# 86A2 DATA SELECTIVE CALLING SERVICE
# HALF-DUPLEX—150-WORD PER MINUTE DATA STATIONS
# DESCRIPTION AND OPERATION

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## 1. GENERAL

**1.01** This section covers the physical and functional description as well as the operating procedures for the half-duplex (HDX), 150-word per minute (wpm), data stations associated with the 86A2 Data Selective Calling Service.

### A. Purpose of Station

**1.02** The 86A2 Data Station is used to provide 150-wpm (150-baud) HDX data service between itself and other stations in the private network of which it is a part under control of a customer-provided line control station (computer switcher). This configuration comprises what will hereafter be referred to as the 86A2 Data Selective Calling System.

### B. Purpose of System

**1.03** The 86A2 Data Selective Calling System is a system which administers one or more HDX lines. When more than one line is involved, the system must also provide store and forward capabilities. Each HDX line can accommodate a number of stations which can be either originate/terminate (ORIG/TERM) or terminate only (TERM ONLY) type stations.

### C. System Arrangement

**1.04** The block diagram of Fig. 1 shows a typical arrangement of a multistation line of an 86A2 Data Selective Calling System. The system consists of the line control station (computer switcher) which has store and forward capabilities and normally, a number of such lines.

**1.05** The 86A2 stations and computer switcher are connected to the HDX lines via the hubbing points. All of the stations on each line must be arranged for HDX, 150-wpm operation.

### D. Station Arrangements

**1.06** The 86A2 station terminal equipment will be Model 37-type teletypewriter (TTY) equipment. The 86A2 station is a self-contained

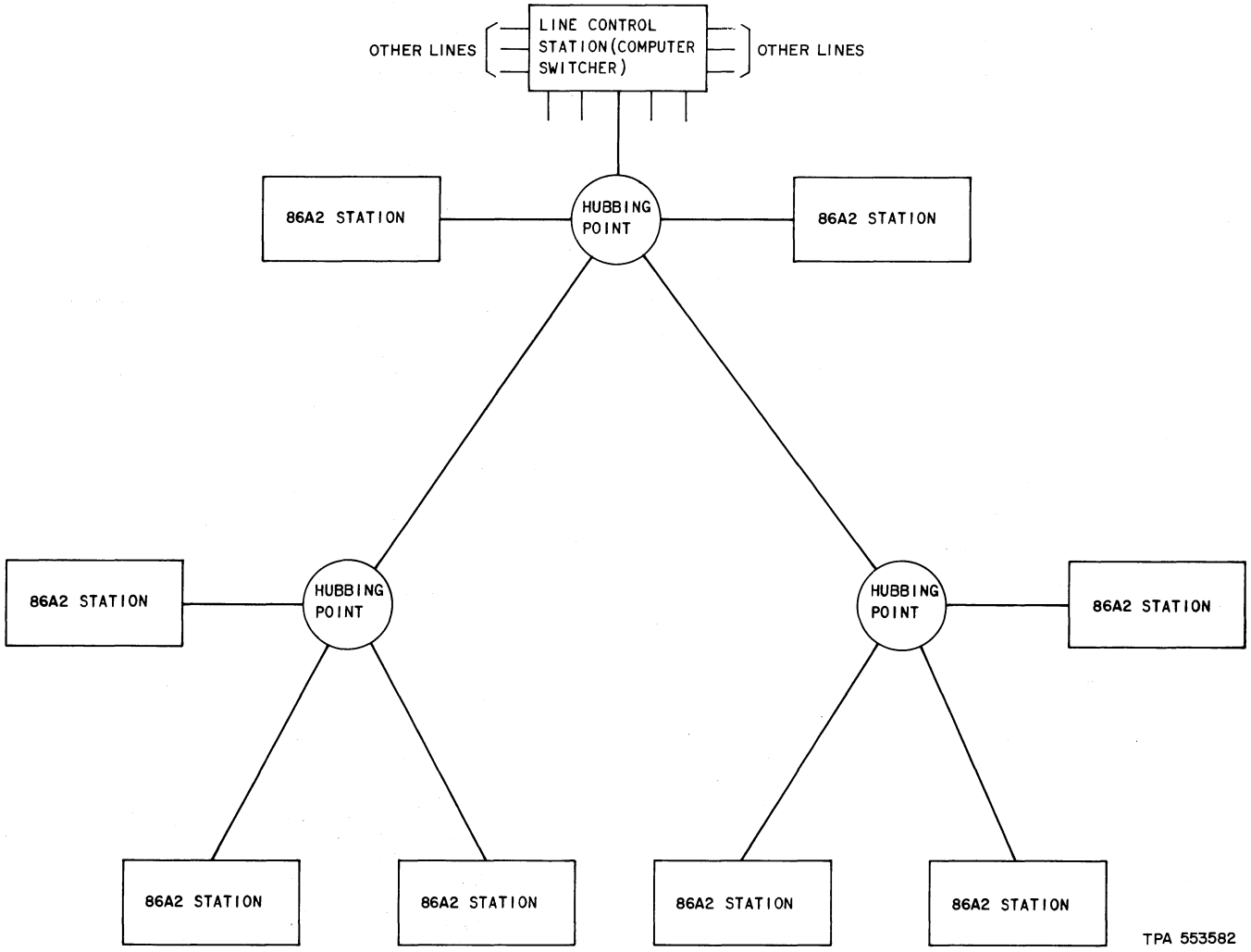



**Fig. 1—Block Diagram of a Typical 86A2 Data Selective Calling Service Multi-Station Line in a System Arrangement**

unit which is intended to be completely assembled at the distributing house prior to delivery.

**1.07** The 86A2 station is available in the following arrangements:

(a) An ASR TTY alone (ORIG/TERM station)

(b) An RO TTY alone (TERM ONLY station—page receiving)

(c) An ROTR TTY alone (TERM ONLY station—tape receiving).

**1.08** In the case of 1.07 (a) and (b), an auxiliary RO or ROTR TTY may be optionally provided as a slave unit to the primary TTY. The auxiliary machine can be turned on and off manually or, during any message delivery, can be turned on and off automatically under on-line signal control. In no case may a 37 ROTR TERM ONLY station be equipped with an auxiliary receiver.

*Note:* The primary RO TTY has sometimes been referred to in the past as the master RO TTY.

**1.09** The block diagram of Fig. 2 shows a typical ORIG/TERM station and a TERM ONLY station. The arrangements for ORIG/TERM and TERM ONLY stations and the components comprising each are given in Table A.

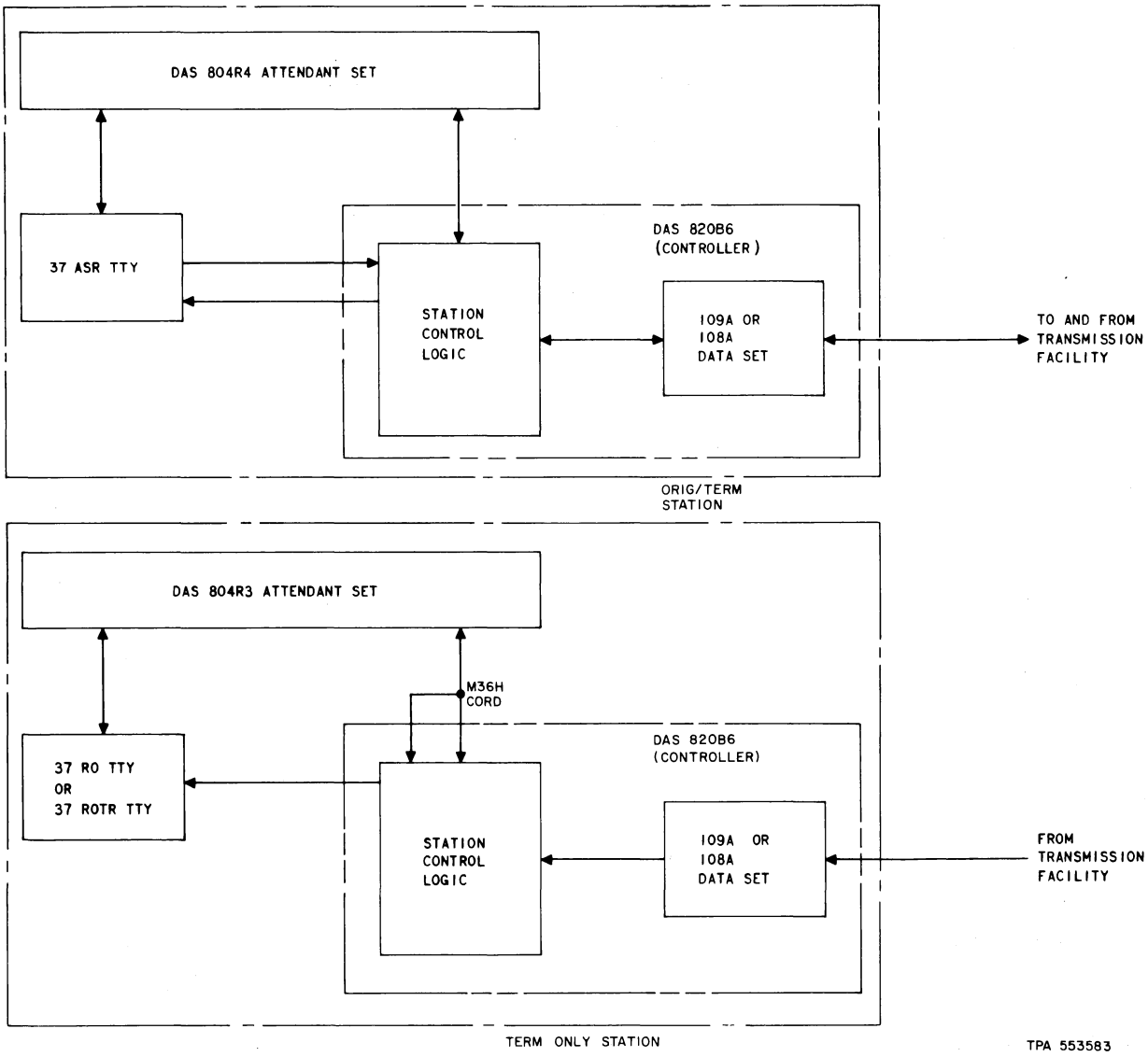



**Fig. 2—Block Diagram of Typical 86A2 Data Stations**

**TABLE A**

**STATION ARRANGEMENT SUMMARY**

| TYPE STATION | ORIGINATE TTY | PRIMARY RECEIVER TTY | ORIG TTY ATND SET | REC TTY ATND SET | CON-TROLLER DAS | MTG BRKT | M36H CORD | AUX RECEIVER TTY (OPTIONAL) |
|---|---|---|---|---|---|---|---|---|
| 37 ORIG/TERM | 37 ASR | | 804R4 | None | 820B6 | 93A | None | 37 RO or 37 ROTR |
| 37 TERM ONLY | None | 37 RO | None | 804R3 | 820B6 | 93A | 4 feet | 37 RO or 37 ROTR |
| | None | 37 ROTR* | None | 804R3 | 820B6 | 95A | 10 or 50 feet | None |

* A KS-20018-L1, L2, L3, or L4 cabinet is also required to mount the controller.

### E. Uses of Station Components

**1.10** The ASR TTY is used at an ORIG/TERM station to:

(a) Prepare tapes for message transmissions

(b) Send all station transmissions

(c) Print local copy of all station transmissions and receptions

(d) Optionally punch tapes of messages received by a station not equipped with an auxiliary ROTR TTY

(e) Print local copy of information sent by the computer switcher [ie, service message concerning messages sent or received by the station, personal address information (PAI), or time, date, and message number (TDM) of messages sent or received by the station].

**1.11** The primary RO TTY is used at a TERM ONLY station to print local copy of all messages received by the station, and print local copy of information sent by the computer switcher (ie, TDM of messages sent or received by the station, PAI, or service messages received from the computer switcher concerning messages received by the station).

**1.12** The primary ROTR TTY performs the same function as a primary RO TTY except that the ROTR TTY punches a tape of the information received instead of printing it in page form. In addition, the ROTR TTY prints the message on tape.

**1.13** An RO or ROTR TTY may be used as an auxiliary machine to a primary ASR or RO TTY. The auxiliary machine, when turned on, performs as a slave to the primary TTY.

**1.14** The Data Auxiliary Set (DAS) 820B6 (controller) enables the station to send and/or receive messages automatically by providing circuits to recognize control characters from the computer switcher and to generate response characters for transmission to the computer switcher. The controller also houses and supplies operating voltages for the Data Set 108A or 109A.

**1.15** The data set converts the digital data received from the data terminal via the controller into voiceband frequency tones (108A) or dc currents (109A) suitable for transmission over the line. It also converts the voiceband frequency tones or dc currents received from the line into digital data suitable to operate the data terminal. In addition, the Data Set 108A monitors the line for a carrier failure and Data Set 109A for current failure. Should the carrier or current fail while the station is selected to transmit or receive, a signal is sent from the data set to the controller. This activates the controller initialization circuits and the stations are deselected.

**1.16** The Data Auxiliary Sets 804R3 and R4 (attendant sets) are used to provide status and alarm indications (audible and visual) for the station as well as control keys for use by the attendant.

**1.17** The 93A mounting bracket is used to mount the controller in the pedestal of the 37-type TTYs. The 95A mounting bracket is used to mount the controller in the KS-20018-type cabinet at an ROTR TERM ONLY station.

**1.18** The M36H cord is available in three lengths (4, 10, and 50 feet). It is used to connect the primary RO or ROTR TTY to the controller.

### F. Station Operation

**1.19** Under normal operating conditions, the computer switcher interrogates each 86A2 station individually in order to determine the following:

(a) Whether the station has traffic available to transmit

(b) Whether the traffic to be transmitted has regular or priority status

(c) Whether the station is ready to receive.

This procedure is referred to as polling. If the station response to this polling indicates it has traffic available to send, the switcher may select the station to send.

**1.20** When the computer switcher elects to pick up traffic from a station that has indicated it has traffic to send, it will select that station as

a sender and, if the customer desires, send the station an originating message number followed by the time and date (if desired) of the message pickup. At this time (dependent on the options provided in the station), one of the following will occur.

(a) Intraline delivery—On signal from the computer switcher, the station will send the message heading to the computer switcher and stop. The message heading will contain the addresses of all of the stations that are to receive the message. If any of the stations addressed in the heading are on the same line as the selected sender (intraline stations), the computer switcher may select them as receivers. The computer switcher then signals the selected sender to transmit the text of the message. The message is simultaneously copied by all the intraline receivers, and if any stations on other lines (interline stations) were addressed in the heading, the message is also stored by the computer switcher for future delivery to the interline addressee(s).

(b) Interline delivery—On signal from the computer switcher, the station will send the entire message (heading and text). The computer switcher will store the message for future delivery to all of the addressees. In this case the addressed intraline stations are treated in the same manner as the interline stations.

**1.21** Message delivery is administered on a selective call-in basis. Each station designated as an addressee in the heading of a message is interrogated by the computer switcher to determine if it is ready to receive. If the station is not ready to receive, the computer switcher will store the message until the computer switcher discovers the station is again ready to receive. If the station is ready to receive, it will be selected as a receiver and the message will be delivered. After the text of each message has been delivered to the selected receive stations, the computer switcher (dependent on the option provided in the station) may perform one of the following.

(a) Roll-call—The computer switcher will interrogate each receive station in turn to determine if the message was received properly. If the computer switcher receives a positive reply to roll-call, it will go on to roll call the other selected receivers; however, if a negative reply is received, an alarm is activated at the station being roll called and the computer switcher will queue (intraline delivery) or requeue (interline delivery) the message for retransmission at a later time. After all of the selected receive stations have been roll called, they are returned to the idle state by the computer switcher.

(b) No roll-call—In this case, the computer switcher will return the selected receivers to the idle state immediately upon completion of the message delivery.

### G. Station Power

**1.22** The 86A2 Data Station requires an individually fused line power source of 106 to 129 volts, 60 $\pm$0.45 Hz. The dc voltages required to operate the controller are supplied by the 24A power unit which is a part of the controller. The ac power for the 24A power unit is supplied from a terminal block on the TTY via the M3AY cord which is supplied with the controller.

## 2. PHYSICAL DESCRIPTION

### A. General

**2.01** This part describes the physical appearance of the 86A2 Data Stations. The various arrangements of each are given in Table A.

**2.02** The 37 ORIG/TERM station arrangement is shown in Fig. 3. Pictured is the 37 ASR TTY with its 804R4 attendant set. The data set, controller, and the 93A bracket (not shown) are mounted inside the 37 ASR TTY pedestal. A 37 RO or ROTR TTY may be used at this station as an auxiliary receiver.

**2.03** The 37 RO TERM ONLY TTY station arrangement is shown in Fig. 4. Pictured is the primary 37 RO TTY and its 804R3 attendant set. The data set, controller, M36H cord, and 93A bracket (not shown) are mounted inside the primary 37 RO TTY pedestal. A 37 RO (Fig. 6) or ROTR (Fig. 7) TTY may be used (optionally) at this station as an auxiliary receiver.

**2.04** The 37 ROTR TERM ONLY station arrangement is shown in Fig. 5. Pictured is the 37 ROTR TTY and its 804R3 attendant set. The data set, controller, and 95A bracket are mounted in a KS-20018-type cabinet. The M36H cord connects

the 37 ROTR TTY to the controller. With the 37 ROTR TERM ONLY station, it is not possible to have an auxiliary receiver.

### B. Teletypewriters

**2.05** The 37 ASR TTY (shown in Fig. 3) is a 4-row, 150-wpm TTY which consists of a page printer, tape punch, tape reader, and keyboard. All messages originated by a 37 station are transmitted from the reader; no provision is made for direct keyboard transmission. Three key selected modes of operation are possible. They are:

(a) The ***off-line mode*** (OFF LINE key operated) in which the typing unit and tape punch operate from either the keyboard or the reader. In this mode, the following functions may be performed:

(1) Messages may be prepared (on tape) for transmission with local copy provided by the page printer.

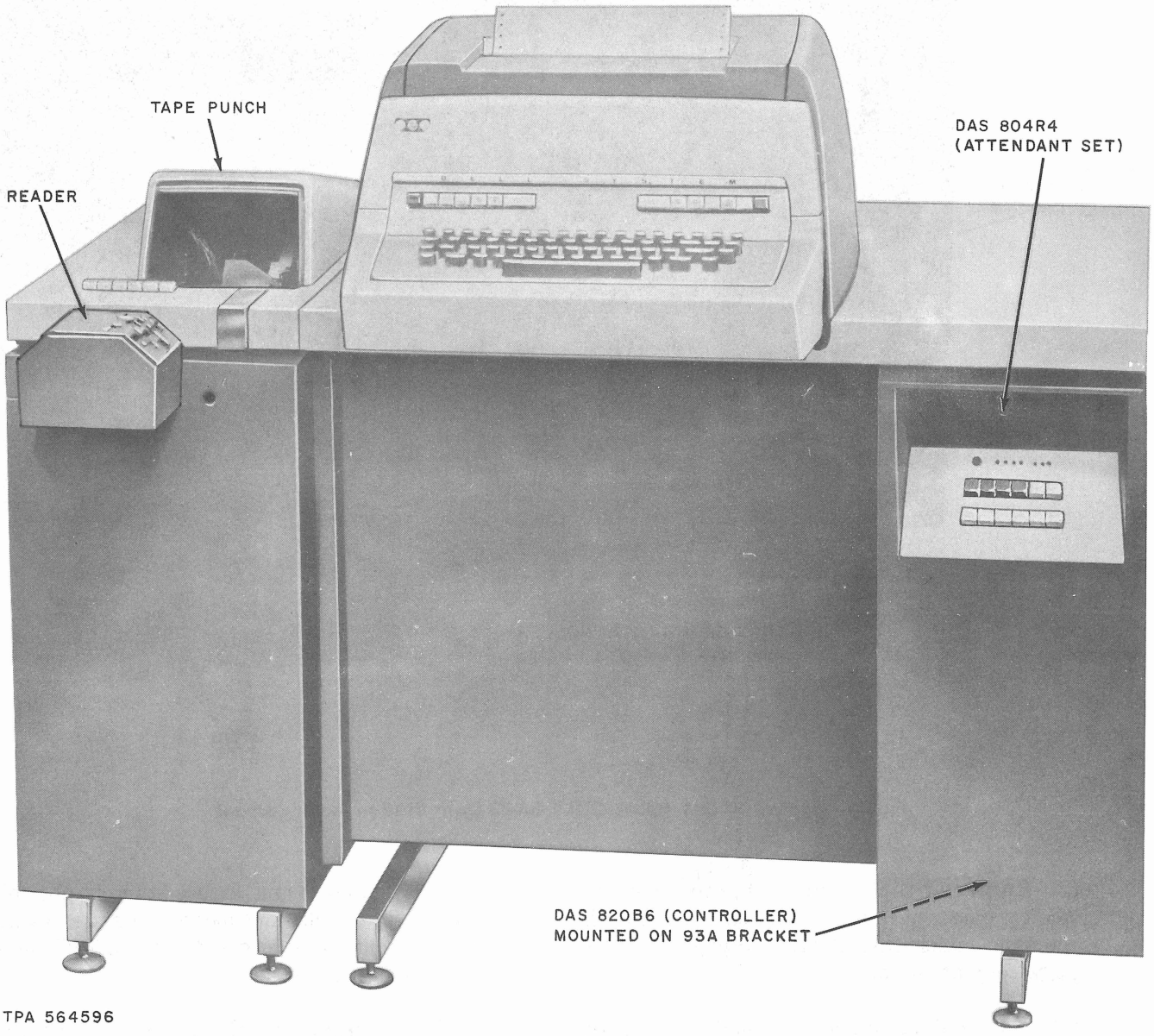



**Fig. 3—Typical 37 ASR ORIG/TERM 86A2 Data Station Arrangement**

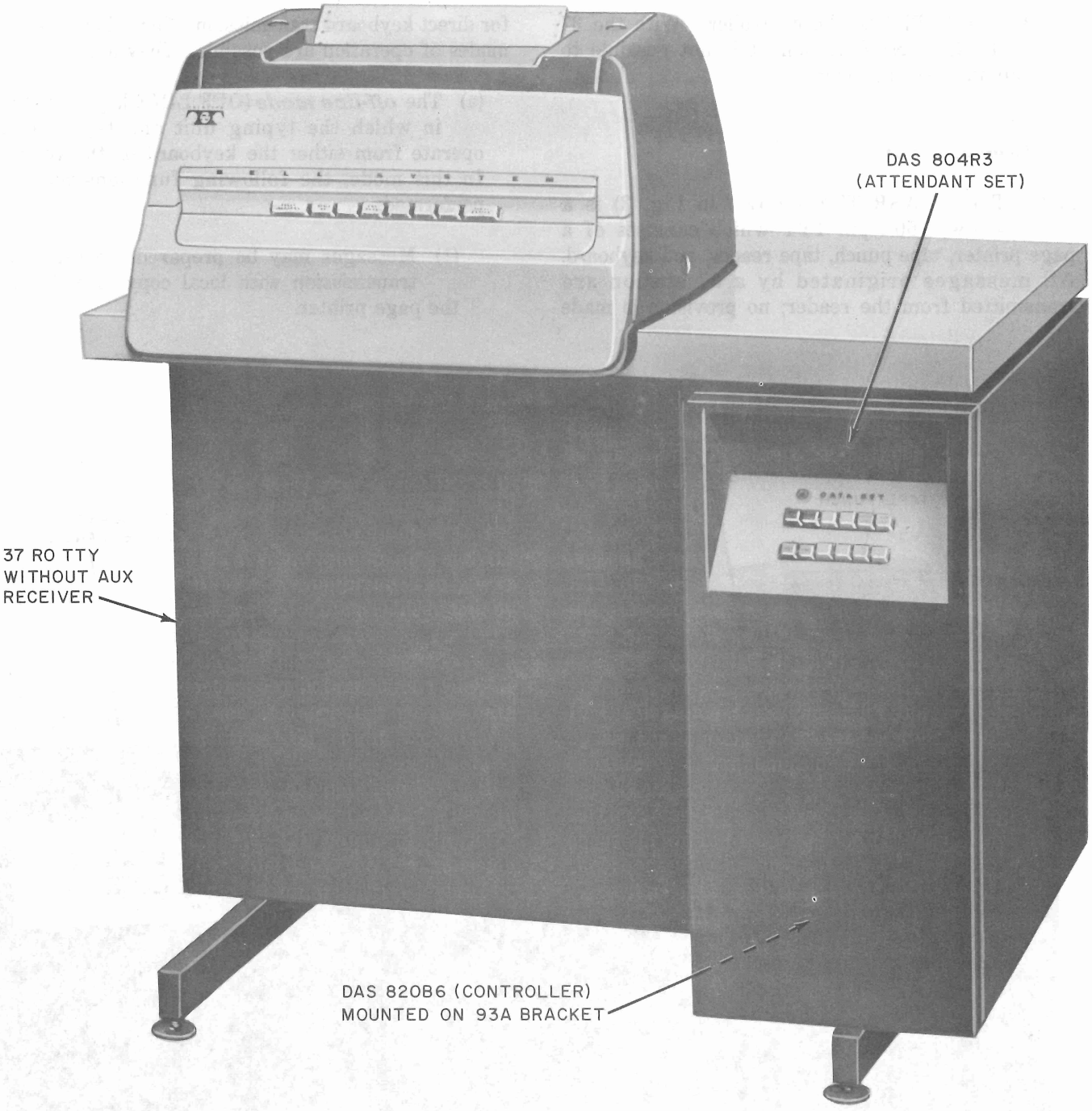



**Fig. 4—Typical 37 RO TERM ONLY 86A2 Data Station Arrangement**

(2) Prepared tapes may be proofread by running the tape through the reader with the tape punch turned off, thereby obtaining page copy of the tape.

(3) A byproduct tape may be made by running a master tape through the reader with the tape punch turned on. In this case, page copy is obtained and tape editing is possible. While in the off-line mode, messages cannot be transmitted or received and the TTY motor runs continuously.

(b) The ***on-line*** mode (ON LINE key operated) in which messages may be prepared on tape, without page copy, while the station is transmitting

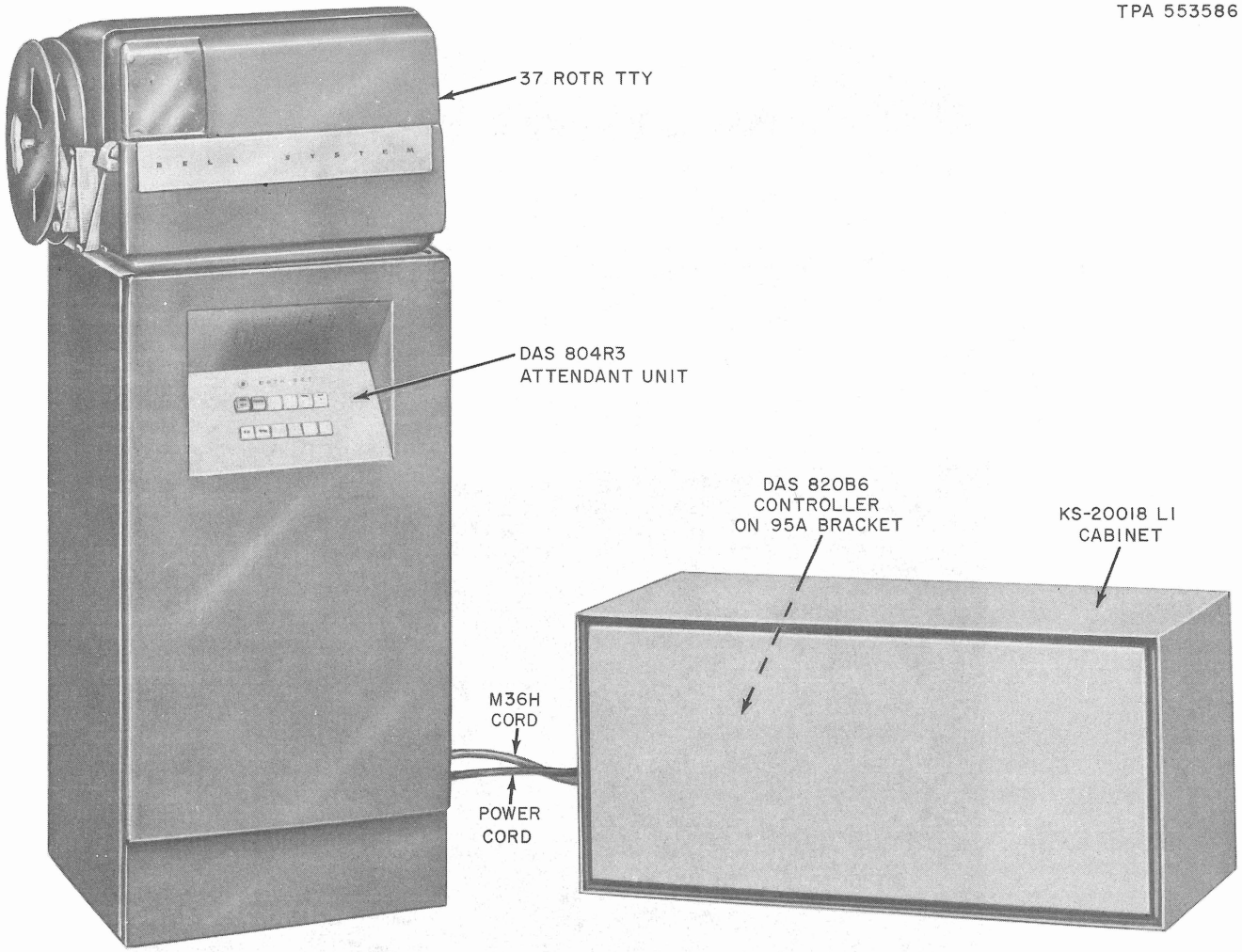



**Fig. 5—Typical 37 ROTR TERM ONLY 86A2 Data Station Arrangement**

messages from the reader or receiving messages from the line. In this mode, the page printer makes local copy of all messages transmitted by the station and the TTY motor runs continuously.

(c) The ***unattended*** mode (UNATT key operated) in which the page printer copies all messages received by the station. At installations not equipped with an auxiliary RO TTY, the tape punch may be called in by line signals and used as an auxiliary receiver. Only the page printer is normally on-line; however, if there is traffic to send and a bid condition is present, the reader remains on until all traffic has been sent. Then the motor turns off and is turned on again only when the station is called in to receive a message.

**2.06** The overall external dimensions of the 37 ASR TTY cabinet are 36-1/4 inches high, 44-1/2 inches wide, and 27-1/2 inches deep. When equipped with the controller, the 37 ASR TTY weighs approximately 360 pounds.

**2.07** The 37 RO TTY is a 4-row, 150-wpm TTY which consists of a page printer. The 37 RO TTY may be used as a primary receiver (Fig. 4) or as an auxiliary receiver (Fig. 6) to a primary 37 RO or ASR TTY. When used as a primary receiver, the TTY motor runs only when the station is called in to receive or when the local PAPER FEED key is operated. When it is used as an auxiliary receiver the TTY motor runs only when the primary TTY motor runs or when the PAPER FEED key on the RO TTY is operated.

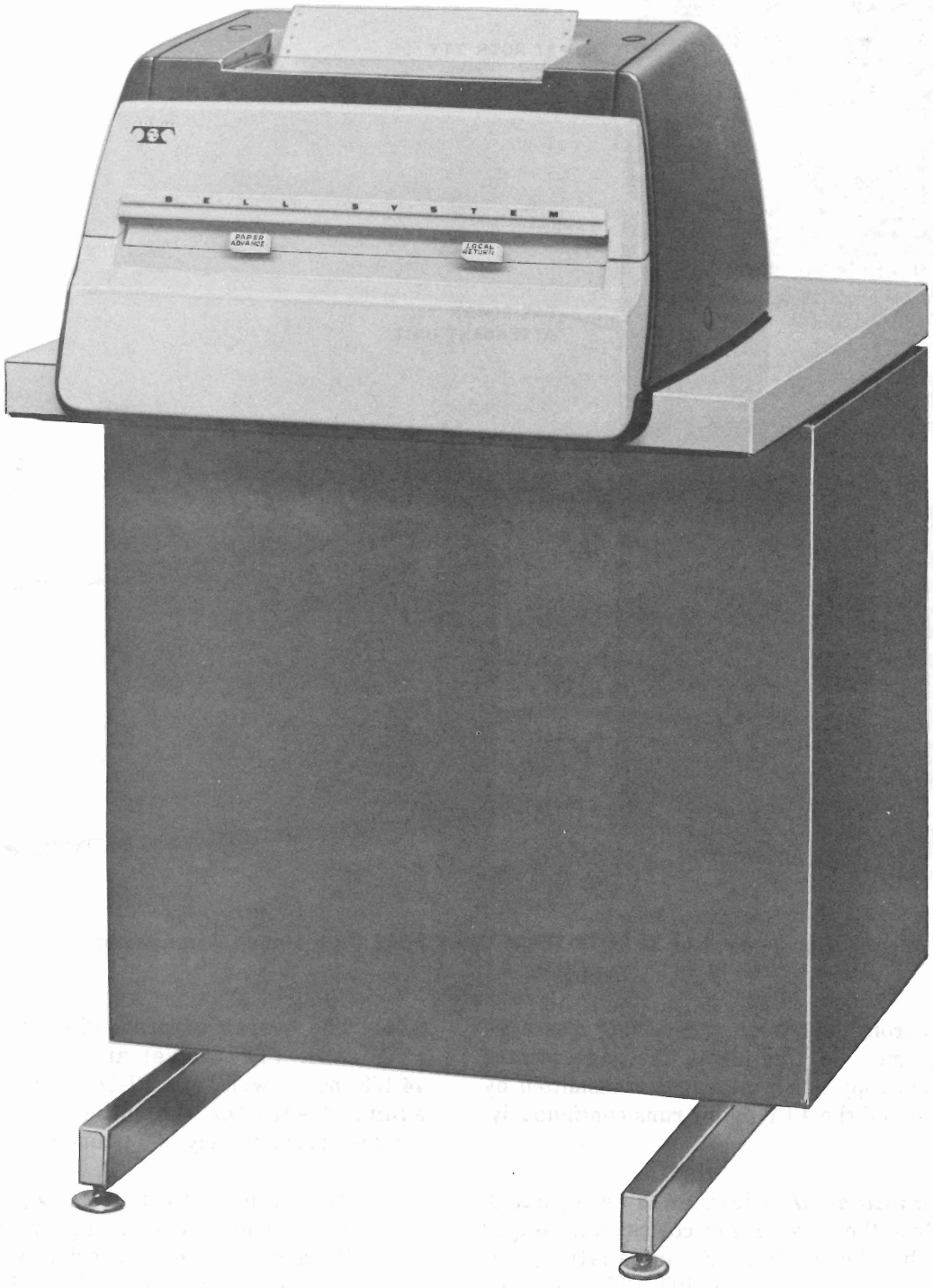



**Fig. 6—Typical 37 RO TTY Auxiliary Machine**

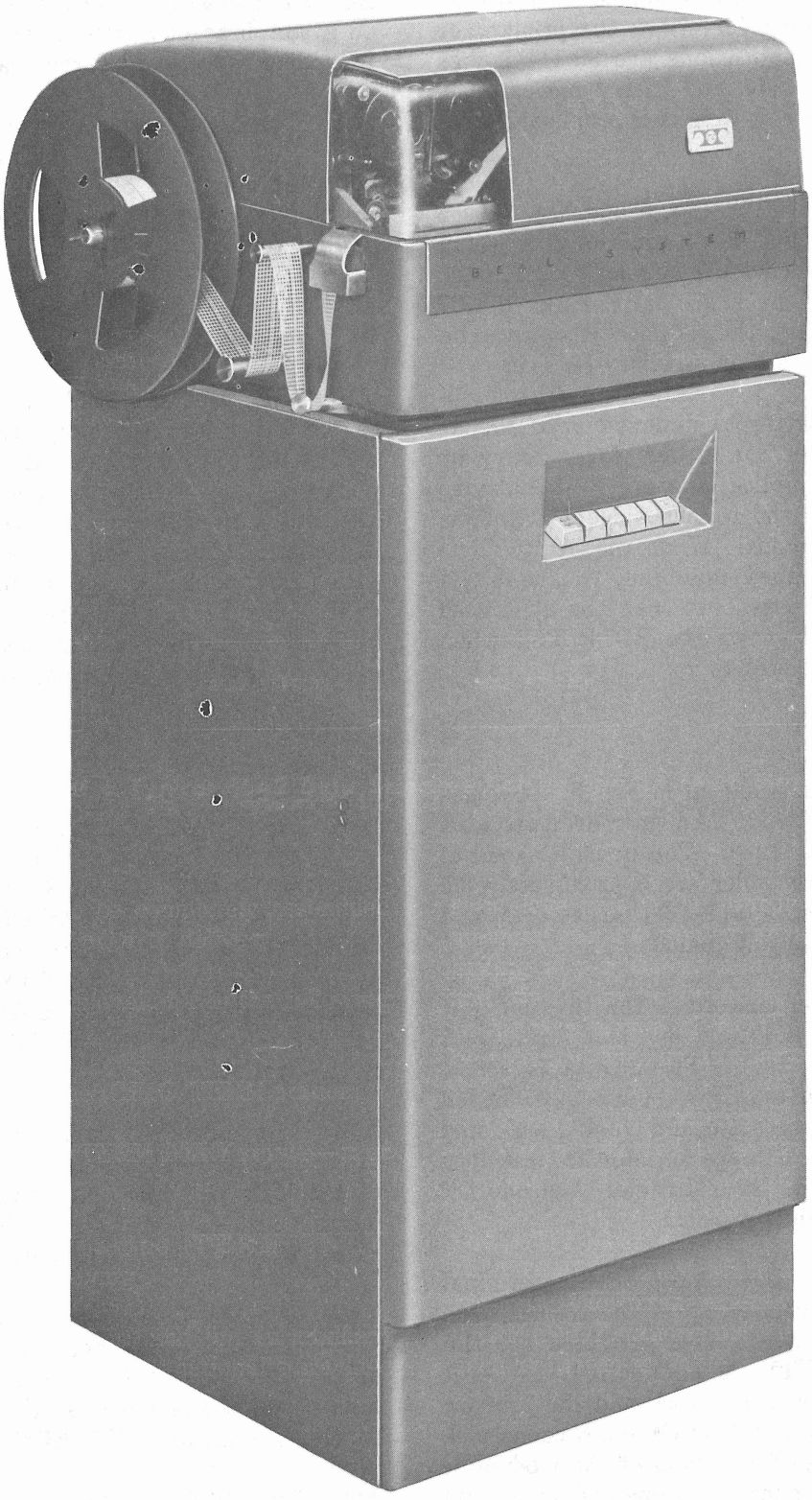


Fig. 7—Typical 37 ROTR TTY Auxiliary Machine

**2.08** The overall external dimensions of the 37 RO TTY cabinet for either the primary or auxiliary receiver applications are 36-1/4 inches high, 32-1/2 inches wide, and 22-1/2 inches deep. Without the controller, it weighs approximately 214 pounds.

**2.09** The 37 ROTR TTY (Fig. 5 and Fig. 7) is a 150-wpm machine which consists of a typing reperforator that punches the standard 1-inch tape. It may be used for the same purposes as the 37 RO TTY except that the 37 ROTR cannot be arranged to operate with an auxiliary receiver.

**2.10** The overall external dimensions of the 37 ROTR cabinet for either the primary or auxiliary receiver applications are 34-1/2 inches high, 15 inches wide, and 15 inches deep. It weighs approximately 75 pounds. When the 37 ROTR is employed as a primary machine, the required controller must be housed externally as illustrated in Fig. 5. Figure 7 shows the ROTR TTY when used as an auxiliary receiver.

### C. Controller

**2.11** The controller is shown in Fig. 8. It comes equipped with a 24A power unit and KS-14532-L16 power cord. The overall external dimensions of the controller are approximately 8.5 inches high, 15.5 inches wide, 6.0 inches deep and it weighs approximately 19 pounds.

**2.12** The controller has slots for thirteen AR circuit packs (CP) and one slot for a Data Set 108A or 109A. In the 86A2 Data Selective Calling System, 12 of the CP slots are used. Seven of the CPs are for the state and control logic and timing functions, four CPs are for interface functions between the TTY and the controller, and one CP contains the in/out shift register.

**2.13** The controller is equipped with a terminal strip for the connection of the transmission facility. Connectors are also provided for the connection of the TTY (M connector), the ASR TTY attendant set (N connector), and the primary RO or ROTR TTY attendant set (M and N connector). Switches are provided for control of the modulator squelch and maintenance tests (manual loop-back) circuits.

**2.14** The controller for the 37 ASR and RO TTY stations is located behind the door on the right-hand side of the TTY pedestal. It is mounted on a 93A bracket which allows it to be pulled out for maintenance and CP removal (Fig. 9).

**2.15** The same controller is used for the 37 ROTR TTY station. It is located in the KS-20018-type cabinet (Fig. 5) and is mounted on a 95A bracket in a position that facilitates maintenance and CP removal.

### D. Data Sets

**2.16** The Data Set 108A or 109A is the printed wiring board assembly located at the right-hand end of the controller (see Fig. 8). Data Set 109A should only be used when line operation is dc and the line impedance is 2000Ω or less and the capacitance of the loop is less than 1 mfd. In all other instances, Data Set 108A must be used. When Data Set 108A is used, it must be series 4 or later. The data set is not supplied with the controller and therefore must be ordered separately.

### E. Attendant Sets

**2.17** Two types of attendant sets are used in the 86A2 stations. They are the DAS 804R3, and DAS 804R4. The 804R4 attendant set shown in Fig. 10 is used in the 37 ASR TTY at ORIG/TERM stations. The 804R3 attendant set shown in Fig. 11 is used in the 37 RO TTY at TERM ONLY stations. The DAS 804R3 attendant set shown in Fig. 12 is used in the 37 ROTR TTY at TERM ONLY stations.

**2.18** The ASR TTY attendant set (804R4) is mounted in the door on the right-hand side of the TTY pedestal. It contains the keys and lamps which are associated with the sending and receiving functions of an ORIG/TERM station.

**2.19** The RO TTY attendant set (804R3) is also mounted in the door on the right-hand side of the TTY pedestal. It contains the keys and lamps which are associated with the receiving functions of an RO TTY TERM ONLY station.

**2.20** The ROTR TTY attendant set (804R3) is mounted on the front door of the ROTR pedestal. It contains the keys and lamps which are associated with the receiving functions of an ROTR TTY TERM ONLY station.

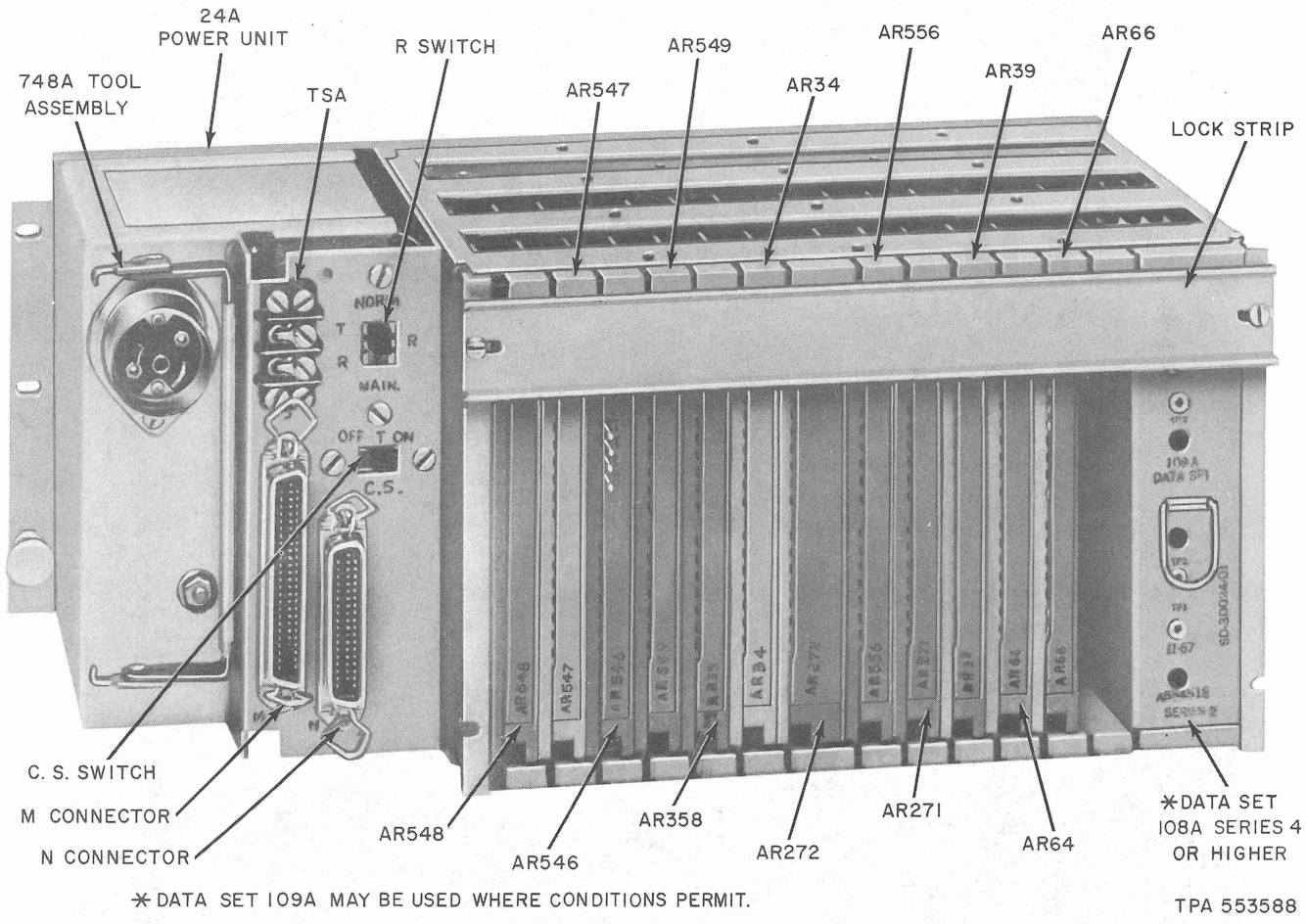



**Fig. 8—Data Auxiliary Set 820B6—Location of Circuit Packs and Components**

## 3. FUNCTIONAL DESCRIPTION

### A. General

**3.01** This part describes the functions of the various components that make up the 86A2 Data Stations and their different arrangements. In the descriptions which follow, it will be assumed that the station under consideration is an ORIG/TERM station. Message transmission will be covered separately from the message reception in order that the latter method of operation may be applied to TERM ONLY station situations.

**3.02** Reference will be made to the ASCII code as shown in Table B. An eighth bit is used in the ASCII code to provide even-bit parity. Table C gives the legend for the various ASCII code designations.

**3.03** When power is first applied or removed and then reapplied to the station, an initializer circuit in the controller applies a momentary positive voltage to all critical state logic memory elements and places the controller in the idle mode.

#### EOT Counter

**3.04** The DAS 820B6 controller used in the 86A2 system is equipped with an EOT counter. This allows the utilization of continuous tape operation without the possibility of starting to send a partially prepared transmission. The messages are prepared as described in 3.05 and fed directly from the tape punch into the reader. When the EOT key of the keyboard is operated to mark the end of transmission, a count is entered into the counter. Now, with the READER ON key operated, the reader will start and the BID lamp will light.

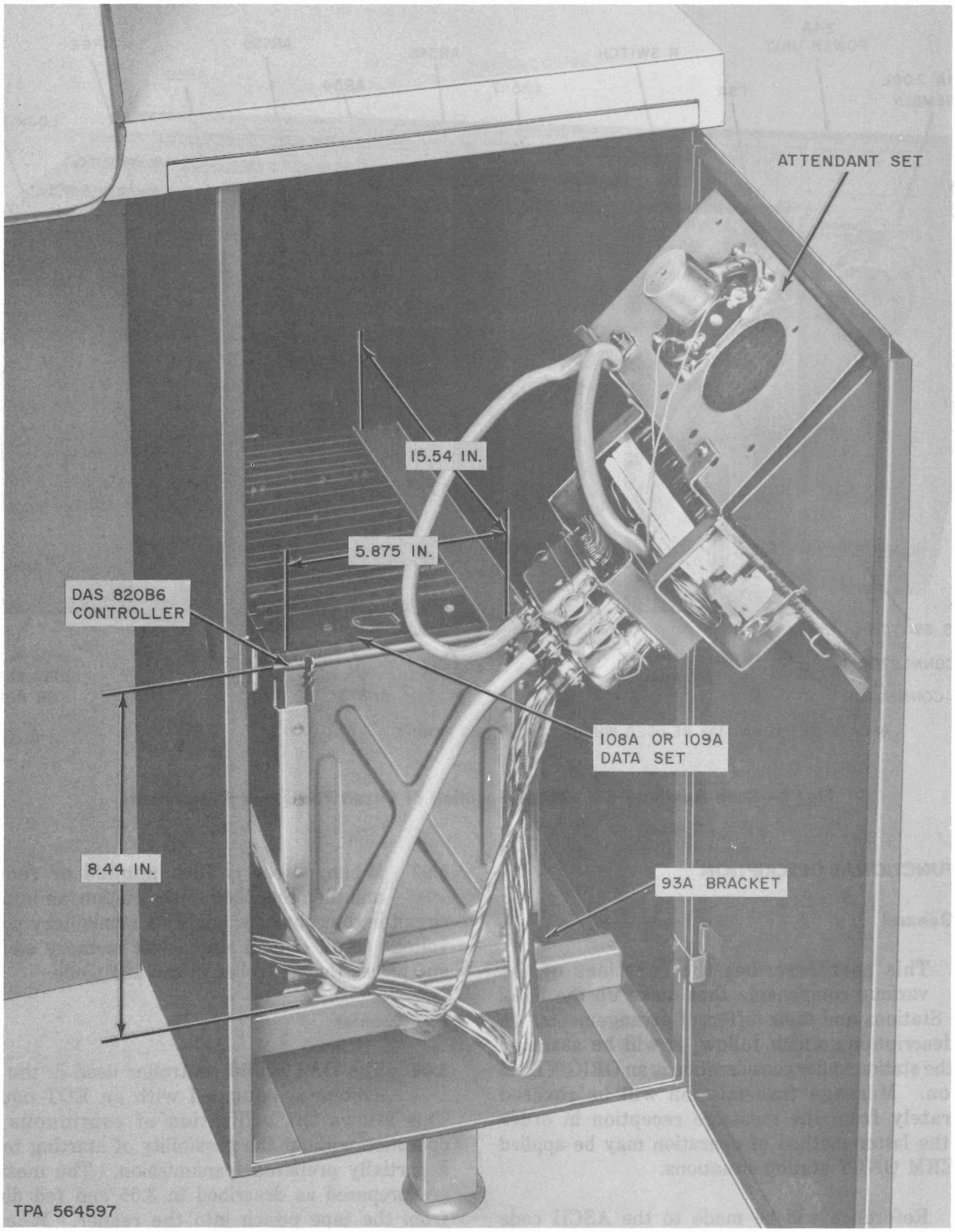



**Fig. 9—Station Controller Mounting Arrangement for 37-Type ORIG/TERM or TERM ONLY Stations**

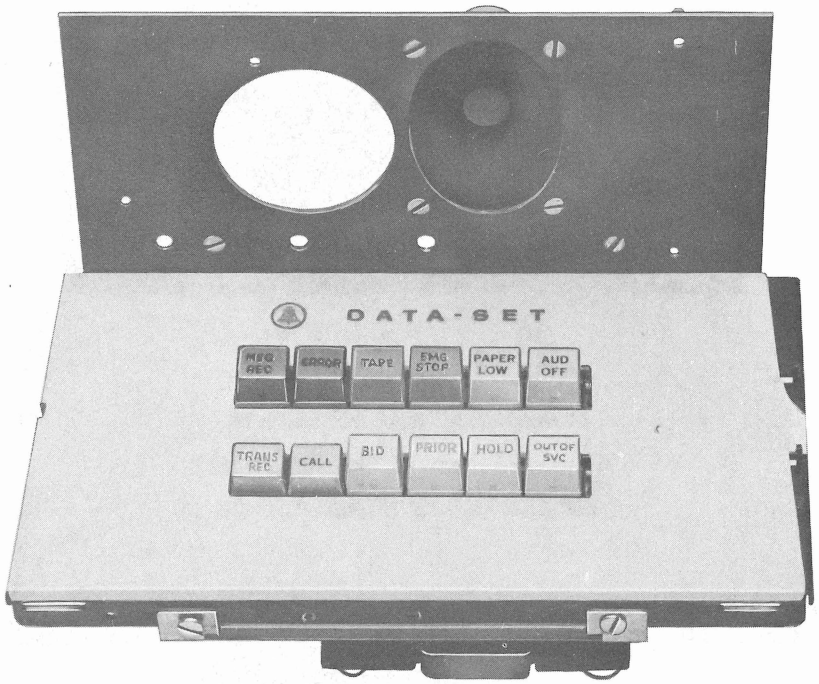



**Fig. 10—DAS 804R4—Attendant Set for 37 ASR TTY ORIG/TERM Station**

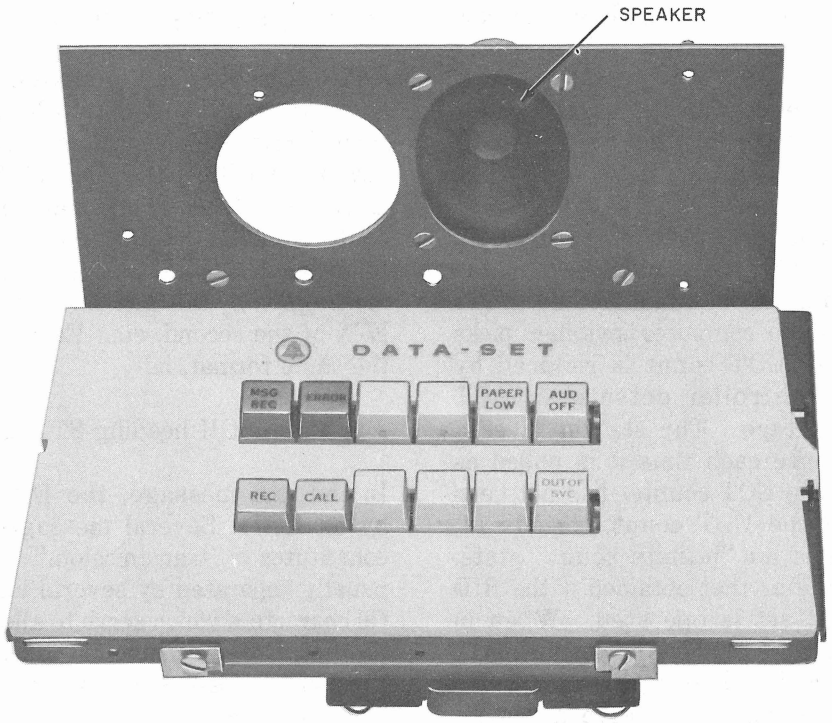



**Fig. 11—DAS 804R3—Attendant Set for 37 RO TTY TERM ONLY Station**

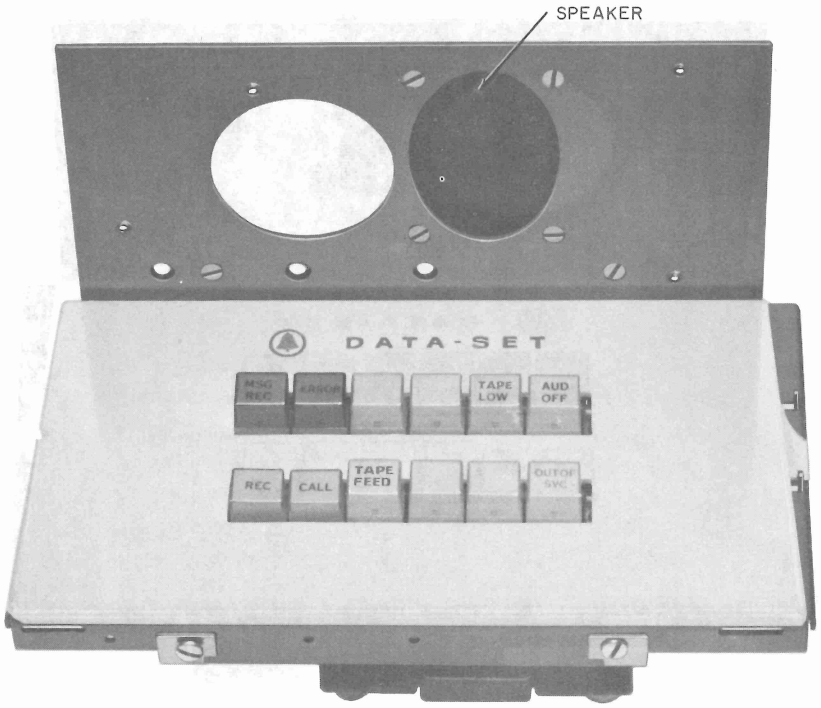



**Fig. 12—DAS 804R3—Attendant Set for 37 ROTR TTY TERM ONLY Station**

The reader will run, discarding the DEL fill characters, searching for the first SOH of the new transmission.

> ***Note:*** While the station is searching for SOH, its response to polling will be "no traffic available."

When the first SOH is detected, the reader will stop and the controller will be conditioned to the traffic available state. A maximum of 14 EOTs may be counted. As the computer switcher picks up the messages, the EOT count is reduced by one each time the controller detects an EOT transmitted from the tape. The station gives a traffic-available response each time it is polled as long as the count of the EOT counter has not been reduced to zero. If the EOT count exceeds 14, the controller assumes an "infinite count" state, which is the same state as that obtained if the BID key on the attendant set is operated. When in the infinite count state, the count in the EOT counter will not be reduced by the transmission of an EOT and the station will give a traffic available response to polling until such time as the EOT counter is returned to the "zero-count" state by a taut-tape condition, tape-out condition, or emergency stop sequence (3.28 and 3.29).

**3.05** Messages are prepared from the keyboard on punched tape. All messages follow the same format which consists of an SOH, the message heading, an STX, the text of the message, and an ETX. If a second message is prepared on one continuous length of tape, it is put on the tape following the ETX of the first message. A third message may be put on the tape following the ETX of the second, etc. Each message must follow the same format, ie:

SOH heading STX text ETX.

In the last message, the ETX must be followed by an EOT. Several messages followed by EOT, constitutes a "transmission." Each transmission is usually separated by several inches of delete (DEL) fill characters which serve to allow the last significant character of the transmission (EOT) to be read by the reader before a taut-tape condition occurs, since it is intended that the station operation be on a "continuous tape" basis. Some control characters require the use of a DEL following their

**TABLE B**

**USA STANDARD CODE FOR**

**INFORMATION INTERCHANGE**

**USAS X3.4 — 1968**

| BITS $B_7$ $B_6$ $B_5$ → | | | | | 0 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1 0 0 | 1 0 1 | 1 1 0 | 1 1 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $B_4$ ↓ | $B_3$ ↓ | $B_2$ ↓ | $B_1$ ↓ | ROW ↓ COLUMN → | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r |
| 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s |
| 0 | 1 | 0 | 0 | 4 | EOT | DC4 | $ | 4 | D | T | d | t |
| 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u |
| 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v |
| 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 1 | 0 | 0 | 0 | 8 | BS | CAN | ( | 8 | H | X | h | x |
| 1 | 0 | 0 | 1 | 9 | HT | EM | ) | 9 | I | Y | i | y |
| 1 | 0 | 1 | 0 | 10 | LF | SUB | * | : | J | Z | j | z |
| 1 | 0 | 1 | 1 | 11 | VT | ESC | + | ; | K | [ | k | { |
| 1 | 1 | 0 | 0 | 12 | FF | FS | , | < | L | / | l | \| |
| 1 | 1 | 0 | 1 | 13 | CR | GS | – | = | M | ] | m | } |
| 1 | 1 | 1 | 0 | 14 | SO | RS | . | > | N | ^ | n | ~ |
| 1 | 1 | 1 | 1 | 15 | SI | US | / | ? | O | — | o | DEL |

Denotes a 1 in the eighth bit (parity bit).

use in a message. These characters are listed in Table D.

**3.06** To initiate the traffic-available state when tapes are prepared in the off-line mode or on another machine, the BID key must be operated after the tape is in the reader and the READER ON key has been operated to ON. Operation of the BID key lights the BID lamp, sets the EOT counter to the infinite count state, and starts the reader. At this point, station operation will be the same as just described (see 3.04) until the first SOH character on the tape is detected. Detection of the SOH character stops the reader. The controller will now respond "regular traffic available" or, if the PRIOR key is operated, " priority traffic available" when polled by the computer switcher. As previously mentioned (3.04), an "infinite count" state in the EOT counter causes the traffic-available state to be maintained until

**TABLE C**

**LEGEND OF VARIOUS ASCII CODES**

| DESIGNATION | DEFINITION | DESIGNATION | DEFINITION |
|---|---|---|---|
| NUL | Null | DLE | Data Link Escape |
| SOH | Start of Heading | DC1 | Device Control 1 |
| STX | Start of Text | DC2 | Device Control 2 |
| ETX | End of Text | DC3 | Device Control 3 |
| EOT | End of Transmission | DC4 | Device Control 4 |
| ENQ | Enquiry | NAK | Negative Acknowledge |
| ACK | Acknowledge | SYN | Synchronous Idle |
| BEL | Bell | ETB | End of Transmission Block |
| BS | Backspace | CAN | Cancel |
| HT | Horizontal Tabulate | EM | End of Medium |
| LF | Line Feed | SUB | Substitute |
| VT | Vertical Tabulate | ESC | Escape |
| FF | Form Feed | FS | File Separator |
| CR | Carriage Return | GS | Group Separator |
| SO | Shift Out | RS | Record Separator |
| SI | Shift In | US | Unit Separator |
| DEL | Delete | SP | Space |

the EOT counter is returned to the "zero-count" state by a tape-out condition or emergency stop sequence. If a taut-tape condition occurs during message preparation, the EOT counter will not be restored to the "zero-count" state. When the taut-tape condition clears, the reader will start and normal count-in/count-out operation will continue with the count previously entered when the taut-tape condition first occurred. If, however, the taut-tape condition is not cleared within the normal intercharacter time-out (seet 3.27), the emergency stop sequence will be performed by the computer switches.

**Polling and Polling Responses (Fig. 13)**

**3.07** The computer switcher polls every station on the line, in turn, by sending DLE followed by the unique station polling code (SPC) of the station being polled. The DLE defines the start logic circuits in the stations. The SPC for each station is a single character chosen from the 94 printing graphics (with the exception of R, P, and +) of the ASC11 code.

**3.08** The station polling response depends upon the status of its sending and receiving terminals and will be one of the following.

(a) CAN—the CAN response is sent if the station has no traffic to send but is ready to receive.

(b) NAK—The NAK response is sent if the station has no traffic to send and is not ready to receive.

(c) P-ACK—The P-ACK response is sent if the station has priority traffic to send and is ready to receive.

**TABLE D**

**FILL CHARACTERS**

| CONTROL CHARACTER | NUMBER OF DEL CHARACTERS NEEDED |
|---|---|
| CR (carriage return)* | 2 |
| New Line | 2 |
| FF (form feed) | 1 |
| VT (vertical tab) clear | 1 |
| VT | 1 |
| HT (horizontal tab) clear | 1 |
| HT | 1 |
| DC2 | 1 |
| DC4 | 1 |
| ETX† | 1 |

* When the carriage return is followed by line feed the line feed serves as a substitute for one of the DC2 characters.

† Only when used to disconnect an auxiliary receiver.

(d) R-ACK—Same as (c) except that the traffic has regular status.

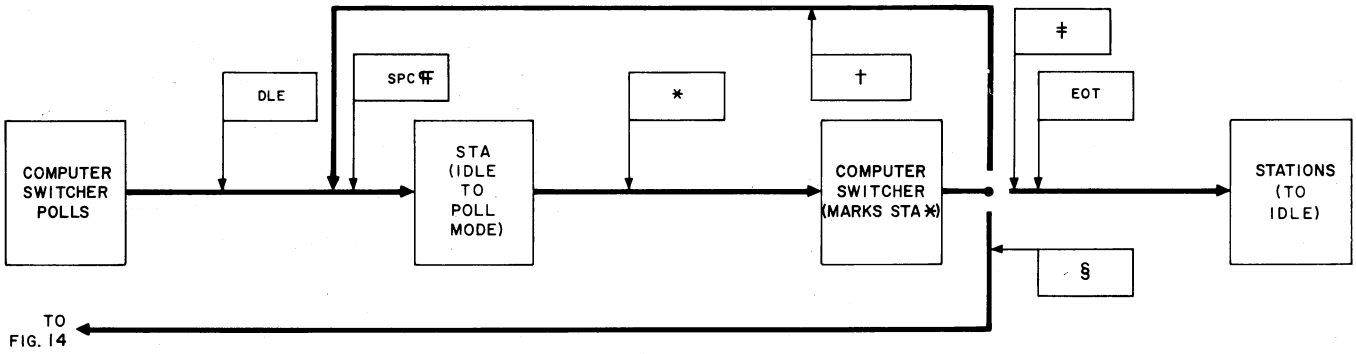
(e) P-NAK—The P-NAK response is sent if the station has priority traffic to send but is not ready to receive.

(f) R-NAK—Same as (e) except that the traffic has regular status.

The reaction of the computer switcher will be somewhat different for each of these possible responses.

**3.09** Upon reception of any polling response, the computer switcher may send the SPC of the next station to be polled. It is not necessary that the DLE be sent again, however, the presence of another DLE character will not adversely affect station operation.

**3.10** Since the 86A2 station responds to polling without becoming selected as a sender, a separate function is required to assign selected-to-send status to a station. If the computer switcher does not discriminate between regular and priority pickup




* POLLING RESPONSES:

| RESPONSE | MEANING |
|---|---|
| CAN ------ | NO TRAFFIC TO SEND — READY TO RECEIVE |
| NAK ------ | NO TRAFFIC TO SEND — NOT READY TO RECEIVE |
| P-ACK ---- | PRIORITY TRAFFIC TO SEND — READY TO RECEIVE |
| P-NAK ---- | PRIORITY TRAFFIC TO SEND — NOT READY TO RECEIVE |
| R-ACK ---- | REGULAR TRAFFIC TO SEND — READY TO RECEIVE |
| R-NAK ---- | REGULAR TRAFFIC TO SEND — NOT READY TO RECEIVE |

† COMPUTER SWITCHER ELECTS TO CONTINUE POLLING WITH NEXT STATION

‡ COMPUTER SWITCHER ELECTS TO TERMINATE POLLING WITHOUT HAVING SELECTED A STATION TO SEND

§ COMPUTER SWITCHER ELECTS TO SELECT POLLED STATION TO SEND

⁋ STATION POLLING CODE

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**Fig. 13—Station Polling Response Sequence Chart**

conditions, it may select the station as a sender upon receipt of either a P-ACK, P-NAK, R-ACK, or R-NAK response. If, however, the computer switcher does discriminate between the regular and priority pickup conditions, it may immediately select a station to send only upon receipt of a P-ACK or P-NAK response and send the SPC of the next station to be polled if the response is R-ACK or R-NAK.

**3.11** If an invalid response (any response other than CAN, NAK, R-ACK, R-NAK, P-ACK, or P-NAK) is received by the computer switcher, the computer switcher (if programmed to do so) will repoll the station in question by sending DLE to redefine the polling sequence followed by the SPC of that particular station. The assumption in this case is that the response was legitimate but had been affected by noise on the line in such a manner that the computer switcher could not recognize it as valid.

**3.12** If the invalid response takes the form of continuous transmission from one of the stations, the computer switcher (if programmed to do so) will initiate an emergency stop action (see 3.28 and 3.29) with an explanatory service message and restart the polling sequence beginning with the last station polled.

**3.13** The computer switcher will employ a response time-out that will indicate when a response is not received within a specified interval of time (600 milliseconds minimum). If a response time-out occurs, the computer switcher is expected to repoll the station in question by sending DLE followed by the SPC of that particular station.

**3.14** As indicated in 3.08, the 86A2 station is designed to include information regarding the status of its ability to receive traffic as a part of every polling response. This is to aid the computer switcher in determining whether or not it is worthwhile to attempt a delivery to the station.

**3.15** There are two ways to terminate the polling sequence. They are:

(a) Return all stations to idle—To return all of the stations to idle, the computer switcher sends the control character EOT. Upon detection of this code, all stations will assume the idle condition.

(b) Selecting a station to send—When a response to polling indicates that a station has traffic that should be picked up, the computer switcher terminates the polling sequence by selecting that station as a sender. To do this, the computer switcher sends the control character ENQ (enquiry) followed by the CEC (call enquiry code) of the station being selected to send. Normal operation will subsequently include the transmission of the control character DC1 (device control 1) by the computer switcher. This will define the end of polling for all other stations on the line, and will unblind the selected stations page printer. The printer is now able to print the TDM when it is sent by the computer switcher (if programmed to do so).

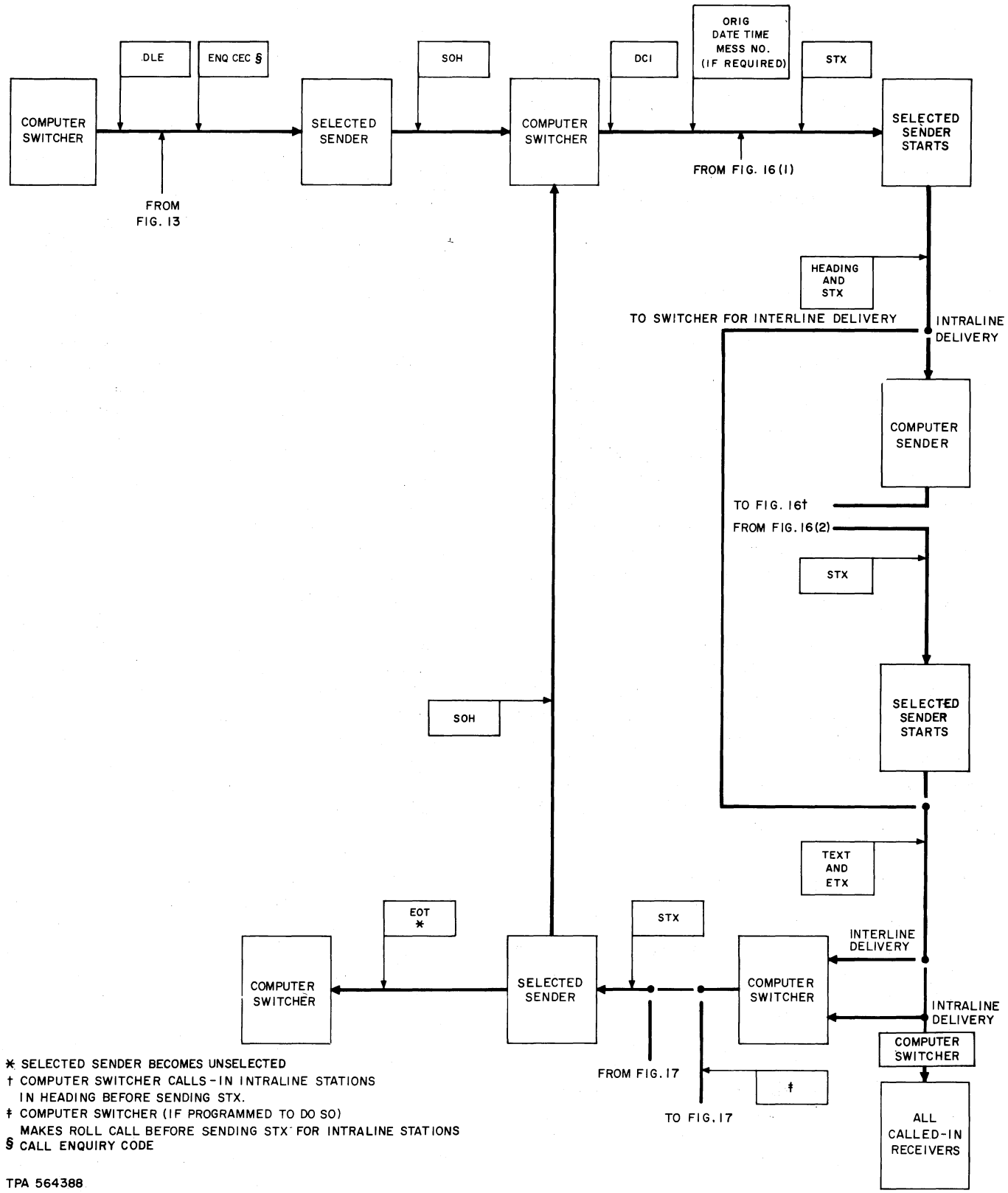
### B. Sending the Message (Fig. 14)

**3.16** There are two conditions under which the computer switcher may elect to select a station to send. They are:

(a) After receiving a response to polling that indicates the station has traffic to send, and if the status of the traffic is priority and the computer switcher is arranged to discriminate between priority and regular traffic, it may immediately select the station as a sender. If the computer switcher does not distinguish between priority and regular traffic, it may select the station as a sender for any traffic available response.

(b) When a computer switcher arranged to discriminate between priority and regular traffic has polled all of the stations, has found none with priority traffic, and has marked one or more of the stations as having regular traffic available.

**3.17** Since, in the case of 3.16 (a), the station is in the polling mode, the computer switcher will, after receiving a traffic available response, send ENQ followed by the station's call enquiry code (CEC) to select the station as a sender. In the case of 3.15 (b), the computer switcher may elect to pick up traffic from any station marked as having traffic available. If the stations are still in the polling mode, the computer switcher can select a station to send by sending the ENQ CEC sequence. If for some reason the polling mode has been terminated, the computer switcher must precede the ENQ CEC with a DLE.




* SELECTED SENDER BECOMES UNSELECTED
† COMPUTER SWITCHER CALLS-IN INTRALINE STATIONS IN HEADING BEFORE SENDING STX.
‡ COMPUTER SWITCHER (IF PROGRAMMED TO DO SO) MAKES ROLL CALL BEFORE SENDING STX FOR INTRALINE STATIONS
§ CALL ENQUIRY CODE

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**Fig. 14—Sender Selection Sequence Chart**

**3.18** If the traffic available status no longer exists at a station when the computer switcher attempts to select it as a sender, it will respond to ENQ CEC with NAK. The computer can then do one of several things:

(a) Select another station to send if any are marked as having traffic available

(b) Poll the next station

(c) Leave the stations in the idle state.

**3.19** Normally, the station selected is still in the traffic available state and detection of ENQ CEC will put it into a selected to send condition with its TRANS REC lamp lighted. This will cause the station controller to send SOH. The station now awaits a "go ahead" signal from the computer switcher. After the computer switcher receives the SOH, it will transmit DC1. The DC1 unblinds the ASR TTY page printer and defines the end of polling, as previously noted, to permit delivery of information to that station by the computer switcher.

**3.20** If such information (eg, the TDM of the message) is required, the computer switcher will now send it to the station where it will be copied by the ASR TTY page printer and will appear ahead of the message heading and text on the station copy. The computer switcher will now send an STX character. If no information is required, the computer switcher will follow the DC1 immediately with an STX character.

**3.21** In either case, detection of the STX character by the station starts its reader. If, after having sent the STX, the computer switcher gets no response from the station within the response time-out interval, the computer switcher will (if programmed to do so) send the STX code again. If repeated attempts to start the station transmitter are unsuccessful, the computer switcher will (if programmed to do so) initiate an emergency stop action, send an explanatory service message, and reactivate the polling sequence starting with either the next station to be polled or the next station to be selected as a sender.

**3.22** As previously mentioned, the detection of STX starts the selected station reader. At this point, operation of the station will be dependent on whether the station is arranged to stop or not stop (controller option) on STX as follows:

(a) If the station is equipped with the "stop on STX" option, it will send the message heading, any DEL fill characters, and STX. Detection of STX from the tape stops the reader. The computer switcher now checks the validity of the heading and proceeds, if intraline operation is employed, to call in any intraline addressee(s). If programmed to do so, the computer switcher now sends personal address information (eg, "for action", for info, etc) and delivery number to the called-in station before repeating the procedure for the other intraline addressees in turn. After all of the intraline addressees have been called in and have received their per station (if required) information, the computer switcher will send ENQ DC2 and, if programmed to do so, the originating TDM to all of the called-in intraline receivers. This may be followed by heading information and another STX. The STX will restart the reader, and the selected sender will transmit the message text up to and including the ETX character. Detection of the ETX by the station may or may not stop the reader, dependent on whether the station is arranged to stop or not stop on ETX (controller option—see 3.23. In either case, the called-in intraline receivers copy the message directly from the selected sender as it is sending. If any interline receivers are included in the heading, the computer switcher will store the message for future delivery.

(b) If the station is not equipped with the "stop on STX" option, it will now send the message heading, any DEL fill characters, STX, and the entire message text up to and including the ETX character. Since the station does not stop on STX, intraline delivery of the message is not possible. Therefore, all message deliveries will be made on an interline basis. As in the case of (a), detection of the ETX may or may not stop the reader, dependent on whether the station is arranged to stop or not stop on ETX (controller option—see 3.23).

**3.23** As mentioned in 3.22 (a) and (b), the station may be optionally arranged to stop or not stop on detection of ETX from the tape. If a station is equipped with the "stop on ETX" option, the reader will stop when ETX is read from the tape. This provides an opportunity for the computer

switcher (if programmed to do so) to perform a roll-call (3.41 through 3.50) of the stations called in as receivers during any intraline delivery.

**3.24** If a station is equipped with the "no stop on ETX" option, detection of ETX from the tape will not stop the reader. The ETX will be sent to the computer switcher and the reader will continue to run sending the EOT (if present) and any DEL fill characters until a taut tape condition or tape out condition exists or another SOH is detected from the tape. This option will normally be provided in the station when the system only employs interline delivery of messages or the computer switcher is not programmed to perform roll-call.

**3.25** When the stations are arranged to "stop on ETX," intraline delivery is employed, and the computer switcher is programmed to perform roll-call, the computer switcher will now roll call the selected intraline receivers to determine if the message was received properly (see 3.41 through 3.50). After roll-call is complete, the computer switcher sends the sequence EOT STX. The EOT returns the selected receivers to idle and the STX restarts the selected send station reader. At this time one of the following may occur:

(a) If the station has additional traffic to send, its reader will start and continue to run until an SOH is detected on the tape. Upon transmitting the SOH the reader is turned off by the controller. The station remains a selected sender and the message pick-up process previously described is repeated.

(b) If the station has no additional messages in that transmission, the ETX on the tape will be followed by an EOT. When the reader is restarted, transmission of the EOT from the tape will unselect the station and extinguish the TRANS/REC lamp. Assuming that the traffic available state had been effected by setting the EOT counter to the "infinite count" state (ie, operating the BID key), the reader will now continue to run until a taut-tape or tape-out condition exists. The EOT counter will be reset to zero and cancel the traffic available state on the tape-out condition only.

(c) However, if the traffic available state had originally resulted from a "finite count" state in the EOT counter (ie, EOT characters counted when punched in tape), transmission of the EOT from the tape unselects the station, extinguishes the TRANS REC lamp, and causes the count in the EOT counter to be reduced by one. If the resulting count in the EOT counter now becomes zero, the reader is stopped and the traffic available state is cancelled. However, if the resulting count in the EOT counter remains greater than zero (indicating that at least one more complete transmission is available), the reader will not stop at the EOT on the tape but will continue to run searching for the SOH that marks the start of the next transmission. The SOH will stop the reader and the traffic available state will be maintained (BID lamp lighted). To pick up the next message, the computer switcher ***must*** repeat the polling and sender selection sequences.

**Hold Operation (Torn Tape Message Introduction)**

**3.26** Use of the HOLD key on the ASR TTY attendant set permits interjecting a message contained on a separate piece of tape during an in-progress transmission without relinquishing control of the line. Operation of the HOLD key while a message is being transmitted causes the station reader to stop upon sending the next ETX it encounters. When the reader stops, the HOLD lamp will light and the audible alarm will sound indicating that the torn tape message may now be inserted in the reader. The tape alarm is inhibited during the hold state. When the reader gate is opened, the traffic available status is canceled (EOT counter set to zero); however, the station remains selected to send for the duration of the intercharacter time-out interval. The torn tape message must conform to the standard message format. Once the torn tape message tape is in place, restoration of the HOLD key and operation of the BID key will restart the reader. The AUD OFF key must be operated and then restored to silence the audible alarm. The reader will run transmitting any DEL fill characters on the tape until it encounters the SOH of the torn tape message. Upon transmission of that SOH, the reader will stop, the computer switcher will send DC1 to unblind the ASR TTY page printer to permit delivery of per station information, and subsequent operation will be as described in 3.20 through 3.25. Operation of the HOLD key while the torn tape message is being delivered will cause the reader to stop again on detection of ETX. The original tape can be

reinserted in the reader and the transmission caused to resume as before.

**3.27** Because of the hold feature and the possibility that tape in the reader may accidently become taut or twisted during transmission (thereby causing the reader to stop), it is recommended that a minimum intercharacter time-out interval of 30 seconds be employed by the computer switcher. This allows the computer switcher to measure periods of abnormal interruption in traffic pick-up before it takes corrective action. When corrective measures are required, the emergency stop action (3.28 and 3.29) is recommended to the customer.

**Emergency Stop (Fig. 15)**

**3.28** There are circumstances (several of which have already been mentioned) that may make it necessary for the computer switcher to interrupt a selected sender. When these occur, the computer switcher will perform an emergency stop action, transmit a service message to the sender, return the station to idle, and continue in the normal manner.

**3.29** In order to perform the emergency stop procedure, the computer switcher transmits a BREAK consisting of from 400 to 750 milliseconds of space followed by a pause of at least 100 milliseconds of mark. The BREAK is detected by the station controller at the selected sender and the reader is (if running) stopped. Following the pause, the computer switcher sends DLE DC1 which lights the EMG STOP lamp on the sending station attendant set, actuates the audible alarm if not inhibited by the AUD OFF key, resets the EOT counter to zero, and unblinds the station page printer. If any intraline stations are selected to receive, the DLE DC1 sequence will light the MSG REC lamps on their attendant sets and actuates their audible alarms (if not inhibited by their AUD OFF keys). The computer switcher may now send a service message (to explain the reason for the interruption) followed by an EOT. The service message will be copied at both the selected sender and any intraline station that has been selected to receive. The EOT will unselect the selected sender and the intraline stations that have been selected to receive. Operation of the EMG STOP key on the selected sender attendant set or the MSG REC key on the affected receivers attendant sets will extinguish the associated lamp, silence the audible alarm (if not already silenced by operation of the AUD OFF key), and restore the station to the idle condition. Until the EMG STOP key is operated, the selected sender is locked in the no traffic available state.

**C. Call-In and Roll-Call**

**Call-In (Fig. 16)**

**3.30** Call-in involves calling each intended receiver and receiving a response indicating its ready-to-receive status. Prior to beginning the call-in routine, the computer may transmit the control character EOT to ensure that all of the receive stations are idle.

**3.31** When the computer switcher elects to call in a station as a receiver, it initiates the procedure by the transmission of ENQ. This will blind any previously selected receive stations.

**3.32** The computer switcher will follow the ENQ with the discrete call enquiry code (CEC) of the intended receiver and wait for the station response. The CEC for each station is a single character chosen from the set of ASCII printing graphics. Since detection of the entire ENQ CEC sequence is necessary for a station to become selected to receive, the computer switcher must send ENQ with each CEC generated.

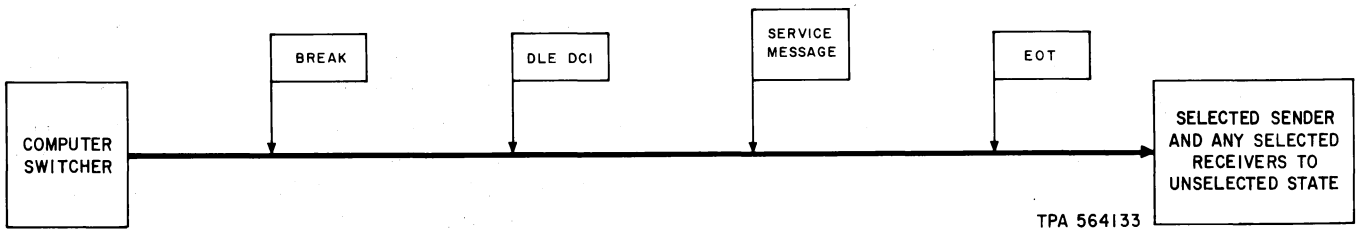
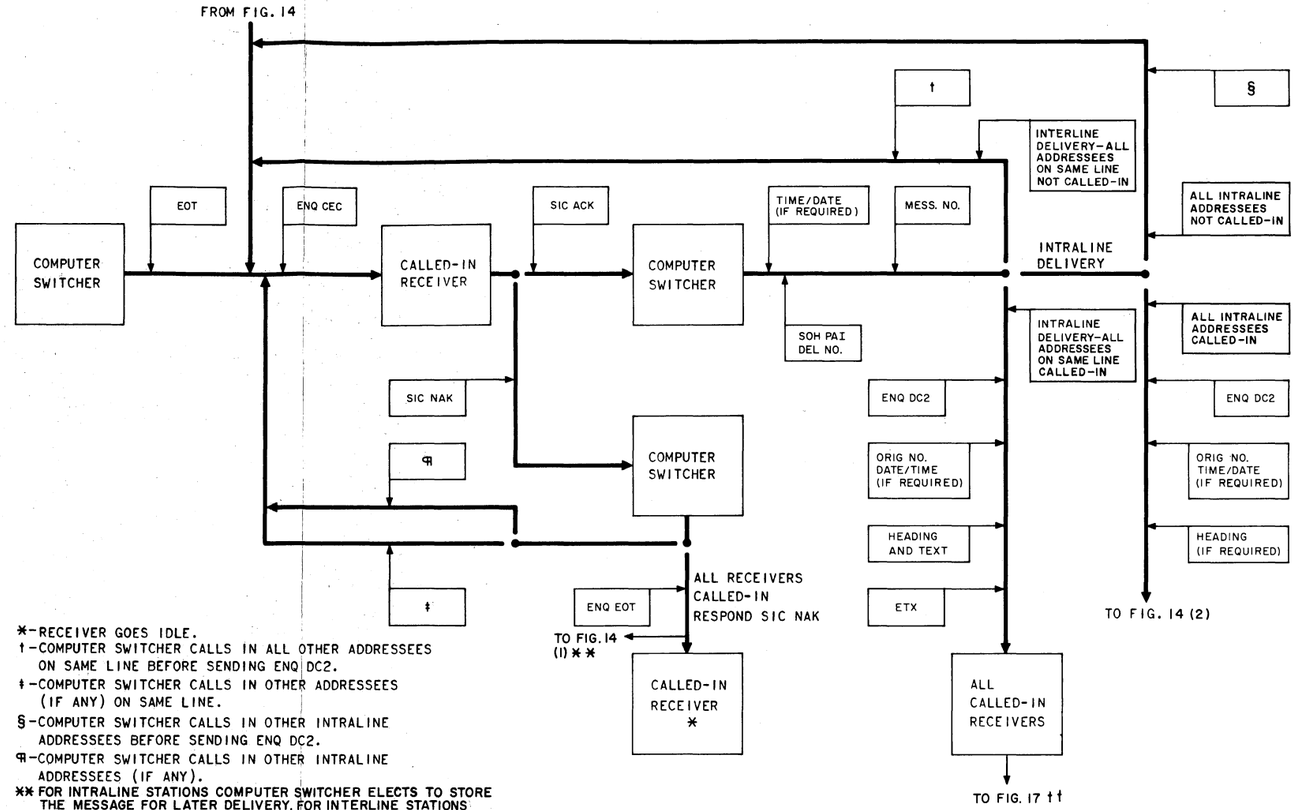



**Fig. 15—Emergency Stop Sequence Chart**




*–RECEIVER GOES IDLE.
†–COMPUTER SWITCHER CALLS IN ALL OTHER ADDRESSEES ON SAME LINE BEFORE SENDING ENQ DC2.
‡–COMPUTER SWITCHER CALLS IN OTHER ADDRESSEES (IF ANY) ON SAME LINE.
§–COMPUTER SWITCHER CALLS IN OTHER INTRALINE ADDRESSEES BEFORE SENDING ENQ DC2.
¶–COMPUTER SWITCHER CALLS IN OTHER INTRALINE ADDRESSEES (IF ANY).
** FOR INTRALINE STATIONS COMPUTER SWITCHER ELECTS TO STORE THE MESSAGE FOR LATER DELIVERY. FOR INTERLINE STATIONS COMPUTER SWITCHER REQUEUES MESSAGE FOR ANOTHER DELIVERY ATTEMPT.
†† FOR ROLL-CALL ONLY--OTHERWISE COMPUTER SWITCHER FOLLOWS WITH EOT TO RETURN SELECTED STATIONS TO IDLE.

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**Fig. 16—Receiver Call-In Sequence Chart**

**3.33** The station will respond to call-in with its discrete station identity code (SIC) followed by either ACK if it is ready to receive or NAK if it is not ready to receive. The SIC for each station is a single character chosen from the set of ASCII printing graphics. If the station replies NAK, the CALL lamp on the receive terminal attendant set will be lighted to indicate to the operation that an unsuccessful call-in attempt has been made. The CALL lamp is extinguished when the station is returned to ready.

**3.34** A station is not ready to receive if any of the following conditions exist:

(a) The station is in the out-of-service mode (OUT-OF-SVC key operated).

*Note:* A selected station will not assume the out-of-service mode until it is returned to idle.

(b) Paper is low or form supply is exhausted and the station is not selected to receive.

(c) Form feeding is taking place and the station is not selected to receive.

(d) The TTY is in the off-line mode.

(e) Tape is low at a 37 ROTR TTY primary receiver.

(f) Tape feedout (TFO) is occurring at a 37 ROTR TTY primary receiver and the station is not selected to receive.

**3.35** If the station response is ACK, the CALL lamp will flash momentarily and the TRANS REC (ORIG/TERM station) or REC (TERM ONLY station) lamp on the attendant set will light steadily. This indicates that the station is selected as a receiver. The computer switcher can now send per station information, such as personal address information (PAI) and/or message delivery number, to the called-in receiver. The PAI includes information such as the name of the individual to whom the message should be delivered, etc. The term also covers such directives as "for action," "for information," "rush," etc. Since any previously called-in receiver has been blinded by the ENQ, this information will be copied only by the station being called in.

**3.36** If additional stations are to be called in, the process described in 3.30 through 3.35 will be repeated for each such station. After all of the intended receivers have been selected, the computer switcher will send ENQ DC2 to unblind them. The computer switcher may now send any information, such as the date, time, and message heading, that is common to all of the selected receivers. This information will be followed by STX. In the case of intraline deliveries, the STX will start the reader of the selected sender which will send the entire message up to and including the ETX. In the case of an interline delivery, the computer switcher will follow the STX with the message text and ETX. In either case the message text will be copied by all of the selected receivers.

**Invalid Responses to Call-In**

**3.37** If the invalid response to call-in takes the form of SIC followed by something other than ACK or NAK, the computer switcher (if programmed to do so) will make a second attempt to call in the station.

**3.38** If the invalid response takes the form of a continuous transmission, it indicates that a sender has been selected and falsely started. In this case, the computer switcher is expected to perform an emergency stop procedure (see 3.28 and 3.29) and send an explanatory service message. This emergency stop procedure will deselect any falsely selected or started send station.

**3.39** If the invalid response takes the form of a SIC ACK with the wrong SIC, it means that the wrong receiver is (or may be) selected. In this case, one of three things can happen depending upon the programming of the computer switcher:

(a) The computer switcher can deselect this receiver along with any others previously selected by sending EOT and reinitiating call-in with the first addressee.

(b) The computer switcher can send ENQ DC2 to unblind all selected stations and follow this with an explanation of why unusual action is being taken. The station is then immediately deselected. The message of explanation will be followed by EOT to perform the deselection process. In this instance, there will be no alarm activated at the selected receivers.

(c) In the case of an interline delivery, the computer switcher can perform the emergency stop procedure (see 3.28 and 3.29). In this instance, an alarm will be activated at the selected stations.

**No Response to Call-In**

**3.40** If the computer switcher receives no response to a call-in attempt within the response time-out interval (600 milliseconds minimum), it (if so programmed) will make one or more additional attempts to call in the station. If repeated attempts to call in the station fail, it is not necessary for the computer switcher to deselect any previously selected receivers. However, dependent on the programming of the computer switcher, it may elect to do so as described in 3.39 (a), (b), or (c).

**Roll-Call (Fig. 17)**

**3.41** Roll-call is the performance of a call-in operation of the already selected receivers at the conclusion of the message delivery to determine if the receivers received the message properly. It consists of calling each of the stations individually and getting a response from them that indicates whether or not they received the message properly. After delivery of the message up to and including ETX, the computer switcher may or may not, dependent on its programming, perform the roll-call operation. If the computer switcher is programmed to deliver common information, such as an end of delivery record, to the selected stations, it may do so either before or after the roll-call function. In cases where this delivery is to follow roll-call, the computer switcher must precede the common information with ENQ DC2. In cases where the delivery is to precede roll-call or no roll-call is to be performed, the ENQ DC2 sequence is not necessary.

**3.42** If the computer switcher is not programmed to perform roll-call, the ETX or delivery of common information will be followed immediately by an EOT. If there are ROTR TTY TERM ONLY stations on the line, there can be no automatic tape feed out (TFO) under these circumstances (see 3.56).

**3.43** If the computer switcher is programmed to perform roll-call, it will initiate the operation by following the ETX of the message or delivery of common information with ENQ. As in the call-in procedure, the ENQ will blind all of the selected receivers. However, since ETX preceded the ENQ this time, it will define the beginning of roll-call instead of initiating call-in. After sending ENQ, the computer switcher will follow with the CEC of a selected station to be roll called.

**3.44** The station will respond to roll-call with its SIC followed by either CAN if the message was received properly, or NAK if the message was not received properly. The NAK response is generated if any of the following abnormalities occur during the interval between the time the station was selected to receive and roll-call.

(a) A paper-out condition was detected on a sprocket-feed machine that resulted in part of the message being lost [ie, the station received a form feed (FF) order followed by a DEL, the form supply became exhausted while feeding was taking place, and the next character was not an ETX marking the end of the message].

(b) The terminal device failed to respond to the received signals during message delivery (a character was lost and did not reach the typing unit).

(c) An error free ETX character was not received or was not detected by the controller.

(d) The receiver became not ready during the delivery (ie, the ASR TTY MODE switch was operated to the OFF LINE position).

(e) A character was received with a parity error or there was a loss of synchronism during reception of the message which caused a parity error indication (optional).

**3.45** If the station responds to roll-call with NAK, the MSG REC lamp on the attendant set will be lighted and the audible alarm (if not inhibited by the AUD OFF key) will sound. The MSG REC lamp can be extinguished and the alarm silenced (if not previously silenced by operation of the AUD OFF key) by operation of the MSG REC key on the attendant set. Following receipt of either a CAN or NAK response to roll-call, the computer switcher can proceed to roll call the next station in line by sending ENQ followed by the CEC of that station.

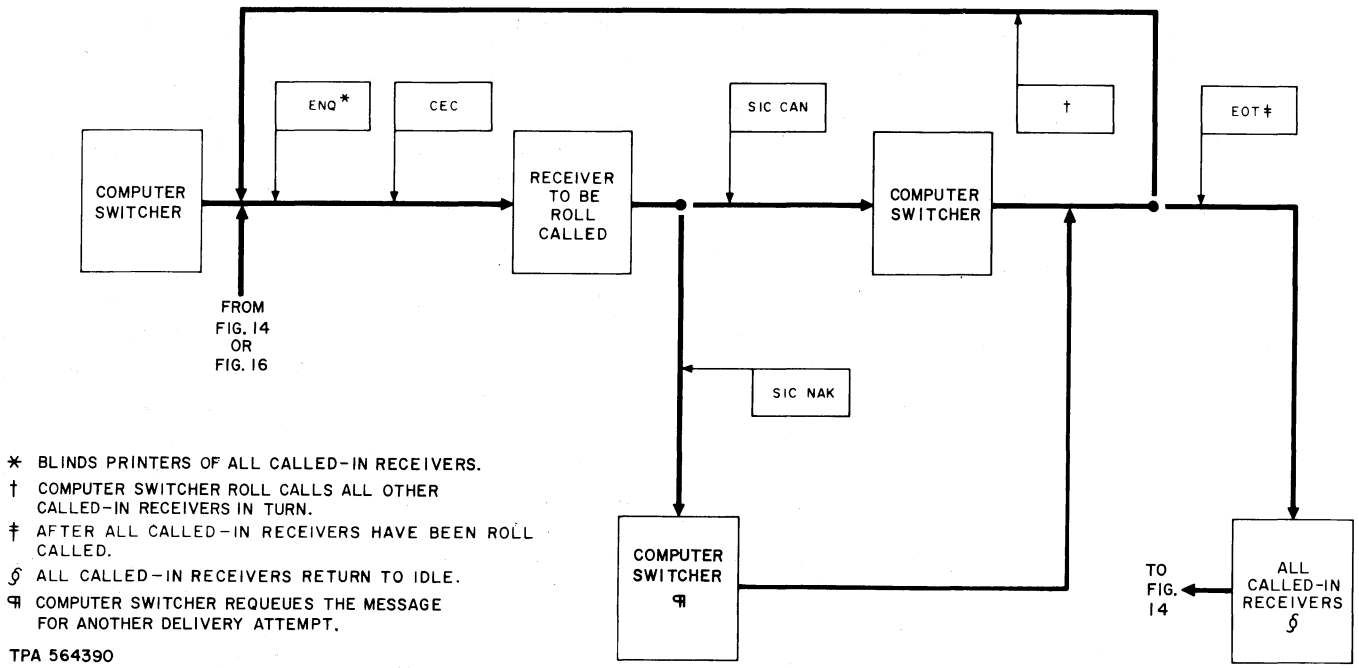



**Fig. 17—Roll-Call Sequence Chart**

**3.46** When an invalid response to roll-call is received, the computer switcher (if programmed to do so) can repeat any given roll-call as many times as desired, in an attempt to obtain a valid response.

**3.47** If the response to roll-call is SIC ACK, it means the station involved has become deselected and is treating the roll-call as a call-in. Since this is an abnormal condition that indicates the message was not properly received, the computer switcher will treat this response the same as a SIC NAK response.

**3.48** If the roll-call response should take the form of a continuous transmission, it indicates that a sender has been selected and falsely started. In this case, the computer switcher should send a BREAK to stop the sender and then proceed with the roll-call function. Upon completion of roll-call, the computer switcher can send EOT to deselect the receivers and then perform an emergency stop with an explanatory service message to inform the selected send station of the problem encountered.

**3.49** As in the case of call-in, a response time-out feature will be employed by the computer switcher. The action taken here will be the same as for call-in.

**3.50** After all of the receivers have been roll called, the computer switcher will do one of two things.

(a) It will send ENQ DC2, as previously indicated, to unblind all of the selected receivers and then deliver common information, such as date and time record, to the receivers. This then would be followed by EOT.

(b) It will send EOT which will return all of the selected receivers to idle.

### D. Auxiliary Receiver Connect and Disconnect

**3.51** A 37 RO or ROTR TTY may be used as an auxiliary receiver at a 37 ASR TTY ORIG/TERM or 37 RO TTY TERM ONLY station. It may be connected or disconnected manually and, if a wiring option is provided in the primary TTY, connect and disconnect may be initiated automatically. In addition, the tape punch of a 37 ASR TTY ORIG/TERM station not equipped with an auxiliary 37 RO or ROTR TTY may be used as an auxiliary ROTR while the station is in the ***unattended*** mode. This is accomplished manually by operation of the PUNCH ON key on the ASR TTY or automatically via line signals.

**3.52** An auxiliary 37 RO or ROTR TTY is connected manually by the operation of the AUX RCVR key located on the primary TTY. This unblinds the auxiliary receiver selector magnet driver (SMD) which is in parallel with the SMD of the primary TTY, thereby allowing the auxiliary receiver to copy the same information that is received by the primary TTY. A lamp located in the AUX RCVR key on the primary TTY is lighted whenever the auxiliary receiver is connected whether done manually or automatically. Restoration of the AUX RCVR key disconnects the auxiliary receiver unless automatic connect was initiated during the period of manual connection and is still in effect when manual disconnect is attempted.

**3.53** When the wiring option that allows automatic auxiliary receiver connect and disconnect is provided in the primary TTY, reception of DC2 by the primary TTY stunt box will connect the auxiliary receiver, and reception of ETX and/or DC4 (option) will disconnect the auxiliary receiver. In this case the lamp in the AUX RCVR key is not lighted. In addition, once the auxiliary receiver is connected, it can be disconnected only when both the manual and automatic controls are in the disconnect state.

**3.54** A print suppression option may also be provided. This option causes the typing unit of the primary TTY to be inhibited from printing and performing other paper-affecting functions while the auxiliary receiver is connected. Disconnecting the auxiliary receiver will restore the primary TTY typing unit to normal.

**3.55** When the auxiliary receiver is a 37 ROTR TTY, automatic tape feedout (TFO) will occur whenever the auxiliary ROTR TTY is disconnected manually, or, if the wiring option is provided in the primary TTY, it may be disconnected automatically (see Table E). In either case, between 2 and 10 inches of tape will be fed out punched with DEL characters. The length of feedout is electrically adjustable. If the auxiliary ROTR TTY is connected manually and the automatic disconnect TFO option is provided, reception of an automatic disconnect character (optionally ETX and/or DC4) will cause TFO to occur, but the auxiliary ROTR TTY will remain connected. In addition, it should be noted that the TFO feature is noninterfering. That is, if any mark-to-space transition is received while a TFO is occurring, the TFO will be stopped and the received character will be punched and printed on the tape.

**TABLE E**

**AUTOMATIC TFO OPTIONS FOR AUXILIARY 37 ROTR**

| AUXILIARY ROTR CONNECT | AUTOMATIC TFO OPTIONS AVAILABLE |
|---|---|
| Manual Only | No automatic TFO |
| | Automatic TFO on manual disconnect only |
| Manual or Automatic (DC2) | No automatic TFO |
| | Automatic TFO on ETX disconnect only |
| | Automatic TFO on DC4 disconnect only |
| | Automatic TFO on ETX or DC4 disconnect |
| | Automatic TFO on manual disconnect only |
| | Automatic TFO on manual or ETX disconnect |
| | Automatic TFO on manual or DC4 disconnect |
| | Automatic TFO on manual ETX or DC4 disconnect |

### 37 ROTR TTY Primary Receiver

**3.56** When a 37 ROTR TTY is used as a primary receiver, there are no provisions for connecting an auxiliary receiver. Automatic TFO (option) will occur when the station is roll called and is activated by the ENQ CEC sequence used in the roll-call process. The CEC must be that of the station being roll called for TFO to the activated. A customer option is also available which provides automatic TFO upon motor shutoff. As for the auxiliary 37 ROTR TTY, the TFO feature is noninterfering.

## E. TTY Functional Description

### ASR TTY

**3.57** The block diagrams of Fig. 18 show the functional arrangements of a 37 ASR TTY when the mode switch is in the following positions.

(a) OFF LINE—This position places the station in the off-line mode. In this mode, the TTY is disassociated from the line (station can neither send nor receive data), the TTY motor runs continuously (unless OOS key is operated), and the keyboard, punch, reader, and typing unit can be used for the following:

(1) To prepare tapes from the keyboard with local copy provided (PUNCH ON/OFF key ON)

(2) To obtain page copy of previously prepared tapes for the purpose of proofreading (PUNCH ON/OFF key OFF)

(3) To prepare byproduct tape from a previously prepared tape (PUNCH ON/OFF key ON), editing or adding to it in the process by keyboarding in the corrective or additional information

(b) ON LINE—This position places the station in the on-line mode. In this mode, the reader is always connected to the line (via the controller and data set) and the TTY motor runs continuously. When the station is selected to send, the reader can transmit data to the line and the typing unit will provide local copy of the signals transmitted. When the station is selected to receive, the typing unit will print copy of the messages received by the station. In either case, the punch and keyboard can be used to prepare tapes without local copy being provided.

(c) UNATT—This position places the station in the unattended mode. In this mode, the TTY motor is normally under control of the line and runs when the station is selected as a receiver or if the station has traffic available to send. The motor will run until all traffic has been sent before it turns off and becomes controlled by the line. In addition, the keyboard and punch are deactivated while the station is in this mode. A customer option is available whereby the punch can be manually or automatically selected when the UNATT mode is employed.

### RO and ROTR TTY (Fig. 19)

**3.58** The voltage signals from the controller are applied to the SMD via the received data lead. The SMD operates the RO TTY page printer or the ROTR TTY typing reperforator.

## F. Station Functional Description

**3.59** During the transmit sequence, the ASR TTY of a sending station converts the characters from the tape to voltage signals which conform to the Electronic Industries Association (EIA) Standard RS-232-C and presents them to the controller. In the controller (DAS 820B-type), the EIA voltage signals are monitored (so that control actions can be taken when required), regenerated, and sent to the data set. The Data Set 108A or 109A converts the signals into voice-frequency tones or dc currents which are suitable for transmission over the line. The attendant set (DAS 804R4) is used with the ASR TTY unit to perform the following functions:

(a) Provide audible and visual alarms and a means for silencing these alarms

(b) Condition the controller to respond to polling with either a regular or priority traffic available indication

(c) Provide manual TTY control functions such as the HOLD operation feature and placing the ASR TTY in an out-of-service condition

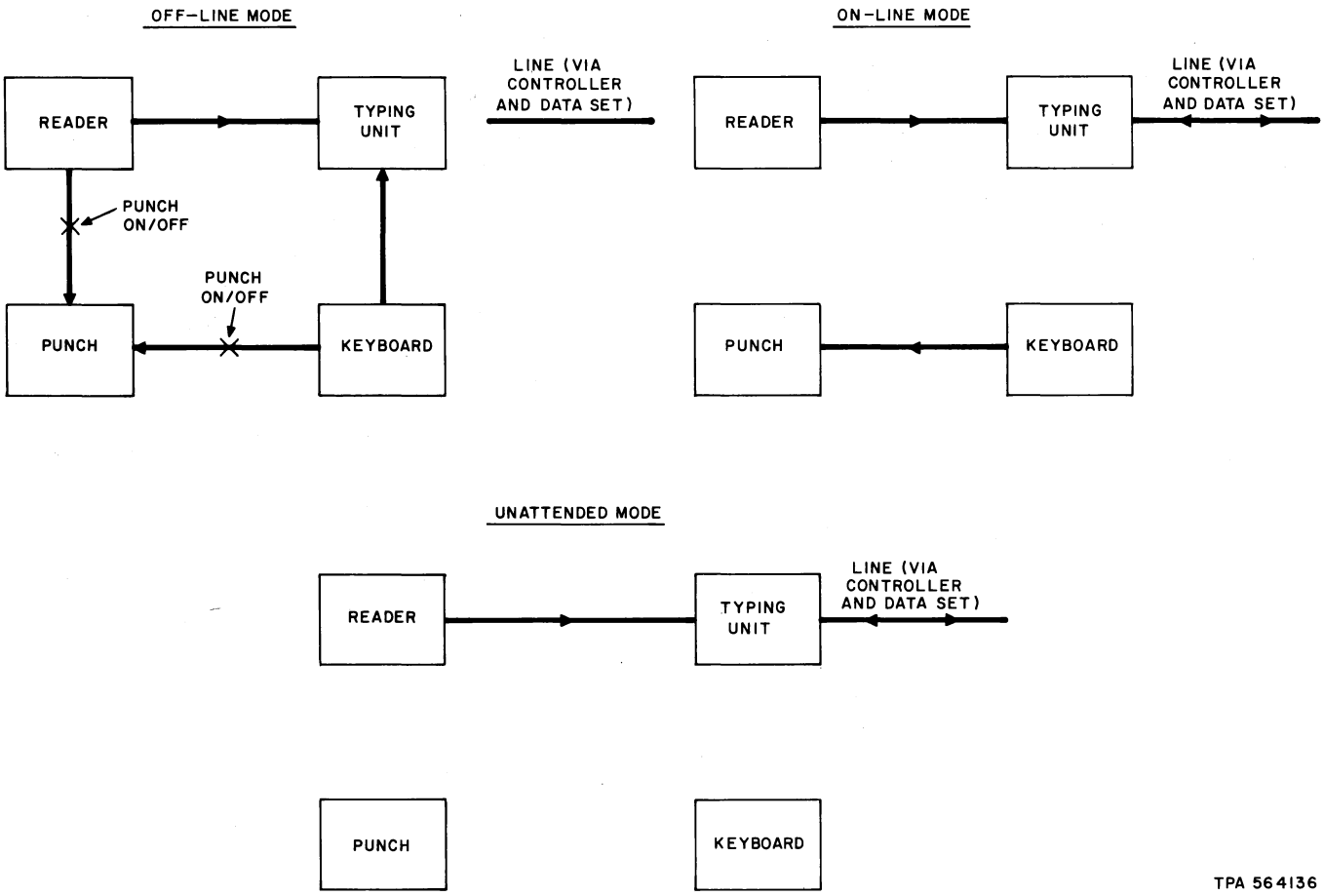



**Fig. 18—Block Diagrams Showing Operational Modes of the 37 ASR TTY**

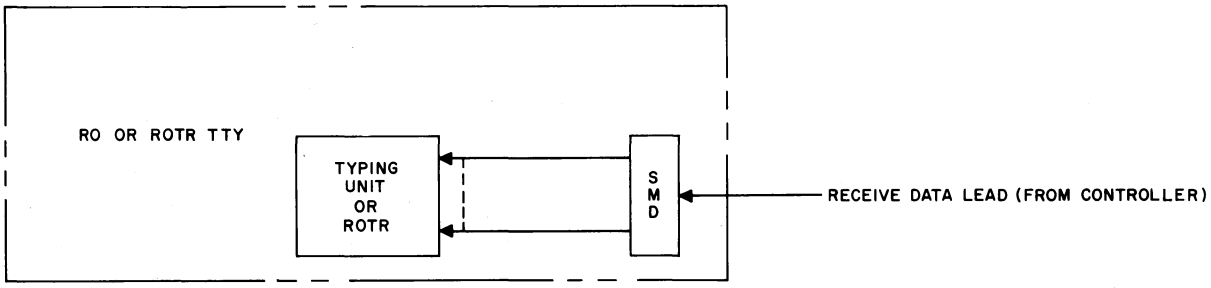



**Fig. 19—Block Diagram of Receiving TTY (RO or ROTR)**

(d) Provide indications as to the status of the station, such as selected to send or receive, traffic available bid condition present, etc.

**3.60** The receive sequence for a station is essentially the reverse of the transmit sequence. The Data Set 108A or 109A converts the voice-frequency tones or dc currents received from the line into EIA voltages and presents them to the controller. The controller performs the same as it did for the transmit sequence and delivers regenerated voltage signals to the SMD of the

primary, and if provided, auxiliary TTY. Because of a buffering action in the controller, there is a one-character delay between the reception of and printing of a character.

**Out-Of-Service (OOS)**

**3.61** Each attendant set is provided with an OUT OF SVC lamp and key. The key is a push-to-operate, push-to-release type switch. The lamp is illuminated whenever the terminal equipment with which it is associated is OOS. When the station is OOS for any reason, the station responds to polling with a no-traffic-available—ready-to-receive (CAN) indication until the computer switcher tries to call it in as a receiver. At this time, the station will respond to call-in with the not-ready-to-receive (NAK) indication and the CALL lamp will be lighted. The station will now respond not ready to receive to both polling and call in until the CALL lamp is extinguished. The CALL lamp is extinguished by putting the station back in service. If, for some reason, the station should again go OOS before polling is attempted, the station will now respond CAN (NAK would be the normal response under OOS conditions). This causes the computer switcher to make another delivery attempt which will relight the CALL lamp. If the OUT OF SVC key on the attendant set is operated while the station is selected to send or receive, the station will not go OOS until it is unselected.

**Automatic Loop-Back Test Mode [Fig. 20 (Data Set 108A Only)]**


***Before a station is put into the automatic loop-back mode, it must be disconnected from the system at the STC.***

**3.62** If the station is equipped with Data Set 108A, it may be automatically placed in the loop-back mode. This mode of operation is intended for use by maintenance personnel only. It allows tests to be made from the test center of most of the controller circuits and the transmission facility. In the loop-back mode, the controller will respond to polling, call-in, and roll-call in the normal manner; however, all message text characters received by the station will be sent directly back onto the line with a one-character delay.

**3.63** The station is automatically looped back when it receives the sequence DLE + DC1 ENQ CEC. The DLE blinds the station receiver. The + character lights the OUT OF SVC lamp and initiates the loop-back mode. The DC1 character unblinds the station and the ENQ CEC places the controller in the loop-back mode. Reception of the EOT character disables the loop-back mode, restores the station to the idle state, and extinguishes the OUT OF SVC lamp.

**Manual Loop-Back Test Mode (Data Set 108A Only)**


***Before a station is put into the manual loop-back mode, it must be disconnected from the system at the STC.***

**3.64** Operation of the R switch, located on the station controller, disconnects the data set from the controller and interconnects its transmitted data lead and received data lead. In this mode, the OUT OF SVC lamp is lighted and tests of the data set and transmission facility can be made from the test center.

**G. Alarms**

**Parity Error**

**3.65** The eighth bit of the ASCII code is used to provide even-bit parity. That is, the eighth

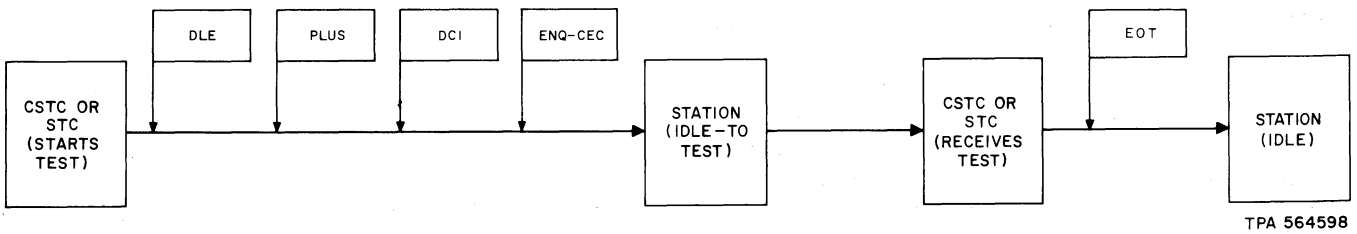



**Fig. 20—Automatic Loop-Back Sequence Chart**

bit of each ASCII code character is chosen (mark or space) so that the character contains an even number of spacing information bits. The controller monitors the number of spacing information bits of each received character. If the count is odd indicating a parity error, the ERROR lamp is lighted, the audible alarm is sounded, and the character with the incorrect parity is changed to an underline (_) by the controller. The underline character (generated by the controller) is of ***odd*** parity. This is done deliberately so that in the event the message (including the error) is punched on tape and retransmitted to another station, the underline replacing the incorrect character will activate the alarm at that station also. The ERROR lamp can be extinguished only by operation of the ERROR key. This will also silence the audible alarm if it has not been silenced previously by operation of the AUD OFF key.

#### Out-of-Synchronism Error

**3.66** The 86A2 station employs asynchronous start-stop operation. Each character consists of a start bit, the seven information bits of the ASCII code, the parity bit, and one-bit stop interval.

**3.67** The controller receive clock, used for sampling and timing the information and parity bits, is started on the mark-to-space transition of the start interval. The clock is arranged to run for a fixed number of cycles and to stop during the stop interval of the incoming character. If the local clock is falsely started, or if the character is mutilated, there may be no marking interval on which to stop at the end of the normal sampling cycle. In this case, the clock will stop at the end of the normal sampling cycle (a fixed timing interval) and wait for the next mark-to-space transition before recycling. The receiver usually regains synchronism quickly unless some repeated combination is transmitted that causes the selector to synchronize on a mark-to-space transition other than the normal start.

**3.68** In order to reduce the number of incorrect characters that are printed when the receiver is recovering synchronism, the controller samples the received character at the end of the timing interval. The controller is looking for the marking stop interval. If this sample is found to be a space, the character is incorrect and is replaced with an underline (_) character, the ERROR lamp is lighted, and the audible alarm is sounded. The error alarm can be silenced and the ERROR lamp extinguished as described earlier.

#### Tape Alarm

**3.69** If at any time while a station is selected as a sender, a taut-tape or tape-out condition occurs or the reader gate is opened, the TAPE lamp will be lighted, the BID lamp will be extinguished, and the audible alarm will sound.

**3.70** When the alarm is caused by a taut-tape condition, clearing the taut-tape condition will relight the BID lamp. Operating the TAPE key will extinguish the TAPE lamp and silence the audible alarm (if not previously silenced by the AUD OFF key). In this case, any count in the EOT counter will not be reduced to zero, and the traffic available state will be maintained. The station will remain selected as a sender unless an intercharacter time out occurs causing an emergency stop to be performed.

**3.71** When the alarm is activated for any reason other than a taut-tape condition, the tape must be in the reader, the gate must be closed, and the TAPE key must be operated to extinguish the TAPE lamp and silence the audible alarm (if not previously silenced by the AUD OFF key). However, in this case, any count in the EOT count will be reduced to zero and the BID key must be operated to relight the BID lamp. The traffic-available state will remain in effect if the station is made operationally ready before intercharacter time-out occurs. If intercharacter time-out does occur, an emergency stop will be performed by the computer switcher.

### H. Carrier Squelch

**3.72** The T switch located on the controller provides the option of squelching the Data Set 108A transmitted carrier whenever the data set detects the loss of received carrier.

### I. Controller Functional Description (Fig. 21)

**3.73** The block diagram in Fig. 21 is of the controller. The signal paths are shown in heavy lines, the control paths in light lines.

**3.74** One shift register is employed in the controller as both the in-line shift register (in the receiving data path) and the out-line shift register

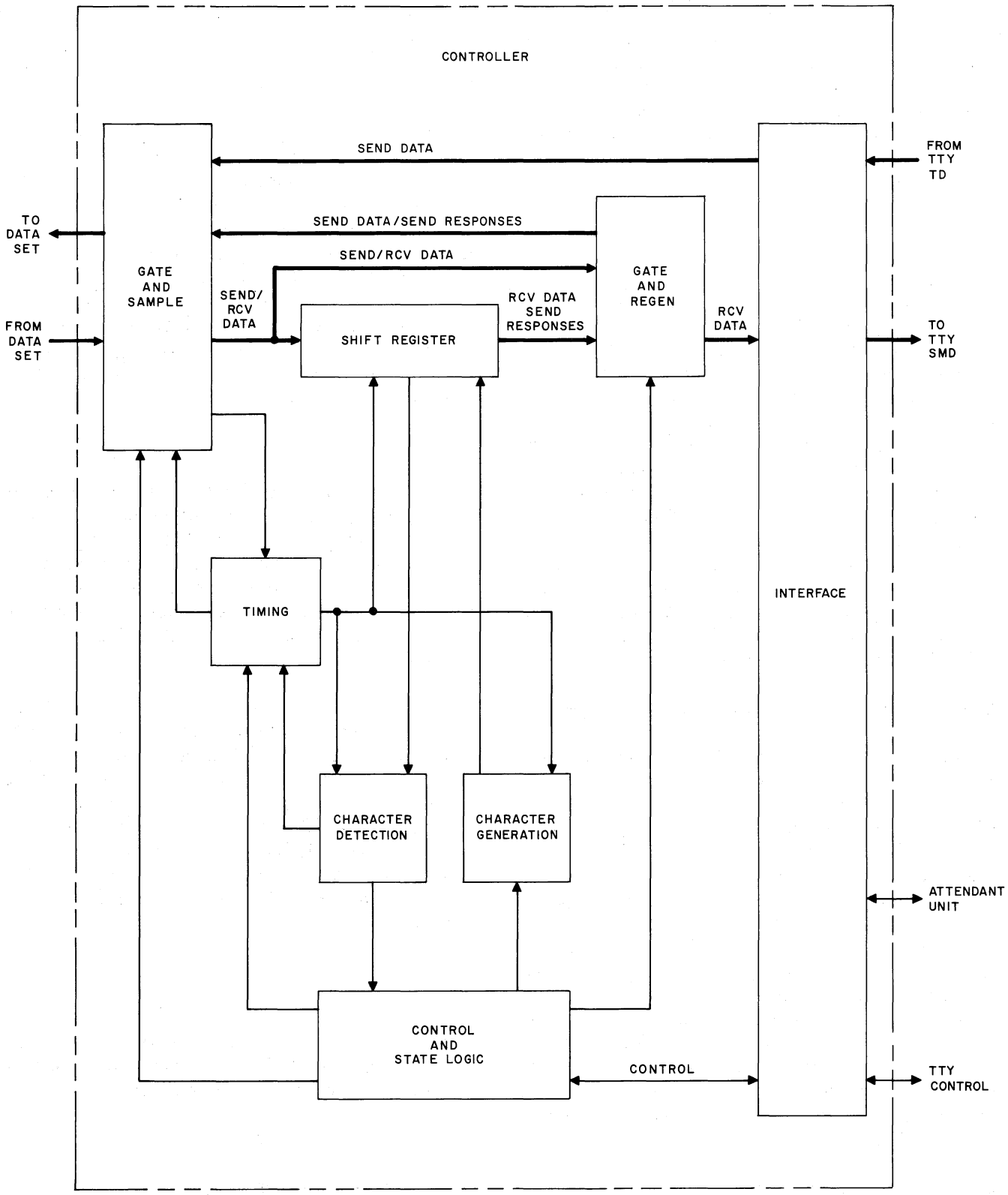



**Fig. 21—Block Diagram of Station Controller**

(in the transmitting data path). It performs the functions of character detection and generation in both circuits. The incoming signal is delayed one character length and the outgoing signal is delayed 1/2-bit length. Because of the timing functions performed by the clock (see 3.66 through 3.68), both the incoming and outgoing signals are, in effect, regenerated.

**Receive mode**

**3.75** In the receive mode, characters are received serially from the data set via the sampling gates. The start of each character triggers the receive clock in the timing circuit and the clock runs for the duration of the character. As explained in 3.66 through 3.68, the clock is used to sample each bit of the character and serially shift it into the shift register. While in the shift register, each character is monitored by the character detection circuit to determine if it is one of a number of specific characters, these being the control characters ENQ, SOH, ETX, EOT, DC1, DC2, STX, and DLE, together with the character + and the station CEC and SPC. The shift register is wired at installation to detect the unique SPC and CEC assigned to the station.

**3.76** The detected characters control the receive states (such as blinding the TTY, etc) of the station and, together with the state logic circuits, initiate appropriate responses.

**3.77** Each succeeding incoming character initiates a new timing cycle and causes the previous character to be shifted out of the shift register. (Exceptions to this occur in the case of the characters DLE, ENQ, and EOT which are erased from the shift register rather than shifted out.) As the characters are shifted out they are regenerated, gated to the SMD via the interface circuit, and recorded by the receiving element of the station. Because the operation of the controller involves a one-character storage, there is a one-character delay between the reception of a character from the line and the outputting of it to the receiving element of the station.

**3.78** An underline (_) generator is provided for printing an underline in place of an erroneously received message character resulting from a parity failure or an out-of-synchronism condition. A generated underline character applied to the shift register wipes out and replaces the erroneous character.

**Generation of Responses**

**3.79** The responses generated by the controller are ACK, NAK, CAN, SOH, P, and R. In addition, the shift register is wired at installation to generate the unique SIC assigned to the station. Which of these characters are generated as a response is governed by the state control logic circuit which monitors the status of the station. The character is written into the shift register in a parallel fashion. The character is then serially shifted out of the register by the transmit clock, regenerated, and then gated to the data set for transmission to the line.

**Send Mode**

**3.80** Characters from the TTY reader are applied serially, via the interface circuit, to the gate and sample circuit under the direction of the state logic control circuit. Timing for the send characters is developed in a manner similar to that for the receive characters. After sampling, the characters are regenerated and gated, with a 1/2-bit delay, to the data set.

**3.81** At the same time, the characters are serially inserted into the shift register. Each character is monitored, as it is shifted into the register, by the character detection circuit in order to detect specific transmit control characters. These characters are SOH, STX, ETX, and EOT. When a transmit control character is detected, the character detection circuit signals the state logic control circuit to sequence the controller through various transmit modes.

**Interface Circuits**

**3.82** The interface circuits control and monitor the station TTY. Some of the more important functions of the interface circuits are:

(a) Data signal exchange

(b) Motor on-off control

(c) Reader on-off control

(d) Lost character detection

(e) Low paper/tape supply detection

(f) Form feed/form out detection

(g) Tape feedout control (37 ROTR TTY primary receiver only)

(h) Ready/not ready receiver status monitoring

(i) Taut-tape/tape-out detection

(j) Noise filtering

(k) EOT counting (ASR TTY only)

(l) Alarm generation

(m) Bid indications (ASR TTY only).

### J. Attendant Set Functional Description

**3.83** The attendant sets provide keys and lamps used for local control, alarm monitoring, and for status monitoring of the station TTY. Two types of attendant sets are used with the 86A2 stations. They are the DAS 804R4 and DAS 804R3.

**3.84** The DAS 804R4 attendant set is used in the ASR TTY of an ORIG/TERM station and provides the following keys and lamps:

(a) Control keys—BID, PRIOR, HOLD, OUT OF SVC, and AUD OFF

(b) Alarm reset keys—TAPE, EMG STOP, ERROR, and MSG REC

(c) Status lamps—BID (white), PRIOR (white), HOLD (white), OUT OF SVC (white), TRANS REC (amber), AUD OFF (white), and CALL (amber)

(d) Alarm lamps—TAPE (red), EMG STOP (red), ERROR (red), MSG REC (red), and PAPER LOW (white).

**3.85** The DAS 804R3 attendant set is used in the primary receive TTY or a TERM ONLY station and provides the following keys and lamps:

(a) Control keys—OUT OF SVC and AUD OFF

(b) Alarm reset keys—MSG REC, ERROR, and PAPER LOW

(c) Status lamps—OUT OF SVC (white), AUD OFF (white), REC (amber), and CALL (amber)

(d) Alarm lamps—MSG REC (red), ERROR (red), and PAPER LOW (white).

**3.86** The DAS 804R3 attendant set, used in the primary receive 37 ROTR TTY of a TERM ONLY station, provides the same keys and lamps as those provided on the DAS 804R3 used in the RO TTY except that the PAPER LOW key/lamp is designated as the TAPE LOW key/lamp and a TAPE FEED key is added so that the operator can cause tape feedout to occur at the station.

**3.87** In addition, each attendant set is equipped with a loudspeaker to provide audible alarm indications. Tables F, G, H, and I list the functions of the various keys and lamps associated with the 804R4 and 804R3 attendant sets.

### K. Data Set Functional Description

#### Data Set 108A (Fig. 22)

**3.88** The transmit frequencies for the Data Set 108A are 2225 Hz for a mark and 2025 Hz for a space. Its receive frequencies are 1270 Hz for a mark and 1070 Hz for a space.

**3.89** In the idle or marking condition, a negative voltage is applied to the transmitted data (BA) lead. This negative voltage conditions the keyer to cause the oscillator to generate a tone representing a mark signal. This frequency will pass through the send filter to the send buffer amplifier. The send buffer amplifier, in addition to isolating the send filter impedance from the hybrid, is an adjustable gain amplifier. The output from the send buffer amplifier passes through the hybrid and then over the private line facilities to the computer switcher.

*Note:* When a Data Set 108A is installed at the data station, a Data Set 108B must be installed at the hub.

**3.90** A marking signal transmitted from the computer switcher will pass through the hybrid at the data station to the receive buffer amplifier. The receive buffer amplifier, in addition to isolating the telephone line from the bandpass filter, is an adjustable gain amplifier. The gain of the amplifier is adjusted in two 4-dB steps by

**TABLE F**

**STATION UNIT ARRANGEMENT SUMMARY**

| MODE | PRINTER | PUNCH | READER | PUNCH ON CONTROL | KEYBOARD |
|---|---|---|---|---|---|
| | CONNECTED TO | | | | CONNECTED TO |
| ON-LINE | Line | Keyboard | Line | Always on (Ineffective) | Punch |
| OFF-LINE | Keyboard and reader | Keyboard and reader | Printer and punch | Effective | Punch and printer |
| UNATTENDED | Line | Disconnected | Line | Always off (Ineffective) | Blinded |

means of the D screw switch. The output of the receive buffer amplifier passes through the bandpass filter to the limiter. The limiter amplifies the output to provide a constant amplitude signal to the discriminator. The two outputs of the limiter are to the discriminator and the carrier detector. The discriminator detects, rectifies, and produces a voltage signal that is proportional to the frequency. The output of the discriminator passes through the low-pass filter. The dc voltage output from the low-pass filter passes through the dc amplifiers and out to the terminal equipment on the received data (BB) lead in the form of EIA voltage signals.

**3.91** The second output from the limiter is to the carrier detector. The carrier detector monitors this output for the presence of an acceptable level of carrier. In the event that the carrier power level falls below −40, −36, or −32 dBm, dependent on the setting of the D switch, for approximately 110 to 250 milliseconds, the carrier detector operates and a signal passes to the amplifier. The amplifier conditions the data carrier detector to turn off lead CF. This notifies the terminal equipment that a failure exists. The amplifier also clamps the BB lead in the marking condition (ie, mark-hold condition). The data set will assume a preconnect mode in which it monitors for incoming marking carrier via the preconnect gate.

**3.92** Some service applications will use carrier squelch on the data carrier failure option. When this option is provided and the T switch is operated to the ON position at the controller, the CF amplifier will cause ground to be applied on lead CS to the oscillator. This shuts off the oscillator thereby inhibiting the transmission of carrier to the hub.

**3.93** In order to restore the station to normal following a carrier failure, two conditions must be met:

(a) A carrier power level greater than −40, −36, or −32 dBm, dependent on the setting of the D switch, must be received.

(b) The received carrier must be a mark frequency.

When the two conditions have been met for 200 to 500 milliseconds, the carrier detector circuit removes the signal to the amplifier. The amplifier then removes the clamp on lead BA, turns on lead CF to notify the controller that carrier has been restored, and, if the squelch option is provided, removes the ground from the oscillator. If the station was selected to send or receive at the time of the carrier failure, the EMG STOP or MSG REC and ERROR lamps, respectively, were lighted and the audible alarm was sounded. These lamps can now be extinguished by the operation of their respective keys. The audible alarm will be silenced by the operation of these keys if it has not been previously silenced by operation of the AUD OFF key.

**TABLE G**

**ATTENDANT SET 804R4 LAMPS**

| LAMP | COLOR | WHEN LIGHTED |
|---|---|---|
| MSG REC | Red | Lights when controller has answered NAK to roll call, DLE is received while station is selected, or carrier fail signal is received from data set (audible alarm sounds) |
| ERROR | Red | Lights when controller detects a parity or out-of-synchronization error (audible alarm sounds) |
| TAPE | Red | Lights when a taut-tape or tape-out condition occurs while station is selected to send (audible alarm sounds) |
| EMG STOP | Red | Lights when computer switcher interrupts sending station by performing emergency stop sequence (audible alarm sounds) |
| PAPER LOW | White | Lights when paper supply is low (audible alarm sounds) |
| AUD OFF | White | Lights when AUD OFF key is operated |
| TRANS REC | Amber | Lights when station is selected as a transmitter or receiver |
| CALL | Amber | Lights when controller has answered SIC NAK to call-in (audible alarm sounds), remains lighted by a call-in until terminal is ready to receive |
| BID | White | With tape properly positioned, momentary operation of BID key or EOT key on ACR TTY keyboard lights BID lamp |
| PRIOR | White | Lights when BID lamp is lighted and PRIOR key is operated |
| HOLD | White | Lights when HOLD key is operated |
| OUT OF SVC | White | Lights when TTY is in the OOS mode |

**Data Set 109A (Fig. 23)**

**3.94** The Data Set 109A is a current transmitting device. The output level is nominally 3 mA for both mark and space. The maximum allowable loop resistance for the 109A is 1500 ohms with one microfarad of shunt capacitance.

*Note:* When a Data Set 109A is used at a station, a Data Set 109B must be used at the hub.

**3.95** A space signal applied to lead BA is inverted. This applies an off condition to the transmit OR gate which causes the transmitter to develop 12 volts. The monitor circuit couples the 12 volts

**TABLE H**

**ATTENDANT SET 804R4 KEYS**

| KEY | TYPE | FUNCTION PERFORMED WHEN OPERATED |
|---|---|---|
| MSG REC | NL | Extinguishes MSG REC lamp and silences audible alarm |
| ERROR | NL | Extinguishes ERROR lamp and silences audible alarm |
| TAPE | NL | Extinguishes TAPE lamp and silences audible alarm |
| EMG STOP | NL | Extinguishes EMG STOP lamp and silences audible alarm |
| PAPER LOW | NL | Extinguishes PAPER LOW lamp, provided the paper supply has been replenished, and silences audible alarm |
| AUD OFF | PP | Silences and/or inhibits audible alarm |
| BID | NL | Conditions the controller to respond to polling with a traffic-available response |
| PRIOR | NL | When operated in conjunction with BID key, conditions the controller to add a priority status to the traffic-available response |
| HOLD | PP | Causes the reader of a selected sender to stop on ETX so that another tape can be placed in the reader without having the station unselected (audible alarm sounds) |
| OUT OF SVC | PP | Places terminal OOS when not selected to send or receive, or if it is selected, when it becomes unselected |

to the line, polarized in a manner such that 3-mA space current flows in the line. A mark signal applied to lead BA also is inverted. This applies an on condition to the transmit OR gate which causes the transmitter to develop four volts. The monitor circuit couples the four volts to the line, polarized in a manner such that 3-mA mark current flows in the line.

**3.96** Since the monitor in the data set recognizes both received and transmitted signals without distinction, it is necessary to prevent transmitted signals from appearing on lead BB. This is accomplished by the transmit delay circuit, receive NOR gate, and receive OR gate. The receiver NOR gate is operated by a positive voltage on either of its inputs. The output of the receiver is positive for a mark while the transmit delay circuit output is positive for a space. The operated receive NOR gate causes the BB lead to be held marking. To compensate for any delay (due to line capacity) in detecting a mark transmission, the transmit delay circuit holds the receive NOR gate for approximately 200 usec after a space-to-mark transition. To ensure that the receive NOR gate is operated before the receiver detects space transmissions, the delay circuit will operate the receive NOR gate before the receiver output goes negative following the mark-to-space transition.

**3.97** When the data set is receiving, the BA lead is clamped to mark by signals from the

**TABLE I**

**RECEIVING ATTENDANT SET (804R3) LAMPS**

| LAMP | COLOR | WHEN LIGHTED |
|---|---|---|
| OUT OF SVC | White | Lights when primary receive TTY is in the OOS mode |
| REC | Amber | Lights when station becomes selected to receive |
| CALL | Amber | Lights when station is not ready to receive when a call-in attempt is made. (Will not extinguish until station is ready to receive) |
| MSG REC | Red | Lights when computer switcher interrupts message delivery to perform a delivery abort sequence or station responds with SIC NAK to roll-call (audible alarm sounds) |
| ERROR | Red | Lights when controller detects a parity or out-of-synchronization error (audible alarm sounds) |
| PAPER LOW* | White | Lights when paper (or tape) supply is low (audible alarm sounds) |
| AUD OFF | White | Lights when AUD OFF key is operated |

* This lamp is designated TAPE LOW on DAS 804R3 used with ROTR TTY.

controller. This places a negative voltage on the receive NOR gate input from the transmit delay circuit, thereby permitting the receiver to control the receive NOR gate. The monitor circuit senses the magnitude and polarity of the line current and provides mark and space indications to the receiver. The receiver recognizes the difference in these indications and converts them into EIA voltage signals. These signals are sent through the receive NOR and OR gates and on to the controller on lead BB.

**3.98** As long as the line current exceeds 1.5 mA in either a mark or space direction, the bridge conducts, thus producing a negative output. The integrator circuit eliminates amplitude variations and presents a constant negative voltage to the inverter where it is inverted. A positive voltage is sent to the controller carrier fail circuit on lead CF. If the line current drops below 1.5 mA, the bridge stops conducting, the integrator discharges, a positive voltage is applied to the inverter, and the inverter sends a negative voltage to the controller carrier fail circuit. This brings in a carrier fail alarm at the station. The negative voltage from the inverter is also applied to the receive OR gate which clamps the BB lead to mark.

## 4. OPERATION

### A. ASR TTY Attendant Set

**4.01** The ASR TTY attendant set (DAS 804R4) contains ten designated keys, all of which contain lamps plus two additional designated lamps. Figure 24 shows the lamps and when they are lighted in addition to the keys and what function they perform when operated.

### B. RO and ROTR TTY Attendant Sets

**4.02** The receiving station attendant set (DAS 804R3) contains four (RO TTY) or five (ROTR TTY) designated keys, all of which contain lamps plus two additional designated lamps. Figure 25 shows the lamps and when they are lighted in

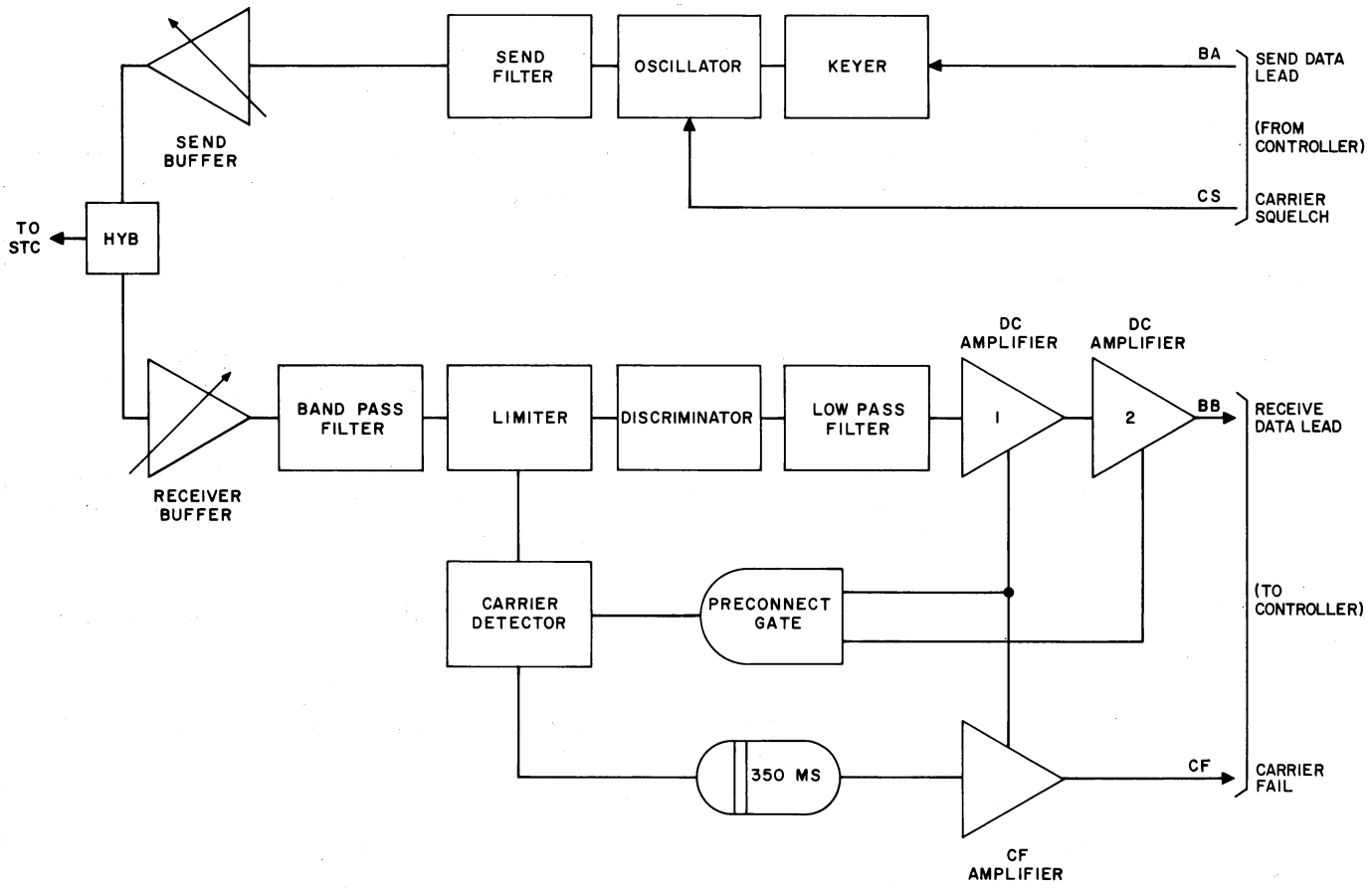



**Fig. 22—Block Diagram of Data Set 108A**

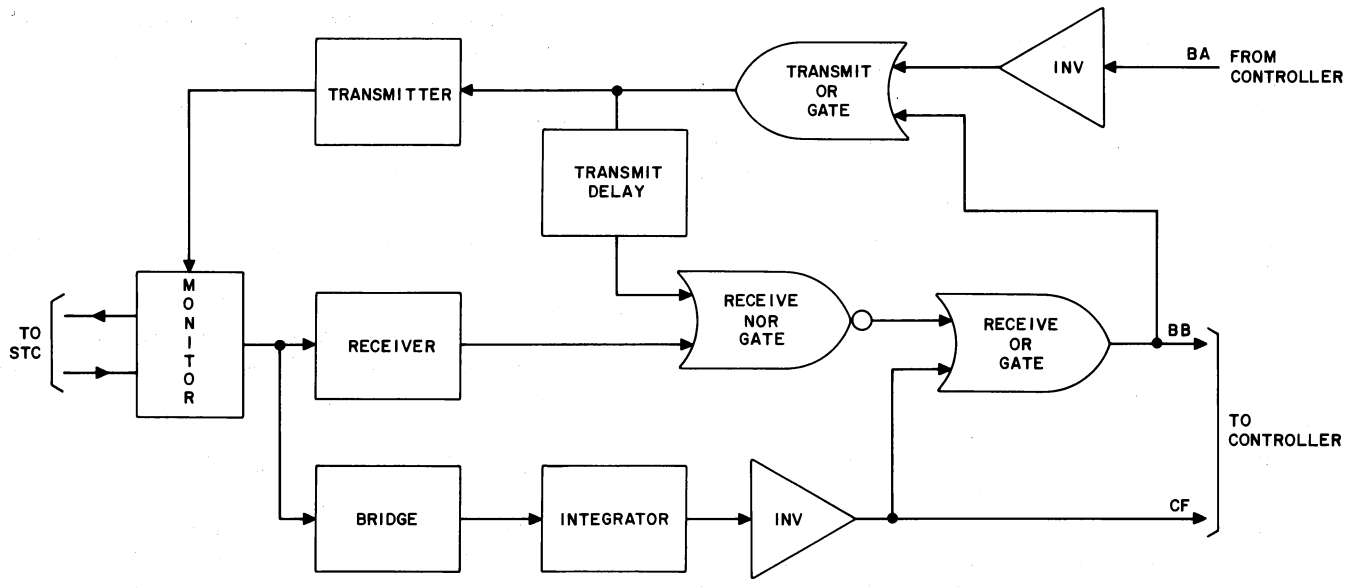



**Fig. 23—Block Diagram of Data Set 109A**

addition to the keys and what function they perform when operated.

### C. Manual Connection and Disconnection of Auxiliary Receiver

**4.03** To manually connect the auxiliary receiver to a 37 primary TTY, operate the AUX RCVR key on the primary TTY. This will connect the auxiliary receiver and cause the AUX RCVR lamp to be lighted. Operation of the AUX RCVR key while the auxiliary receiver is connected will disconnect the auxiliary receiver and extinguish the AUX RCVR lamp unless, while connected manually, an automatic auxiliary receiver connection was called for by line signals (DC2) at a station equipped with the automatic auxiliary receiver connect option. In the latter case, the disconnect will not occur until an auxiliary receiver disconnect is called for by line signals (ETX and/or DC4).

**4.04** The 37 ROTR TTY is not provided with a means for connecting an auxiliary receiver.

### D. Sending Stations

**4.05** The 37 ASR TTY is equipped with three nonlocking, push-to-operate key/lamps for selecting the station mode of operation. They are the OFF LINE, ON LINE, and UNATT keys. Operation of any one of these keys lights the associated lamps, conditions the controller for the associated mode of operation, and extinguishes the lamps of any previously selected mode. Tapes can be prepared in either the off-line or on-line modes of operation. Table J and Fig. 18 provide a summary of how the various station units are arranged in each mode.


***Operation of the OFF LINE key while the station is selected to send will remove the traffic available status. If the reader is running, it will continue to run in the normal manner and the message will be copied by the page printer. However, the transmission of the message to the line will be inhibited. After time-out, the computer switcher will send the emergency stop sequence.***

**4.06** To prepare tapes in the on-line mode, operate the ON LINE key. This lights the ON LINE and PUNCH ON lamps. In this mode, the tape punch is always on. The message can now be typed out on the keyboard as in the off-line mode of operation; however, the page printer will not make copy of the message being punched and printed on the tape.

**4.07** To prepare tapes in the off-line mode, insure the station is ***not*** selected to send (TRANS REC lamp extinguished) and then operate the OFF LINE key. This lights the OFF LINE lamp on the TTY and the OUT OF SVC lamps on the ASR TTY attendant set. The station will now respond NAK to polling and SIC NAK to receive call-in. Now operate the PUNCH ON key (PUNCH ON lamp lighted) and type out the message, being sure to follow the proper format (see 3.04), on the keyboard. In this mode, the message being punched and printed on the tape will be printed by the page printer. Restoration of the PUNCH ON key will extinguish the PUNCH ON lamp and inhibit the operation of the tape punch thereby allowing the keyboard and page printer to be used for typing practice.

**4.08** To send a transmission when the EOT counter is to be used, operate the ON-LINE key. Advance the tape from the punch to the reader, being sure to leave enough slack in the tape to loop it under the taut tape lever, by means of DEL characters. Close the reader gate, operate the READER ON key, and type the message (or messages), including EOT, on the keyboard. This causes the punch to perforate the tape. The EOT (when typed on the keyboard) will raise the count in the EOT counter by one, light the BID lamp (assuming the count in the EOT counter had been zero), cause the reader to run until the controller detects SOH from the tape, and cause the station to give a traffic-available response to polling.

**4.09** To send a transmission when the EOT counter is not to be used, operate the ON LINE key, insert the prepared tape into the reader, close the reader gate, operate the READER ON key, and operate the BID key on the attendant set. This lights the BID lamp and starts the reader which runs until the controller detects SOH from the tape. The detection of SOH causes the station to give a regular-traffic-available response to polling. If the PRIOR key is operated in conjunction with the BID key, the station will give a priority-traffic-available response to polling. The first EOT detected from the tape will remove the priority status; however, the traffic available state

will be maintained until the reader gate is opened or a taut-tape or tape-out condition occurs.

**4.10** Normally, to send a message or series of messages in the unattended mode, it is necessary to operate the UNATT key after the station is selected to send while in the on-line mode. This will allow the transmission to continue unaffected until the first EOT is read from the tape. This EOT will normally revoke the bid even when the count in the EOT counter is not yet zero. However, an option is available on the 37 ASR TTY that permits the introduction of a bid (by operation of the BID key) while the MODE switch is in the UNATT position. With this option, the bid remains valid until the tape runs out or the count in the EOT counter is reduced to zero. In the latter case, the EOT count ***must*** be introduced in the counter while the MODE switch is in the ON LINE position.

#### Hold Operation

**4.11** To send a message on a tape other than one the station is already transmitting, depress the HOLD key (on the ASR TTY attendant set) before the ETX on the tape being transmitted reaches the reader. This causes the HOLD lamp to light, the audible alarm to sound, and the reader to stop when the controller detects the ETX from the tape. The new tape, which must conform to the standard format, can now be placed in the reader in place of the original tape. Opening the reader gate to remove the original tape causes the count in the EOT counter to become zero and extinguishes the BID lamp. With the new tape inserted in the reader, restore the HOLD key, and operate the BID key. This will cause the transmission to resume with the new tape being transmitted. Restoration of the HOLD key extinguishes the HOLD lamp and operation of the AUD OFF key silences the audible alarm.

**4.12** To resume transmission of the original tape, the hold operation described in 4.11 must be repeated and the original tape reinserted in the reader at the exact point where the original transmission was stopped.

#### Emergency Stop

**4.13** If the computer switcher transmits an emergency stop procedure to the station during the transmission of a message, the following will occur:

(1) The station reader will stop, the traffic available state is cancelled, and the EOT counter will be set to zero.

(2) The EMG STOP lamp will be lighted and the audible alarm will be sounded.

The computer switcher may now send an explanatory service message, which is copied by the ASR TTY page printer. Upon completion of delivery of the service message (if any), the station will become unselected as a sender (TRANS REC lamp extinguished). The ASR TTY is idle and it is necessary to operate the EMG STOP key in order to extinguish the EMG STOP lamp and (if not already silenced by operation of the AUD OFF key) silence the audible alarm.

#### Taut-Tape Condition

**4.14** When a taut-tape condition occurs at the reader while the station is selected as a sender and not in hold, the TAPE lamp will light and the audible alarm will sound. After the condition is cleared, operation of the TAPE key will extinguish the lamp and (if not already silenced by operation of the AUD OFF key) silence the alarm. If, during the taut-tape condition, an intercharacter time-out has not occurred causing the computer switcher to perform an emergency stop, transmission of the message will be resumed.

### E. Emergency Stop of ASR TTY Motor

**4.15** In order to stop the ASR TTY motor in an emergency, operate the OUT OF SVC key on the attendant set and set the MODE switch to the OFF LINE position.

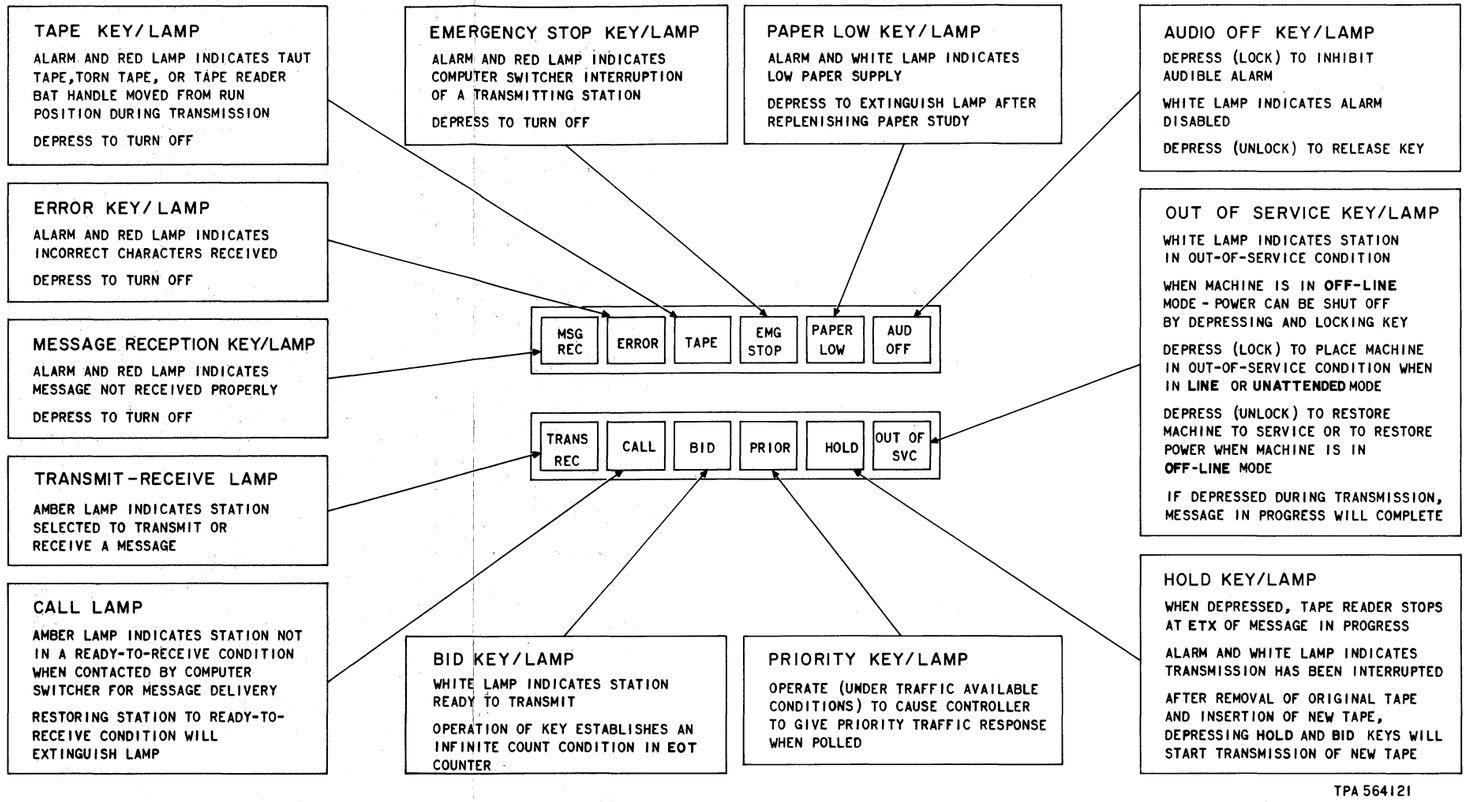
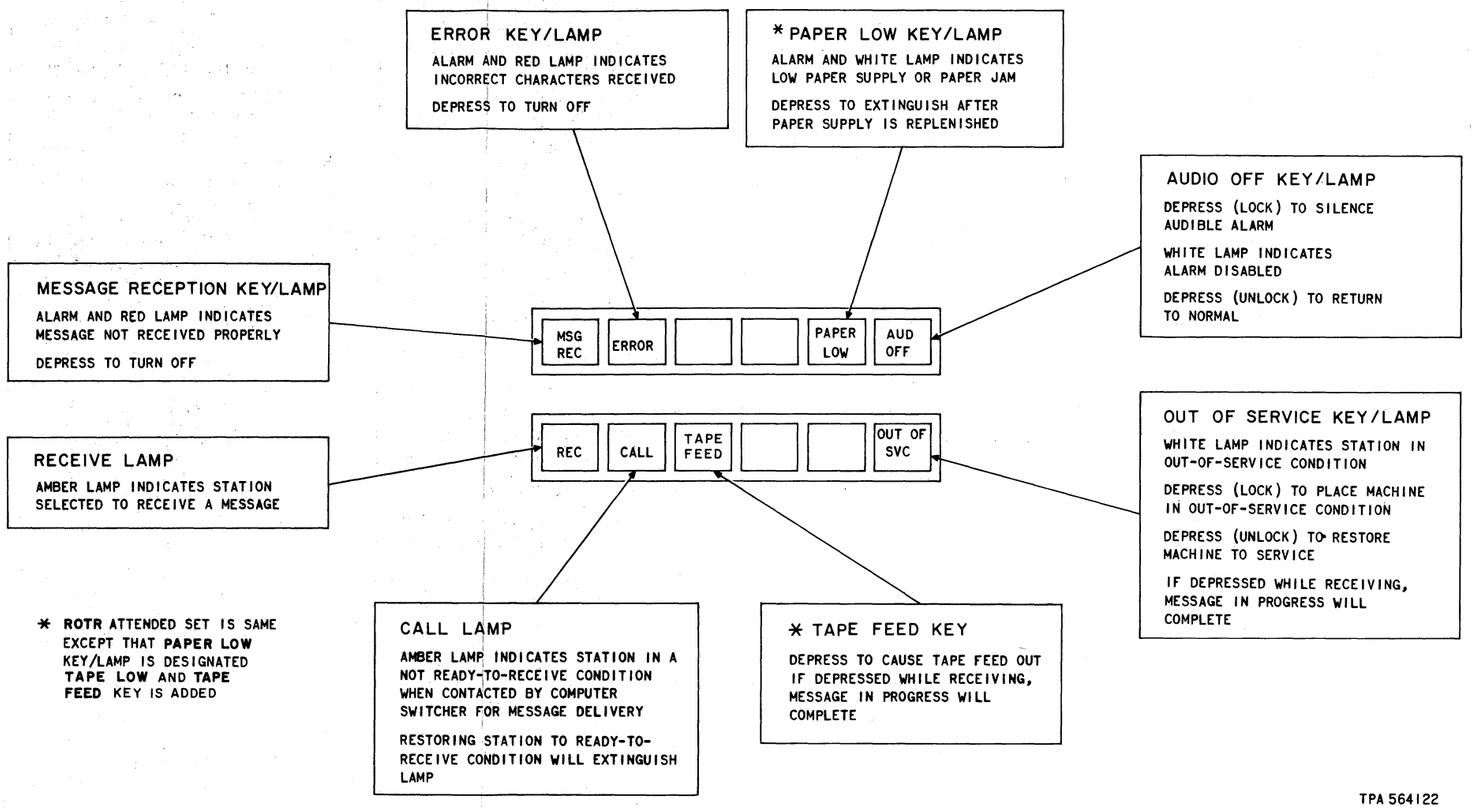



**Fig. 24—ORIG/TERM Station Attendant Set (DAS 804R4) Key Functions and Lamp Indications**




* **ROTR** ATTENDED SET IS SAME EXCEPT THAT **PAPER LOW** KEY/LAMP IS DESIGNATED **TAPE LOW** AND **TAPE FEED** KEY IS ADDED

TPA 564122

**Fig. 25—TERM ONLY Station Attendant Set (DAS 804R3) Key Functions and Lamp Indications**

## TABLE J

## RECEIVING ATTENDANT SET (804R3) KEYS

| KEY | TYPE | FUNCTION PERFORMED WHEN OPERATED |
|---|---|---|
| OUT OF SVC | PP | Places receive terminal OOS when it is not selected to receive or, if it is selected to receive, when it becomes unselected |
| MSG REC | NL | Extinguishes MSG REC lamp and silences audible alarm |
| ERROR | NL | Extinguishes ERROR lamp and silences audible alarm |
| PAPER LOW* | NL | Extinguishes PAPER LOW (TAPE LOW) lamp provided the paper (tape) supply has been replenished and silences audible alarm |
| AUD OFF | PP | Silences and inhibits the audible alarm |
| TAPE FEED† | NL | Initiates tape feedout |

* This key is designated TAPE LOW on DAS 804R3 used with ROTR TTY.

† This key is functional on DAS 804R3 used with ROTR TTY only.