37 TELETYPEWRITER AUTOMATIC SEND-RECEIVE (ASR)

STATION ARRANGEMENT – NONSWITCHED POINT-TO-POINT

PRIVATE LINE SERVICE

DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This section provides a description of the features and operating characteristics of the Model 37 Automatic Send-Receive (ASR) Teletypewriter (TTY) Station for nonswitched point-to-point private line service (Figure 1). For more detailed information on the sets and components comprising the station, refer to the section reference listing in Part 5. Since this is a general revision and the previous issue did not receive general distribution, marginal arrows normally used to indicate changes have been omitted.

1.02 The 37 ASR TTY station includes all of the components, and provides all of the features, of the 37 Keyboard Send-Receive (KSR) TTY station. In addition, the 37 ASR TTY station provides the capability of sending and receiving messages using paper tape. Refer to Section 591-801-102 for a description of the KSR TTY station.

1.03 The standard 37 ASR TTY station includes a 37 ASR Set, and either a Data Auxiliary Set 820D or the 1A data station, Single Channel Arrangements (SCA).

1.04 The 37 ASR TTY is a heavy duty set that functions with the ASCII (American National Standard Code for Information Interchange) code and operates with a data set having EIA (Electronics Industries Association) Standard RS-232-C interfacing. Messages are transmitted and received at the speed of 150 wpm (words per minute).

1.05 References to left or right, top or bottom, front or rear, etc, apply to the terminal in its normal position as viewed by the operator in front of the terminal.

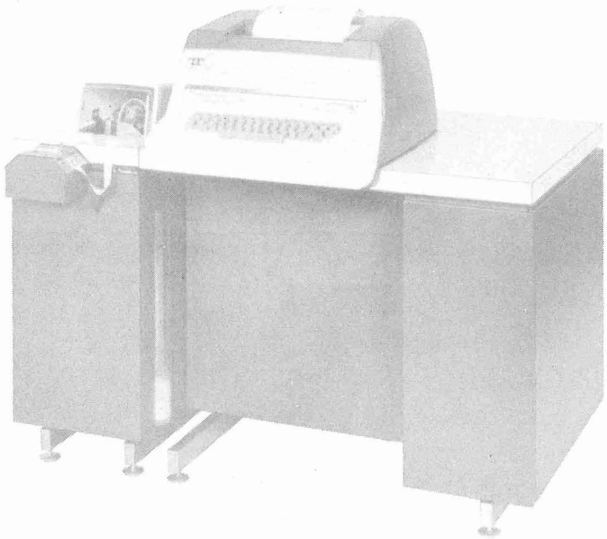

Figure 1 - Model 37 ASR TTY Station

Prepared for American Telephone and Telegraph Company by Teletype Corporation

2. STATION FEATURES

2.01 Since the 37 ASR TTY station includes a complete 37 KSR TTY Set, the features listed and described in Section 591-801-102 apply. The following features are also provided with the addition of the separate Reperforator-Transmitter (RT) module (Figure 2) in this station.

(a) A 150 wpm, 10-unit code tape reader, controlled locally or on-line.

(b) A typing or nontyping reperforator operating at 150 wpm with a 10-unit code and controlled locally or on-line.

(c) Tape alarm indicators.

(d) A variety of optional tape handling devices including power winders/unwinders.

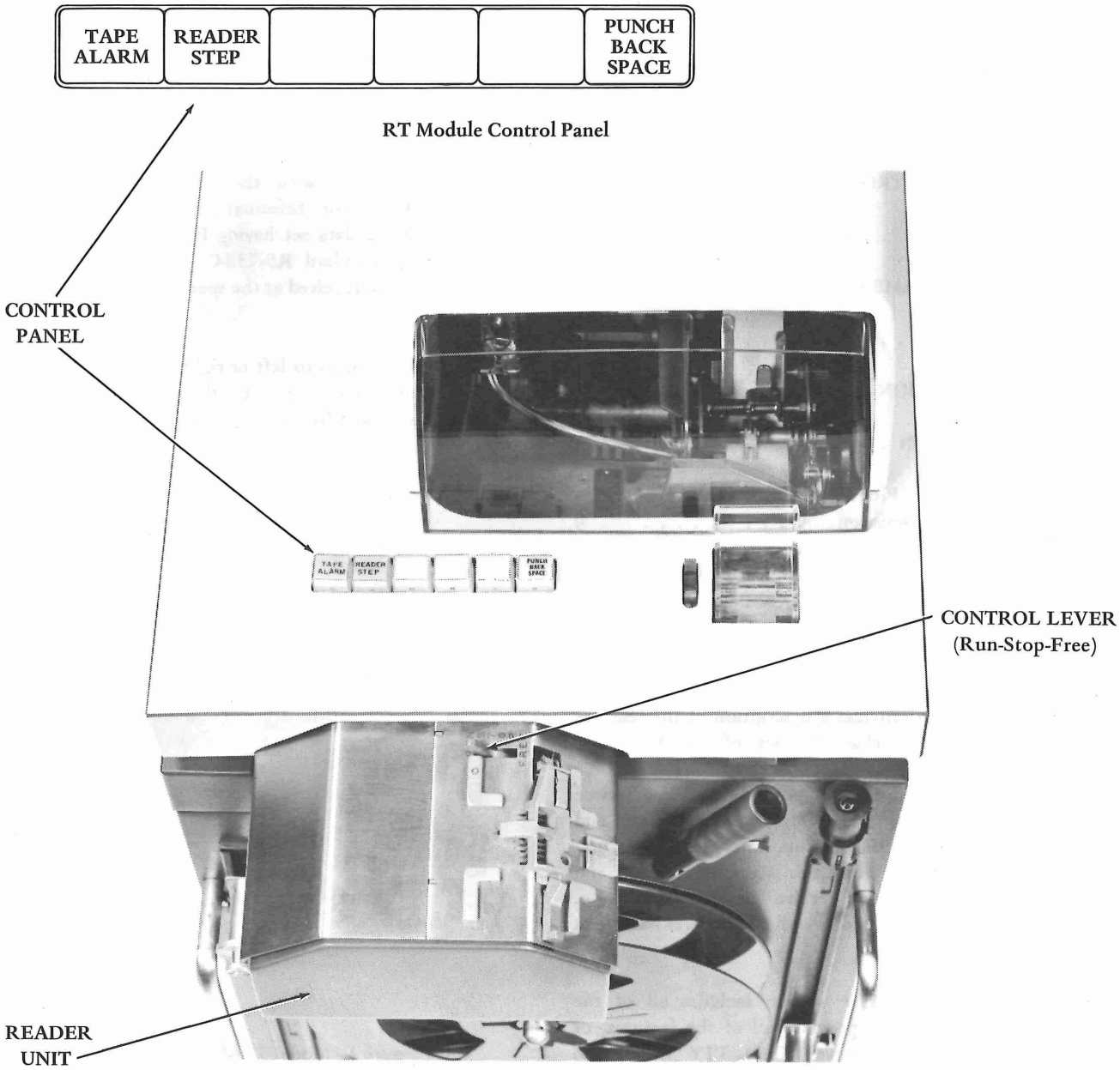

Figure 2 - Reperforator-Transmitter (RT) Module

2.02 The on-line reperforator and reader control features permit automatic turn-on and turn-off, in response to line signals, of the reperforator and reader. The operation of this feature is described in Part 4, operation.

3. STATION ARRANGEMENT

COMPONENTS

3.01 The standard and alternate components used in the 37 ASR TTY station for point-to-point private line service are listed in Table A.

3.02 A brief description of the components included in the RT module is provided in the following paragraphs. For a description of the remaining station components, refer to Section 591-801-102 or to the description sections listed in Part 5.

(a) Nontyping Reperforator: This electromechanical receive-only unit fully perforates 8-level tape. It is equipped with the off-line backspace and manual interfering tape feed-out features. See Figure 3. The typing reperforator is available as an option.

TABLE A

STATION COMPONENTS

STANDARD COMPONENT	ALTERNATE COMPONENT
Typing Unit (friction feed)	Typing Unit (sprocket feed) Variety of Typeboxes
Teletypewriter Base	—
Typing Unit Cover and Pan	—
Keyboard (including reset mechanism)	—
Teletypewriter Table (double compartment)	Single compartment table in standard or shallow depths providing no facilities for mounting the data auxiliary set
Electrical Service Units	—
Motor Units	—
Reperforator-Transmitter (RT) Cabinet	Reperforator-Transmitter (RT) Cabinet equipped with one of the following: a. Tape Winder b. Tape Winder/Unwinder Optional Tape Storage Bin
Nontyping Reperforator	Typing Reperforator
Tape Reader	—
Data Auxiliary Set equipped with the 108A, 108C, or 109A Data Set (Figure 6).	1A Data Station – Single Channel Arrangements (SCA)

(b) Tape Reader: This electromechanical sending unit senses fully perforated 8-level tape. It is equipped with a manual control lever, the reader step feature, and tight-tape and tape-out alarm sensors. Refer to Figure 4 and Table C.

(c) Motor Units: Separate synchronous-type motor units provide the power for operating the reperforator and tape reader.

(d) Electrical Service Unit: Provides the electronic circuitry for operating the reperforator and tape reader. It interconnects with the electrical service unit in the KSR set.

(e) Reperforator-Transmitter (RT) Cabinet: This cabinet provides mounting and control facilities for the reperforator, tape reader, electrical service unit, motor units, and optional tape handling equipment.

OPERATING CONTROLS

3.03 The controls necessary for operating the 37 ASR TTY station are located on the control panel above the keyboard (Figure 5 and Table B) and the RT module panel (Figure 2 and Table C).

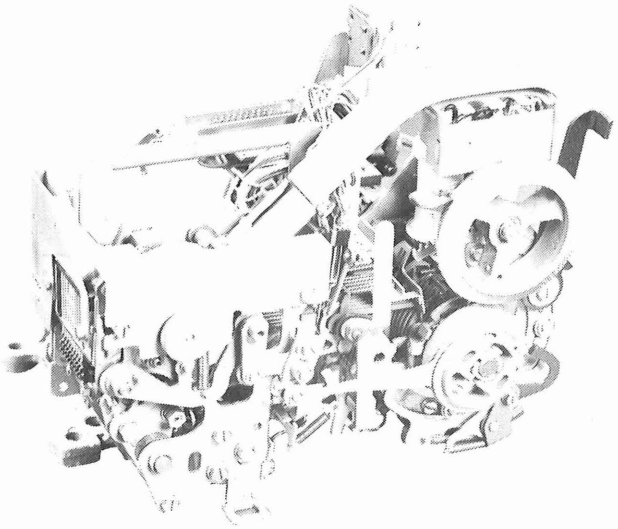

Figure 3 - Nontyping Reperforator

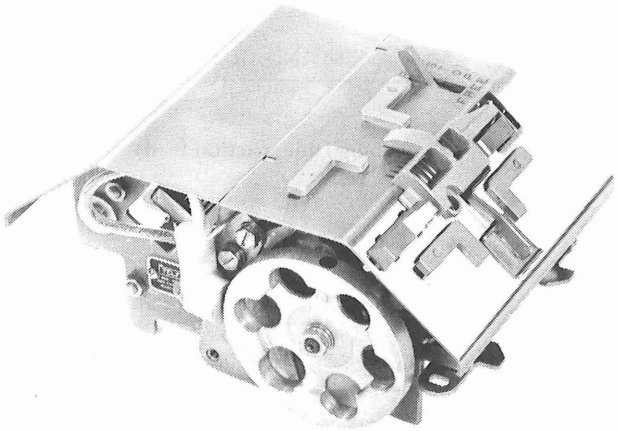

Figure 4 - Tape Reader

ORIG	SEND	RECEIVE	CLEAR	INTRPT		PAPER ADVANCE

(Left-Side Pushbuttons)

LOCAL RETURN	CARRIER FAIL	OUT OF SERVICE	ERROR		PAPER ALARM	EOL

(Right-Side Pushbuttons)

READER AUTO	PUNCH ON	PUNCH LOCAL	READER LOCAL	PRINTER LOCAL	KBD LOCAL

(Center Pushbuttons)

Figure 5 - Typical Control Panel Arrangement

TABLE B

CONTROLS DESCRIPTION

CONTROL (Figure 5)	FUNCTION
ORIG (Originate)	Depressing this pushbutton lights the associated indicator, starts the terminal motors, and generates an ENQ "wake up" character on-line after allowing a nominal time delay for the motors to attain operating speed. Each operation of the pushbutton thereafter produces an ENQ character provided the terminal is not in the receive or "slave " mode. The effect of this switch is disabled if any of the following conditions exist within a terminal: PRINTER LOCAL — CARRIER FAIL OUT OF SERVICE — OFF LINE (if Distant Terminal is KSR) PAPER ALARM
SEND	This lamp lights to indicate that the terminal has attained master status by either having received ACK in response to an ENQ, or by an interchange of master/slave status.
RECEIVE	This lamp lights to indicate that the terminal has attained slave status by either having sent ACK in response to a received ENQ, or by an interchange of master/slave status.
CLEAR	Operation of this switch, while the printer is on-line and either the SEND or RECEIVE lamp is on, automatically generates the character sequence DLE-EOT on-line. This sequence turns off the motors and the SEND or RECEIVE lamp which was previously on. Operation of this switch while the terminal is in a contention mode (motors on, but neither SEND nor RECEIVE lamp on) turns the motors off but does not generate DLE–EOT character sequence.
INTRPT (Interupt)	When momentarily depressed, this pushbutton causes a timed (380 to 750 millisecond) spacing signal to be sent on-line. The interrupt provides the slave station with the ability to halt transmission from the master station. A detected interrupt switches both the master and the slave terminals into the contention mode. If the distant terminal is in an alarm or local mode, each depression of the INTERRUPT pushbutton causes one ring of the bell at the distant terminal, alerting the remote operator that the terminal requires attention.
READER AUTO	When this pushbutton is depressed, its associated lamp lights and the station is conditioned for automatic on-off control of the reader via control characters. A second operation of the pushbutton extinguishes its light and disables the automatic reader control feature. The reader and printer must be in the same mode for the feature to be effective.
PUNCH ON	When this pushbutton is depressed, its associated lamp lights and the reperforator selector is unblinded. A second operation of the pushbutton extinguishes the lamp and blinds the reperforator selector. For local operation, the PUNCH ON pushbutton and PUNCH LOCAL pushbutton must both be selected.

TABLE B

CONTROLS DESCRIPTION (Continued)

CONTROL (Figure 5)	FUNCTION
PUNCH LOCAL	When this pushbutton is depressed, the associated lamp lights, the reperforator is placed in the off-line (local) mode, and the reperforator and reader motors start. The punch selector may be blinded or not, depending on the state of the PUNCH ON pushbutton. Depressing the PUNCH LOCAL pushbutton again turns off the light and motors and restores the reperforator to the idle condition.
READER LOCAL	When this pushbutton is depressed, the associated lamp lights, the reader and reperforator motors start, and the reader is placed in the off-line (local) mode. When the pushbutton is depressed again, the lamp goes out, the motors stop, and the reader is placed in the on-line mode.
PRINTER LOCAL	When this pushbutton is depressed, the associated lamp lights, the typing unit motor starts, and the typing unit is placed in the off-line (local) mode. When the pushbutton is depressed again, the lamp goes out, the motor stops, and the printer is placed in the on-line mode.
KBD LOCAL	When this pushbutton is depressed, the associated lamp lights, the typing unit motor starts, and the keyboard is placed in the off-line (local) mode. When the pushbutton is depressed again, the lamp goes out, the typing unit motor stops, and the keyboard is placed in the on-line mode.
CARRIER FAIL	This lamp lights to indicate loss of received carrier or line current detected by the data set. The terminal with the CARRIER FAIL condition is switched into the contention mode. Loss of carrier at the sending terminal stops transmission and turns off the SEND lamp. When carrier returns, the sending terminal must re-initiate call establishment procedures. Loss of carrier at the receiving terminal turns off the RECEIVE lamp and stops reception. When carrier returns, the terminal will again receive a message, even though the RECEIVE lamp is still off.
OUT OF SERVICE	Depression of the OUT OF SERVICE pushbutton lights the associated lamp and places the terminal in a "do not answer" mode. Operation of the pushbutton during a message turns the motors off immediately. Optionally, the Out of-Service condition may be deferred until the message is completed. When the Out-of-Service condition is in effect, neither ENQ nor ACK is detected or generated. If the distant terminal is equipped to send a NAK character in response to ENQ, indicating that it is not available for communications, the OUT OF SERVICE lamp turns on momentarily and generates a single ring of the bell.
ERROR	This lamp lights upon receipt of one or more characters having incorrect vertical parity. The lamp is extinguished by operation of the associated switch.
PAPER ALARM	This lamp lights to indicate a low-paper condition on printers equipped with a paper supply roll or a paper-out condition on printers equipped with forms. The paper alarm condition prevents an answer to the ENQ character.
EOL (Printer End of Line)	This lamp lights to indicate the end of a printed line (adjustable for any length of line suitable to the typing unit). The lamp goes off when a new line is started.

TABLE C

RT MODULE OPERATING CONTROLS

CONTROL (Refer to Figure 2)	FUNCTION
TAPE ALARM	This lamp lights whenever the reperforator tape supply is depleted, or when the tape in the reader is tight, twisted, or bunched.
READER STEP	This control advances the reader tape forward one character for each operation of the switch.
PUNCH BACK SPACE	This pushbutton backspaces the tape in the reperforator one character each time the pushbutton is depressed.
RUN-STOP-FREE	This control lever on the tape reader provides manual start/stop reader control. In the FREE position, the feed wheel is free and the tape may be pulled through the unit without opening the tape lid. When the automatic reader start feature is activated, transmission can occur with the control lever in either the RUN or the STOP position, but not in the FREE position. Operation is possible with the control lever in STOP since, in this mode, the unit is controlled by external electronic circuitry.

3.04 Data Auxiliary Set 820D (Figure 6) equipped with a 108A or 108C Data Set contains a test pushbutton accessible by the operator. This button conditions the data set for loop-back testing and is only operated upon direction of the Telephone Company.

INTERFACE

3.05 The teletypewriter interface consists of defined leads, listed in Table D, which conform to EIA Standard RS-232-C.

POWER REQUIREMENTS

3.06 The 37 ASR TTY station requires a 117 volt ±10 percent, 60 Hz ac power source, and is rated at 550 watts maximum power consumption, depending on the features. In the station idle mode (motors off), the data set remains energized.

4. OPERATION

4.01 The ASR station may operate locally, on-line, or locally and on-line simultaneously. Mode switches selected by the operator, condition the ASR terminal to respond to the appropriate line or local data.

LOCAL OPERATION

4.02 Transmitters and receivers to be used in the local mode, are chosen by depressing the appropriate pushbutton on the control panel. A lighted pushbutton signifies local operation has been selected for that device, and motors associated with that device are activated.

4.03 There are two reperforator controls, one is designated PUNCH LOCAL and the other is designated PUNCH ON. To operate the reperforator in the local mode,

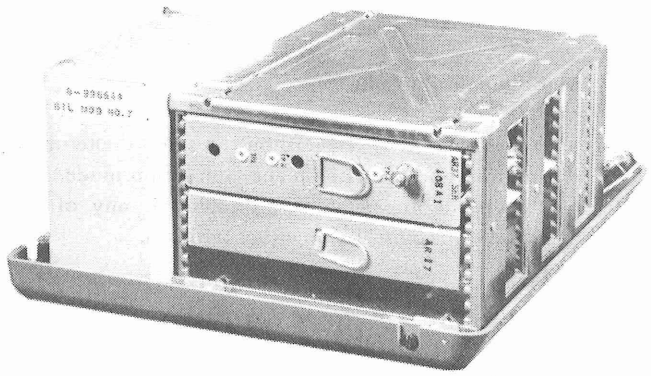

Figure 6 - Data Auxiliary Set 820D

TABLE D

TELETYPEWRITER AND DATA SET INTERFACE LEADS

DESIGNATION	NAME	PURPOSE
AA	Protective Ground	Connects ac power service ground to the equipment chassis. It is electrically isolated from signal ground.
AB	Signal Ground	Provides a common return path for all data signals.
BA	Transmitted Data	Carries outgoing data when the set is on-line.
BB	Received Data	Carries incoming data when the set is on-line.
CF	Data Carrier Detector	Provides an indication that data carrier is being received.

PUNCH LOCAL starts the reperforator and reader motors and places the reperforator in the local mode, and PUNCH ON unblinds the reperforator selector.

4.04 A transmitter which has been placed in the local mode sends data only to those receivers which have been placed in the local mode. Individual device selection in the ASR couples together those senders and receivers which are in the local mode as indicated by an illuminated pushbutton; all other devices are off or on-line. A portion of the ASR may therefore operate off-line while another portion operates on-line. For example, an operator may produce tape by selecting the keyboard and punch in the local mode while the printer is receiving a message on-line.

LINE OPERATION

A. Establishment Procedure

4.05 Operating the ORIG pushbutton starts the terminal motors and places it in the contention mode. The effect of operating the switch is disabled if any of the following conditions exist within either terminal.

PRINTER LOCAL	CARRIER FAIL
OUT OF SERVICE	OFF LINE (if Distant Terminal is KSR)
PAPER ALARM	

These conditions inhibit the terminal from initiating a bid for master status, or keep it from responding to another with the affirmative reply of ACK. In the contention mode, all transmitting devices of a terminal are blinded, and only the ENQ-ACK character generating ability of a terminal is allowed to function. In the absence of a Carrier Fail indication, a remote terminal that does not respond generally implies an alarm, Out-of-Service, or off-line condition. In this situation, a bidding terminal has the provision to ring the bell at the remote terminal by the operation of the INTRPT pushbutton. Each operation of the pushbutton generates one ring of the bell at the remote terminal to alert the operator.

4.06 Approximately 1-1/2 seconds after the motor turns on, the local station automatically generates an ENQ wake-up character on-line. The spacing bits of the ENQ character start the motor of the remote terminal, provided none of the inhibiting conditions listed above exist within the remote terminal.

4.07 If the remote terminal already has its motors running, it responds to a received ENQ character by sending either an ACK reply or no reply. An ACK reply immediately switches the remote terminal from contention into the slave or receive mode, holding all transmitting devices blinded, and simultaneously prevents it from initiating a bid for master status. If the motors of the remote terminal are off when the ENQ character is received, the motors turn on, but no response is generated, and a second operation of the ORIG pushbutton at the bidding station is now necessary to elicit a response.

4.08 When the private line link is from a terminal to a computer, the first ENQ character generated by the bidding terminal following motor turn on may solicit either an ACK or a NAK reply. A NAK reply indicates that the computer is not available for communication, and is shown by a momentary flash of the OUT OF SERVICE lamp and a single ring of the bell at the bidding terminal. The bidding terminal remains in the contention mode after detecting NAK.

4.09 In other applications, a computer may be the calling station. A computer must perform the same establishment procedures as those described for the terminal-to-terminal procedure. If the remote terminal motors are not operating, the first ENQ character from the computer starts the terminal's motors. A second ENQ character, delayed from the first by a minimum of two seconds to permit motors to attain operating speed, is required to elicit the positive ACK response from the remote terminal.

4.10 Upon receipt of the affirmative reply ACK, a bidding station assumes master status (SEND light on), and then proceeds to transmit a message.

4.11 Whenever both terminals initiate bids for master status simultaneously, a garble will result and neither station gains control. Contention continues until one station refrains from initiating a bid of its own.

B. Message Transmission

4.12 Message transmission is initiated by the master terminal after the previously described establishment procedure. Transmission proceeds in one direction without replies.

4.13 The receiver may stop the sender by generating an interrupt signal. Depression of the INTRPT pushbutton generates a timed signal which, when detected at the sender, stops the transmission and switches both terminals into the contention mode. The set which now transmits the first ENQ character and receives the affirmative ACK reply gains master status and is permitted to transmit.

4.14 Communication between two Model 37 terminals must be conducted in the half-duplex mode. Communication between terminal and computer may be conducted in a half-duplex mode or a limited full-duplex mode known as echoplex.

4.15 In the half-duplex mode the sending and receiving channels of the terminals are tied together electrically so that information sent on-line is detected at both stations. Since responses are required to establish and terminate a communication, this mode of operation is demanded in terminal-to-terminal operation.

4.16 In echoplex, the sending and receiving channels are electrically separated so that the computer detects what is sent by the master terminal, but the master detects only what is sent or "echoed" back by the computer. The computer echoes to the receiving channel the transmission it detects on the sending channel. Echoplex requires full-duplex facilities to afford the capability of retransmitting the characters entered into the computer by the master terminal.

4.17 Additional time is required by the teletypewriter to perform certain machine control functions. Delete (DEL) characters are used as fill characters, in tapes transmitted and received by the teletypewriter, to provide the time required. The control characters, and the number of fill characters (or equivalent pause), are listed below.

Carriage Return	2
New Line	2
Form Feed	1
Vertical Tab Clear (Esc 6)	1
Vertical Tab Set (Esc 5)	1
Horizontal Tab Clear (Esc 2)	1
Horizontal Tab Set (Esc 1)	1
Punch On (DC2)	1
Punch Off (DC4)	1

4.18 An optional one character delay interval of idle time may be inserted automatically after every control character. The automatic delay interval allows sufficient time for the typing unit to fully respond to the control character command. A serviceman can enable this feature by removing straps wired in the electrical service unit.

C. Termination Procedure

4.19 The terminate function is initiated manually by operation of the CLEAR pushbutton. This action automatically causes a DLE-EOT (Data Link Escape followed by End of Transmission) character sequence to be generated on-line. The printer stunt box contact in each terminal detects this sequence, and turns the motors off after negating the master/slave relationship that existed during the last transmission.

4.20 The master terminal may also transmit EOT from the keyboard to indicate it has no more data to send. EOT reverses the master/slave relationship which existed during the previous transmission, allowing a "back and forth" conversation mode. The master/slave relationship is interchanged each time EOT is sent and received. A master terminal, after having sent EOT, assumes slave status, while the slave terminal, upon receiving EOT, assumes master status. DLE-EOT character sequence is the terminate function and turns the motors off.

4.21 An optionally available termination procedure negates the master/slave relationship when EOT is sent and received, and returns both terminals to contention. The motors remain on, but the SEND light of the former master terminal and the RECEIVE light of the former slave terminal turn off. The idle line timer or the DLE-EOT character sequence turns the motors off.

4.22 Operating the CLEAR pushbutton when a terminal is in the contention mode turns the terminal motors off without generating a DLE-EOT character sequence on-line. The motors of the distant terminal remain on.

4.23 A two to twenty minute idle line timer operates in parallel with the CLEAR pushbutton. The timer is serviceman adjustable in four steps with nominal time outs occurring at 2, 5, 10, and 20 minutes. At idle line turn-off, the DLE-EOT character sequence is automatically generated on-line if the terminal is in the master or slave status. If the terminal is in contention at the idle line time out, the motors turn off but the DLE-EOT character sequence is not generated.

5. REFERENCES

5.01 The following sectionalized literature pertains to the Model 37 ASR stations for nonswitched point-to-point private line service.

ASR STATION	NUMBER
Installation	591-802-201
ASR SET General Description and Operation	574-302-102
KSR STATION Description and Operation	591-801-102
MOTOR UNIT Description and Principles of Operation	570-220-100
TYPING UNIT Description and Principles of Operation	574-320-101
KEYBOARD UNIT Description and Principles of Operation	574-321-101
TYPING UNIT COVER AND PAN Description and Operation	574-326-101
TABLE Description and Operation	574-323-101
ELECTRICAL SERVICE UNIT Description and Operation	574-322-101
REPERFORATOR-TRANSMITTER (RT) CABINET Description and Operation	574-327-100
NONTYPING REPERFORATOR Description and Principles of Operation	574-329-100
TYPING REPERFORATOR Description and Principles of Operation	574-330-100
TAPE READER Description and Principles of Operation	592-801-100
DATA SETS Description and Operation (108A- and 108C-Type)	591-023-101
Description and Operation (109A-Type)	591-024-101
Description and Operation (1A Data Station)	591-813-101
TYPING UNIT BASE Description and Operation, Adjustments, and Lubrication	574-331-100