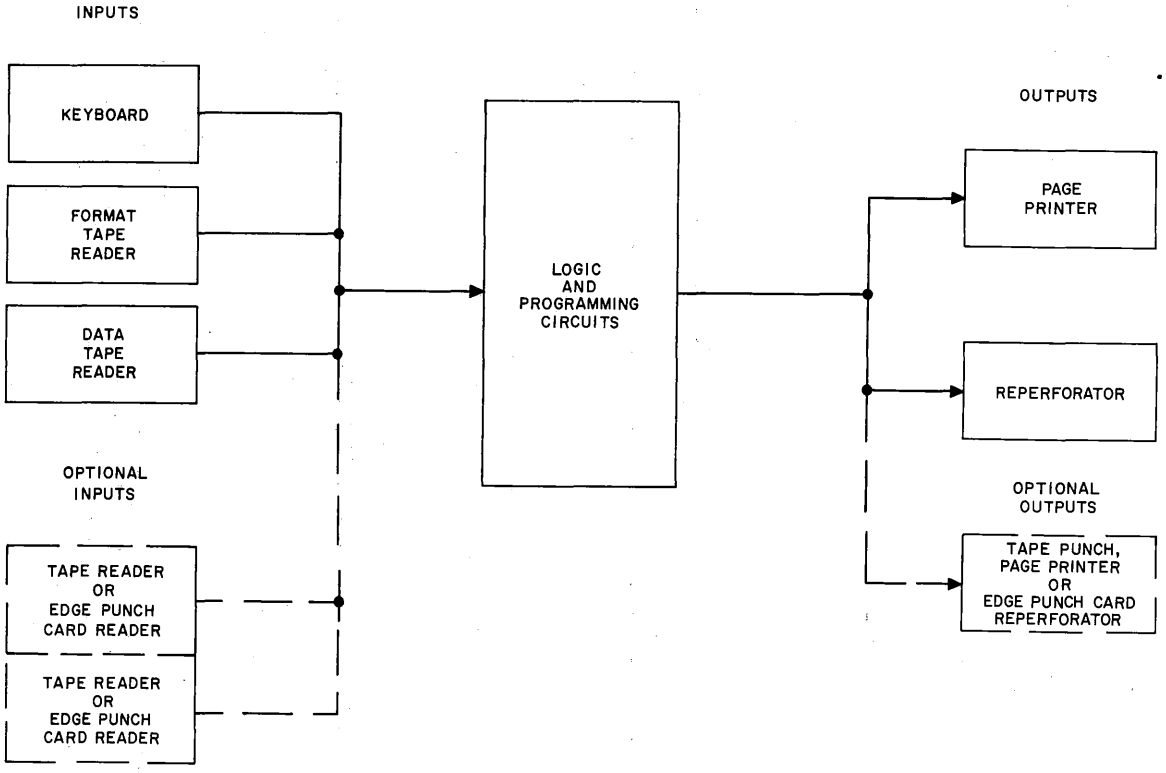

Fig. 3—Off-Line Mode

TABLE A

CODED COMPONENTS FOR CONTROLMATIC TTY

EQUIPMENT	FEATURES
35A Reader (2 required)	1. Parallel output, 8 level 2. One auxiliary contact, normally open 3. Two-position control lever "RUN-FREE," spring biased to "RUN" 4. 48-volt clutch magnet 5. Single-cycle clutch 6. Tight tape, tape-out contact 7. 50-pin separable connector 8. Mounts on a 35-type reader base
35AA Electrical Service Unit	1. Two 500 milliampere selector magnet drivers w/Break Detection Feature 2. Copylight Transformer Assembly 3. Three wiring fields 4. Cabling to connect to format logic panel 5. Main control relay 6. Cabling to connect to control panels
35B Distributor	1. Serial output, 8 level 2. One auxiliary contact, normally open 3. 14-pin separable connector 4. Equipped with gearing 5. Mounts on a 35-type reader base
35A Format Logic Panel	1. Eight plug-in printed circuit cards for set control circuits 2. Relays—wire spring, mercury, and dry reed 3. ±48 volt power supply 4. Separable connectors and cables 5. Approximately 18 by 14 inches 6. Single chassis 7. Mode switching relays (in addition to relays provided for format logic) 8. Break detector SMD used as incoming call detector 9. Mounts vertically on rack in pedestal of teletypewriter cabinet
35A Reader Base	1. Mounts two 35-type readers 2. Drive gears 3. Motor with fusing 4. Provision for mounting a 35-type distributor 5. Reader front panel 6. Sheet metal tape pan with tape guide
35F Teletypewriter Cabinet	1. Furnished with a framework in the pedestal to mount the logic panel and data set

TABLE A — Cont

EQUIPMENT	FEATURES
35S Teletypewriter Base	1. Even parity, 11-unit code keyboard with ASCII 2. Tape container (not equipped with tape-out alarm switch) 3. Arranged for quick electrical disconnect of reperforator from base 4. Intermediate gear assembly 5. Parallel output from code reading contacts
35R Typing Unit	1. Individual form insertion for 9-1/2 by 11 inch forms 2. Sprocket feed 3. Low paper, paper out switch 4. Horizontal tabulation 5. Vertical tabulation 6. 9-1/2 by 11 inch form feed-out 7. 500 milliampere selector

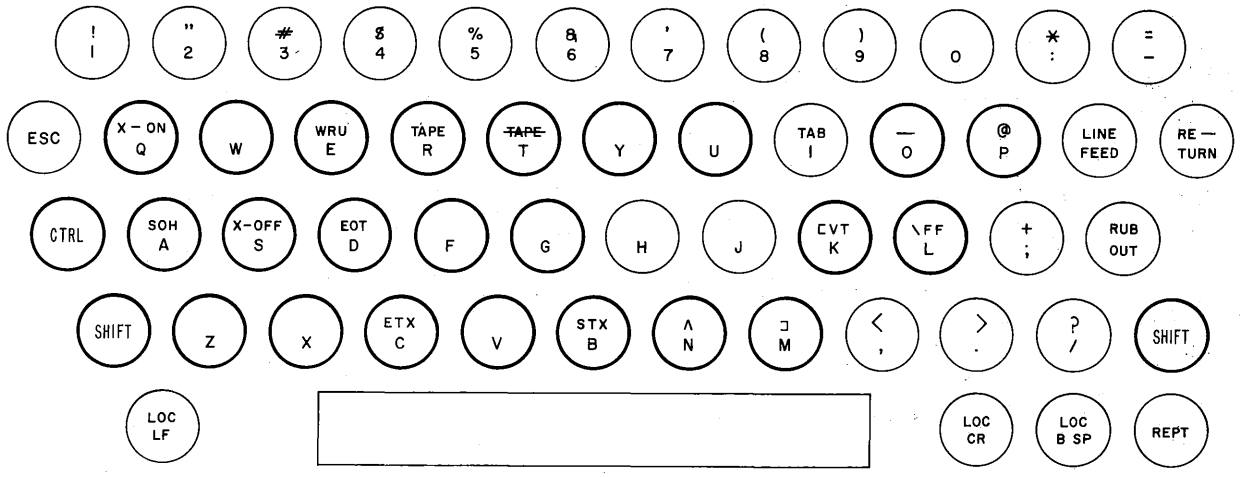

Fig. 4—Keyboard

3.06 ***Main Control Panel:*** The main control panel is located at the right of the keyboard (see Fig. 5). On it are mounted a lamp (KEYBOARD BLINDED) for indicating keyboard condition and a twist switch (ON LINE-OFF-FRMT CTRL) for

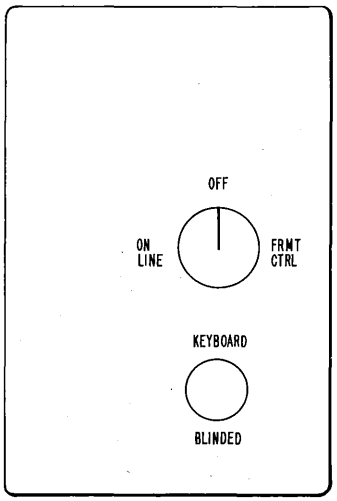

Fig. 5—Main Control Panel

setting the three modes of station operation. The ***on-line*** mode enables the station to function as a conventional private line TTY station and permits operator selection of the most applicable transmission mode (K, KT, T, TTS, TTR). The OFF position disables the TTY functions but allows the data set to remain on. The FRMT CTRL mode conditions the station to operate as a program generating device, (logic circuitry activated) and permits operator preparation of format and by-product tapes.

3.07 ***Local Control Panel:*** Five modes of on-line operation are provided in the CONTROLMATIC station. While these modes permit on-line traffic to be sent and received, the simultaneous preparation of a by-product tape is also provided. This flexibility allows the operator to select the mode most suitable for handling job and traffic requirements. The five modes are selected by a a twist switch located on the local control panel as shown in Fig. 6.

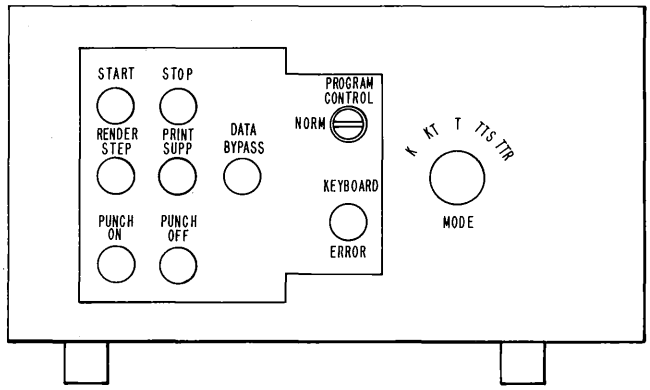

Fig. 6—Local Control Panel

The function of each switch position is as follows:

K—Keyboard—This mode permits transmission of traffic via the keyboard with the page printer monitoring transmitted data. See Fig. 7.

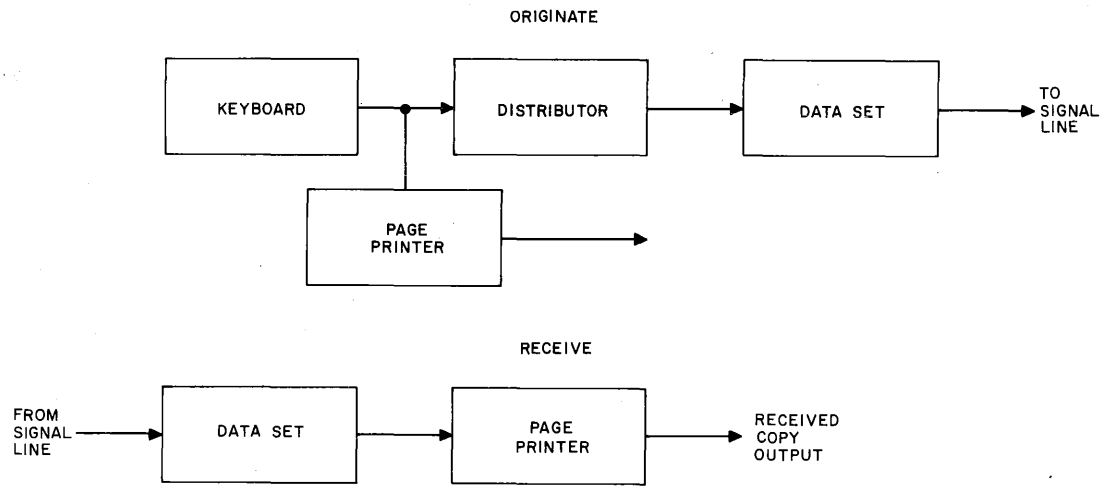

Fig. 7—K Mode

KT—Keyboard Tape—This mode provides the ability to monitor the transmitted data from the keyboard and received traffic via the reperforator and page printer. See Fig. 8.

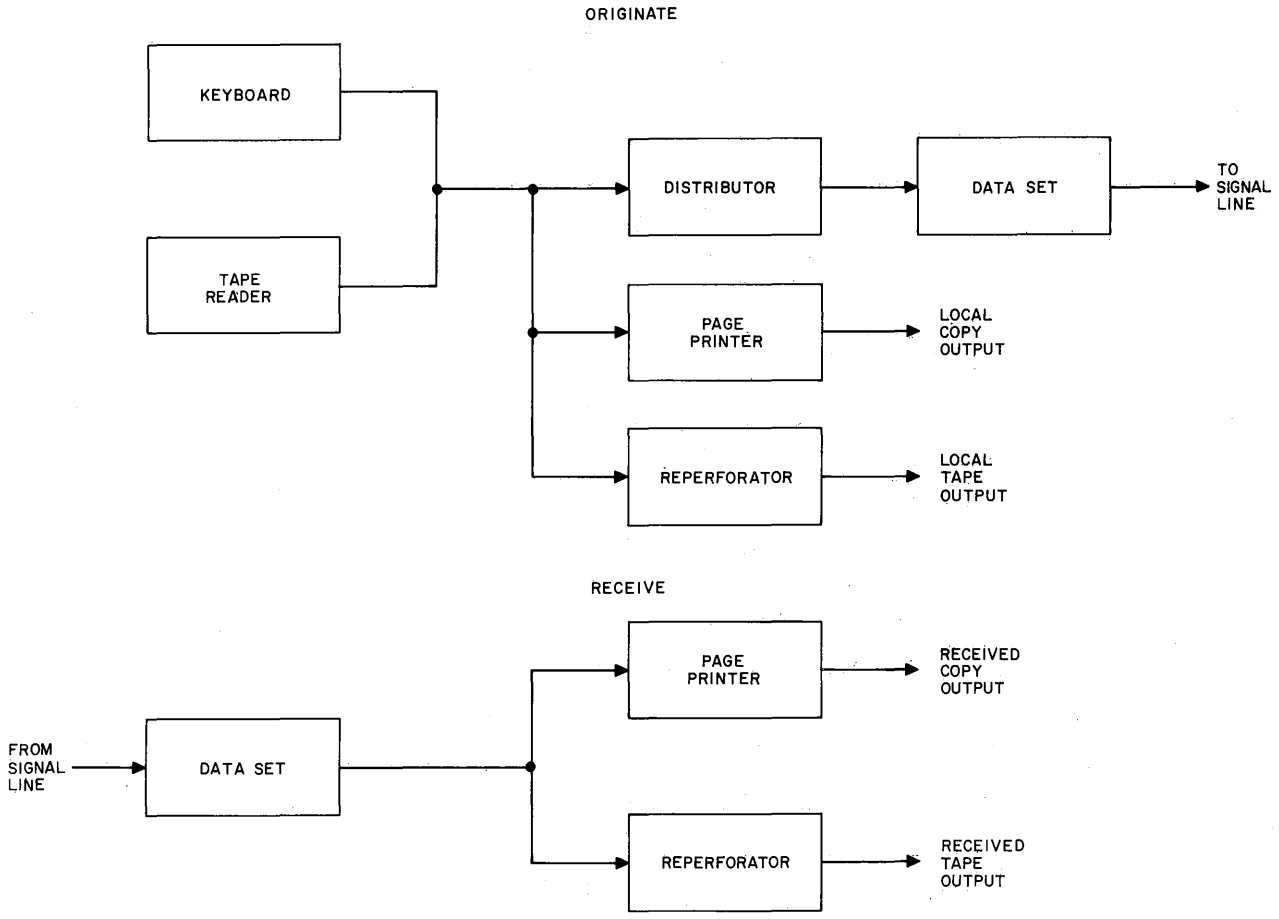

Fig. 8—KT Mode

T—Tape—This mode allows traffic to be received via the page printer while allowing simultaneous preparation of tape. See Fig. 9.

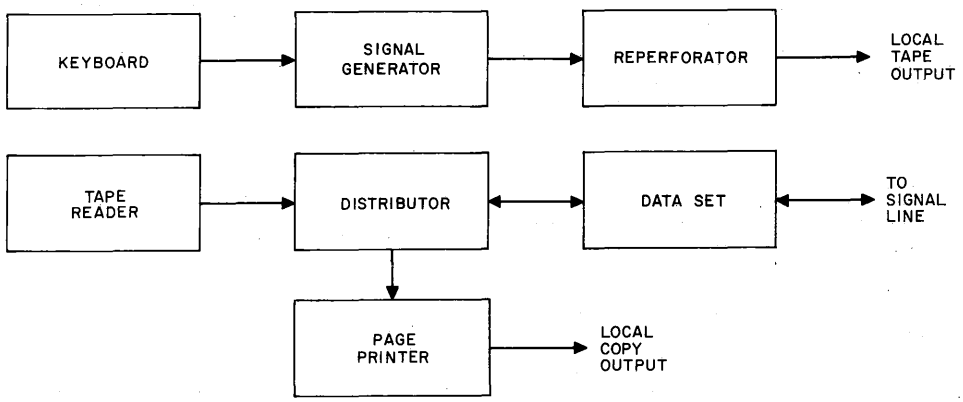

Fig. 9—T Mode

TTS—Tape-to-Tape Send—This mode permits traffic to be sent via the reader while allowing simultaneous preparation of tapes. See Fig. 10.

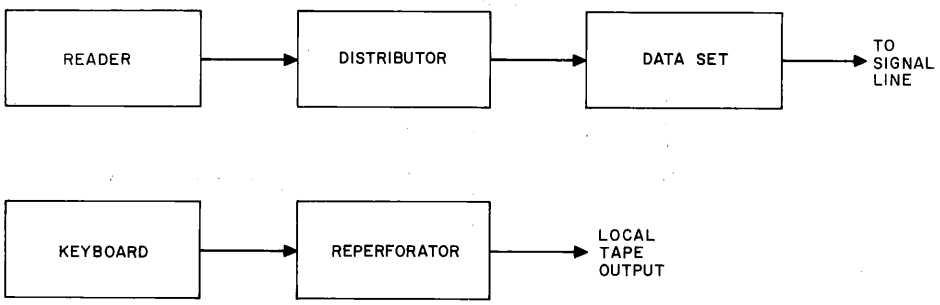

Fig. 10—TTS Mode

TTR—Tape-to-Tape Receive—This mode permits traffic to be received via the reperforator. The program reader is disabled. See Fig. 11.

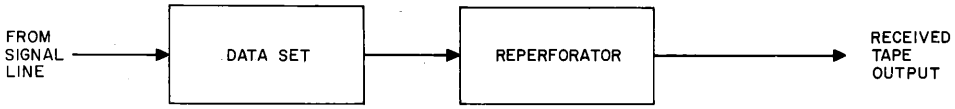

Fig. 11—TTR Mode

TABLE B

ON LINE MODE SWITCHING CONDITIONS

MODE CONDITION	TTY UNIT CONDITION			
	PROGRAM TAPE READER	KEYBOARD	REPERFORATOR	PAGE PRINTER
K	Disabled	On signal line circuit	Aux local	On signal line circuit
KT	On	On signal line circuit	On signal line circuit	On signal line circuit
T	On	Aux local	Aux local	On signal line circuit
TTS	On	Aux local	Aux local	Blinded to signal line circuit
TTR	Disabled	Aux local	On signal line circuit	Blinded to signal line circuit

Note: The program tape reader is the only reader available in the on-line mode.

3.08 Table B shows the equipment and corresponding circuit conditions for each mode of the selecting switch.

3.09 The eight centrally located controls outlined in white on the local control panel are unique for CONTROLMATIC TTY operation. They are operational only when the station is in a format mode and provide functions which are not required for normal on-line TTY operation. The function of each key is as follows:

START—This control normally starts the format (inboard) reader. The data reader will also be started if it has been programmed.

STOP—This control stops both readers and terminates both data bypass and print suppress modes.

READER STEP—This control enables the preselected reader (under format control) to read and advance one character each time the pushbutton is operated.

PRINT SUPP (print suppress)—This control starts the input device which has been selected but prevents the page printer from receiving information. Other controls are not affected. This mode of operation continues until a stop code is read or the STOP pushbutton is operated. Operation of the STOP pushbutton usually results in printing a garbled character. The mode will not stop until the last character cycle has been completed.

DATA BYPASS—This control permits skipping over blocks of data that are not always required. This mode of operation continues until a print restore character is read or the STOP pushbutton is operated. The mode will not stop until the last character cycle has been completed.

PUNCH ON—This control permits the reperforator to accept data.

PUNCH OFF—This control prevents data from reaching the reperforator.

PROGRAM CONTROL—This is a two-position twist switch which activates and deactivates the program control features. When turned to NORM, the format control codes are prevented from entering the format logic tree.

3.10 Table C shows the conditions established for controls related to format operation and on-line transmission modes.

Note: The KEYBOARD ERROR designation is a plugged mounting reserved for use with the fixed field modification kit.

TABLE C

LOCAL CONTROL PANEL OPERATION

KEY	MODE	LAMP LIGHTS	LENS COLOR	METHOD OF OPERATION
Start	FRMT	X	White	Push
Stop	FRMT		Red	Push--
Reader Step	FRMT		White	Push
Print Suppress	FRMT	X	White	Push
Data By Pass	FRMT	X	White	Push
Punch On	FRMT	X	White	Push
K, KT, T, TTS, TTR	ON LINE			Twist
NORM/ PROGRAM CONTROL	FRMT			Twist
Keyboard Error	FRMT	See Note.		

Note: Plugged closed—reserved for installation of Fixed Field Modification Kit.

Break Release and Message Waiting

3.11 This equipment is located at the extreme right of the page printer. See Fig. 12. The lamp and key functions are as follows:

MESSAGE WAITING—This is an indicator lamp which is part of the incoming call detection

feature. The lamp lights when the station is called while in the format mode.

BREAK BRK-RLS—This is a three-position toggle switch, spring loaded to the center (normal) position. An open line condition is generated by operating the switch to the BREAK position which stops transmission over the line, blinds the sending TTY keyboard and lights the BREAK lamp. Operation of the switch to the BRK-RLS position restores transmission ability and extinguishes the lamp.

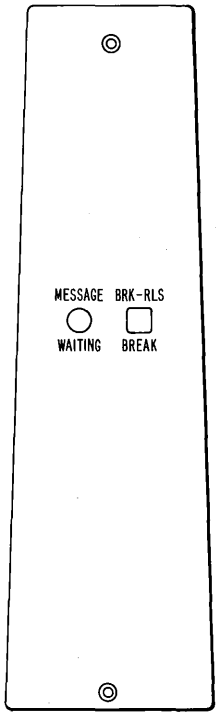

Fig. 12—Break Release and Message Waiting

Format Control

3.12 Format (program control) codes are nonprinting characters which condition the CONTROLMATIC to respond to various logic functions, ie, data input selection, tape control, punch control, maintain format, etc.

3.13 Format codes are generated by the operator at the TTY keyboard. Operation of CTRL and P keys sets the format condition and permits subsequent control codes to be treated as internal codes. Operation of CTRL D, A, E, or F keys terminates this condition.

3.14 Table D list the keys to be operated, ASCII code generated, and logic function for each code. Fig. 4 shows the keyboard control keys in heavy outline for CONTROLMATIC operation.

3.15 The format logic panel is located at the left side of the station behind the front panel. The relays and plug-in circuit cards for internal control code functions are mounted on the format logic panel. It also contains a +48v power supply.

3.16 The format logic panel functions to recognize internal control codes generated at the keyboard and/or local control panel and causes the station to take appropriate action in response to these codes. Inputs from the keyboard are in the form of parallel signals which the code recognition circuits must recognize and convert into specific relay operations. Bit relays are arranged in a logic tree which requires that certain contact closures be made to provide an enabling path for CONTROLMATIC functions. Signals from the eight controls on the local control panel require no information conversion but directly enable the circuits to respond for each control operation.

3.17 A block diagram which shows the relationship of the format logic panel to the the station components is shown in Fig. 13.

3.18 Before a control code can be applied to the logic tree, it must first be recognized as a valid code in the control group. This is accomplished by requiring that all control characters have either bits 4, 6, and 7 spacing, or bits 6 and 7 spacing and bits 4 and 5 marking. The control code recognition circuits will operate when either of these conditions is met.

3.19 When either condition is satisfied, four code relays are energized in accordance with the spacing and marking condition of bits 4, 5, 6, and 7. The contacts of these relays are arranged in a logic tree which provides a path for pulses to be applied to control circuits for specific functions.

3.20 A specific character (CTRL P) must be generated before any control character may be generated. This conditions the logic to respond to subsequent valid control codes.

3.21 Operation of CTRL D terminates code recognition and causes the station to respond to the standard ASCII codes. Operation of CTRL A, E, or F, which selects optional input devices, will also end control code recognition.

TABLE D

FORMAT CONTROL CODES

KEYBOARD DESIG-NATION	ASCII CODE GENERATED	CONTROLMATIC LOGIC FEATURE	FUNCTION
CTRL A	SOH	Data input 1	Permits the data tape reader and keyboard to operate, stops the other input devices, and conditions the set to respond to the ASCII codes.
CTRL B	STX	Auxiliary receiver on	Permits auxiliary receiver to operate.
CTRL C	ETX	Auxiliary receiver off	Stops auxiliary receiver.
CTRL D	EOT	Normal code	Conditions the set to respond to the ASCII control codes.
CTRL E	ENQ	Data input 2	Permits operation of a stepping switch input and the keyboard, stops the other input devices, and conditions the set to respond to the ASCII control codes.
CTRL F	ACK	Data input 3	Permits operation of an auxiliary input device and the keyboard, stops other input devices, and conditions the set to respond to the ASCII control codes.
CTRL G	BEL	Print restore	Ends the automatic print suppress mode of operation (permits the typing unit to again operate, and stops the reader if preceded by a stop code). It also ends the maintain format mode and the data by-pass mode. (Bell)
CTRL P	DLE	DLE	Conditions the set to respond to internal control codes. This code is always suppressed in the program control mode.
CTRL Q	DC1	Program tape reader on	Permits operation of the program tape reader and the keyboard, and stops the other input devices (X-On).
CTRL R	DC2	Punch on	Permits operation of the tape punch (TAPE).

TABLE D — Cont

KEYBOARD DESIG-NATION	ASCII CODE GENERATED	CONTROLMATIC LOGIC FEATURE	FUNCTION
CTRL S	DC3	Stop	Stops all input devices except the keyboard to permit the operator to enter information. It also ends the manual print suppress mode by permitting the typing unit to operate, and stopping the reader (X-Off).
CTRL T	DC4	Punch off	Stops the tape punch.
CTRL U	NAK	Automatic print suppress	Stops the typing unit and keeps the reader running until the next print restore code (if there is an intervening stop code) (Error).
CTRL V	SYN	Maintain format	Modifies the print suppress mode and the data by-pass mode by allowing ASCII controls . . . CR, LF, TAB, V.T., and FORM . . . to be received by the typing unit (and the tape punch in the case of "data bypass"). This allows the typing unit to advance across and down a form when a section is not used.
CTRL W	ETB	Card eject	This is a lead on which an electrical pulse is provided to a card reader, to enable the card reader to eject a card.
CTRL X	CAN	—	Fixed field arrangement No. 1.
CTRL Y	EM	—	Fixed field arrangement No. 2.
CTRL Z	SUB	—	Fixed field arrangement No. 3.
SHIFT-CTRL K	ESC	—	Keyboard unblinded. Keyboard indicator lamp extinguished.
SHIFT-CTRL L	FS	—	Keyboard blinded. Keyboard indicator lamp lighted.
SHIFT-CTRL M	GS	—	Typing unit blinded.
SHIFT-CTRL M	RS	—	Typing unit unblinded.
SHIFT-CTRL O	US	—	Unassiged (SPARE).

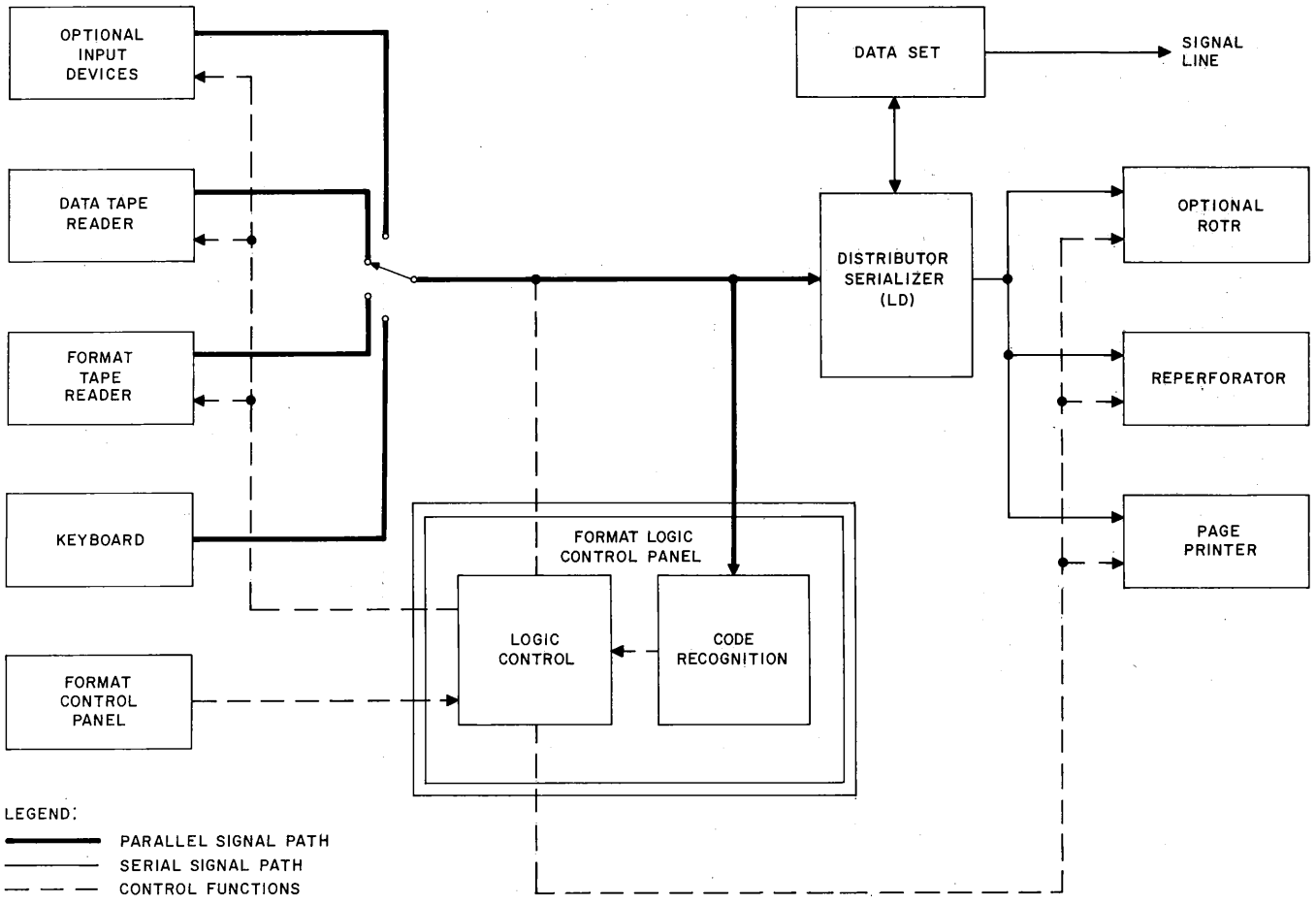

Fig. 13—Format Logic Functions

Optional Features

3.22 Optional apparatus and features applicable to the CONTROLMATIC station are as follows:

- ***Tape Verifier***—TP330710—This unit verifies an original by-product tape by making a character-by-character comparison during preparation of a second by-product tape from the original data.

- ***Two-Color Printing***—TP179724—Ribbon shift is provided under control of logic circuits and the operator.

- ***Fixed Field Operation***—TP330690—Five fixed field operations are provided by this kit. A field is an information requirement where the data station or operator must supply information, such as a blank space on a business form.

(1) ***Mandatory Field, Mandatory Keyboard Fill:*** The operator must always enter the field with a precise number of keyboarded printing characters.

(2) ***Mandatory Field, Mandatory Partial Keyboard Fill—With Automatic Pad-Out:*** The operator must always enter the field with a minimum number of keyboarded printing characters. After the minimum number has been satisfied, transfer to the subsequent field is by automatic pad-out (automatic spacing) of the partially filled fields.

(3) ***Mandatory Field, Mandatory Partial Keyboard Fill—Without Automatic Pad-Out:*** The operator must always enter the field with

some minimum number of keyboarded printing characters. Manual transfer to a subsequent field, after the minimum number of characters has been satisfied, is required.

(4) ***Permissive Field, Graphics Only—With Automatic Pad-Out:*** The operator is permitted to determine if a field is to be entered. If entered, only printing characters are valid. Partially filled fields are then padded out automatically.

(5) ***Permissive Field, All Characters Valid—Without Pad-Out:*** The operator is permitted to determine if a field is to be entered. If entered, all ASCII characters are valid. Manual transfer to a subsequent field is required.

3.23 The Data Auxiliary Set 820D2 functions to establish connections between stations via a private line network. When equipped with a Data Set 108-type, the dc TTY pulses are converted into ac signals for transmission to the signal line.

3.24 The data sets employ frequency shift modulation with a frequency shift of +100 Hz for a mark and -100 Hz for a space. The sending center frequency of transmission for Data Set 108A-type is 2125 Hz (f_2); for Data Set 108C-type, the frequency is 1170 Hz (f_1). The receiving center frequency of transmission for Data Set 108A-type is 1170 Hz (f_1); for Data Set 108C-type, the frequency is 2125 Hz (f_2). These are the same frequencies which are used in TWX and DATA-PHONE® service; however, Data Set 108A-type has a fixed mode of operation which corresponds to the answer mode. Similarly, the fixed mode of operation of Data Set 108C-type corresponds to the originate mode.

3.25 Data Sets 108A- and 108C-type will operate satisfactorily over voiceband loops and trunks which allow the incoming carrier frequency to arrive at a signal strength greater than -40 dBm.

3.26 When the Data Auxiliary Set 820D2 is equipped with Data Set 109A, the data station will provide low-speed half-duplex (HDX), serial data communication over a closed loop 2-wire metallic private line circuit.

3.27 The data station can communicate only with Data Set 109-type used in one of the following arrangements:

(a) Data station-to-hub operation where Data Set 109B-type is used at the hub.

(b) Data station-to-data station operation where Data Set 109A-type is used at the distant station.

3.28 The data station is limited to use on a 2-wire metallic line because Data Set 109A-type will operate only over a closed loop. The line used by the data station cannot be equipped with anything that will break the dc path of the loop. See Fig. 14 for typical arrangement for data set configuration. For additional information concerning Data Set 108-type and 109-type, refer to the reference in Part 4 of this section.

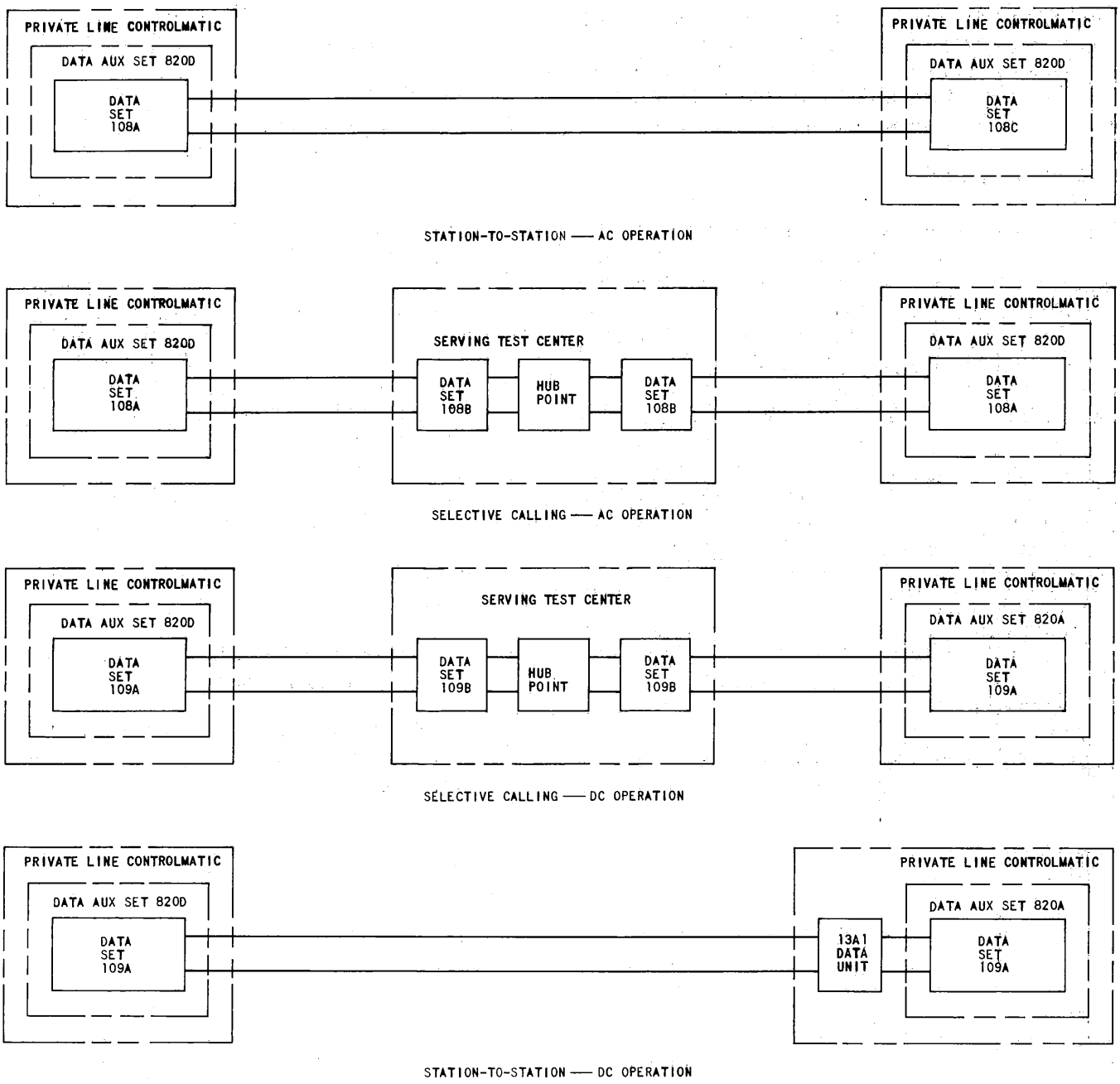

Fig. 14—Originating and Receiving Stations

Originating Traffic

3.29 Traffic is originated on a station-to-station arrangement by turning on both TTYs (main control panel switch set to ON-LINE), operating the BREAK BRK-RLS key to the BREAK and BRK-RLS positions in sequence, and transmitting from the desired station. The originating and receiving stations will be connected to the signal line and both TTYs will automatically respond. When more than two stations are used, a hub arrangement is used and a particular station or stations may be selected to receive by keyboarding the desired station address.

3.30 Either station attendant may interrupt transmission by operating the BREAK

BRK-RLS key to the BREAK position for a 1/2-second interval. This timing prevents the break signal from being misread as a TTY character or a disconnect signal. Before either station can resume sending, the BREAK BRK-RLS key must be operated to the BRK-RLS position.

Answering Traffic

3.31 When a receiving station is in a format mode (main control panel switch set to FRMT CTRL), an incoming call detector monitors the signal line. When a distant station wishes to call, the attendant operates the BREAK BRK-RLS key to the BREAK position. The call detector senses the break at the receiving station and activates the MESSAGE WAITING indicator lamp (blue) located on the faceplate. The local attendant can answer by switching to the on-line mode. The MESSAGE WAITING indicator lamp will be extinguished. If the attendant is in the midst of a formatting exercise, the call indication can be ignored and the lamp retired by depressing the LAMP key. The driver is blinded when the set is switched to the on-line mode and the call detection feature is disabled.

4. REFERENCES

4.01 The following documents pertain to the CONTROLMATIC TTY data station.

- 591-023-101—Data Sets 108A- and 108C-Type—Single Private Line Station—Using Data Auxiliary Set 820D-Type—Description and Operation
- 591-023-201—Data Set 108A- and 108C-Type—Installation and Connections
- 591-024-301—Data Set 109A-Type—Using Data Auxiliary Set 820D-Type—Single Private Line Station—Maintenance
- Equipment Planning Guide—Automated Communications Set (TTY Publication)
- Schematic Wiring Diagram for Model 35 ASR Set With Format Control Arranged for Private Line
- 574-207-100—CONTROLMATIC TTY—General Description and Operation
- 574-207-200—CONTROLMATIC TTY—Installation
- 574-207-300—CONTROLMATIC TTY—Service Maintenance and Tests
- 591-024-501—Data Set 109A-Type—Using Data Auxiliary Set 820D-Type—Single Private Line Station—Tests